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VERMONT YANKEE

Site Assessment Study

October 2014

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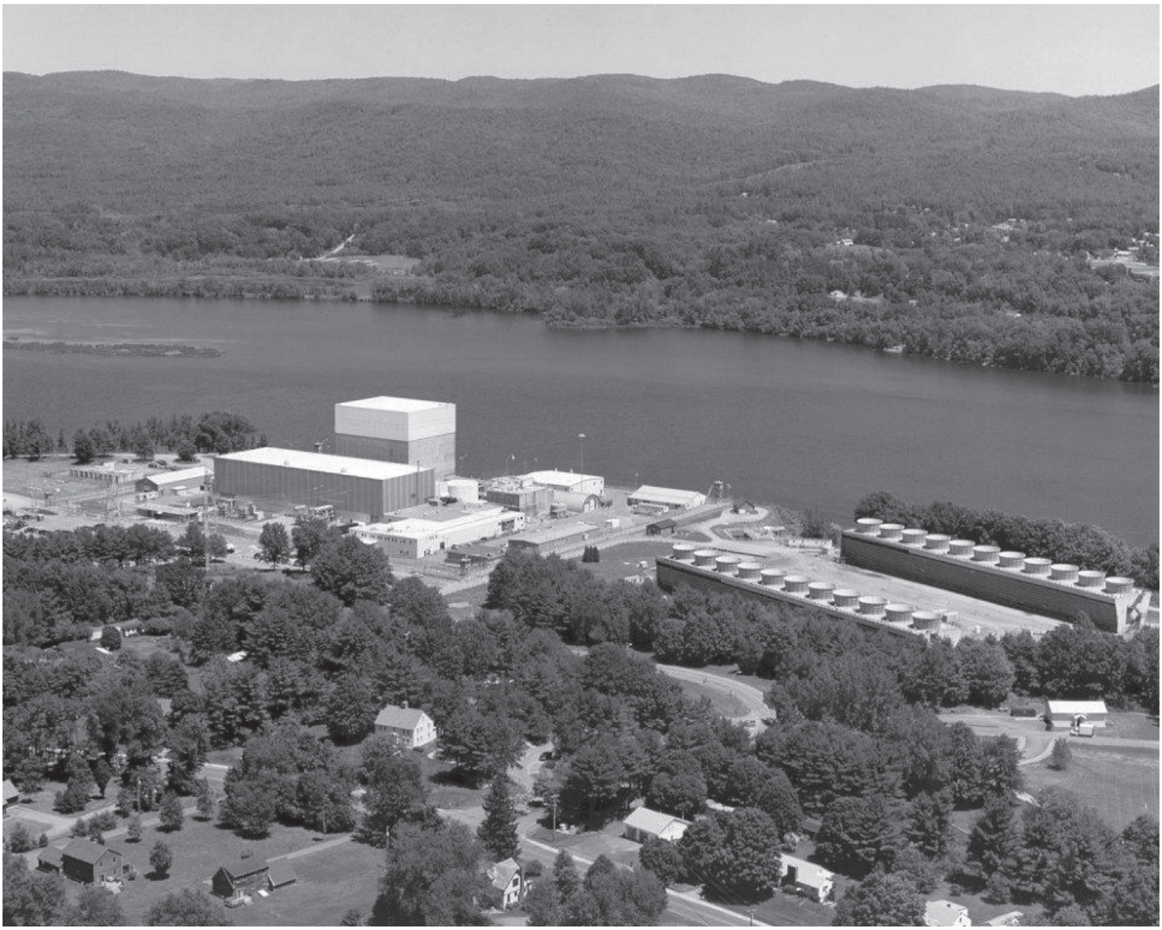

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List of Acronyms Used in This Report:

ACM	Asbestos Containing Materials
ANI	American Nuclear Insurers
AOG	Augmented Off-Gas
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COB	Construction Office Building
CR	Condition Report
CSM	Conceptual Site Model
CST	Condensate Storage Tank
DCGL	Derived Concentration Guideline Level
DOE	U.S. Department of Energy
ENVY	Entergy Nuclear Vermont Yankee, LLC
EPA	U.S. Environmental Protection Agency
FR	Federal Register
FSAR	Final Safety Analysis Report
GPI	Groundwater Protection Initiative
GTCC	Greater Than Class C Waste
HSA	Historical Site Assessment
ISFSI	Independent Spent Fuel Storage Installation
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual (NUREG-1575)
MCL	Maximum Contaminant Level
MH	Manhole
MPC	Multi-Purpose Canister
NDT	Nuclear Decommissioning Trust
NEI	Nuclear Energy Institute
NPDES	National Pollution Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
ODCM	Off-Site Dose Calculation Manual
PCB	Polychlorinated Biphenyl Compounds
PCE	Tetrachloroethylene
PGQS	Primary Groundwater Quality Standards
PNL	Pacific Northwest National Laboratory
RBC	Risk Based Concentration
RCA	Radiologically Controlled Area
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Condition
REMP	Radiological Environmental Monitoring Program
SFA	Spent Fuel Assembly
SMAC	Site Management Activities Complete
SVE	Soil Vapor Extraction
TSCA	Toxic Substances Control Act
UST	Underground Storage Tank
VOC	Volatile Organic Compound
VANR	Vermont Agency of Natural Resources
VTDEC	Vermont Department of Environmental Conservation
VYNPS	Vermont Yankee Nuclear Power Station

Executive Summary

In August 2013, Entergy Corporation announced that the Vermont Yankee Nuclear Power Station (VYNPS) would not be refueled and would cease operations at the end of its current operating cycle. In December 2013, several Vermont state agencies and VYNPS owner Entergy Nuclear Vermont Yankee (ENVY) negotiated a settlement agreement that, among other things, included commitments by ENVY that VYNPS would cease operations by the end of 2014 and that ENVY would prepare a Site Assessment Study.

At the time the agreement was negotiated, it was unclear exactly what a Site Assessment Study was, since no other nuclear utilities had prepared one. It was, however, understood between ENVY and the Vermont agencies that the Site Assessment Study would provide a basis for discussion about what would become of the VYNPS plant and site after cessation of operations. This report is a good faith effort by ENVY to consolidate into one source a summary of the historical environmental and radiological condition of the site, to explain what activities ENVY currently expects to occur as VYNPS transitions from an operating to decommissioning site, and to discuss the updated cost estimates for the decommissioning of the site. This report summarizes historical information about the VYNPS site including information about events that were required to be reported to State of Federal regulatory authorities. Where required, these events were reported to the appropriate regulatory agency in accordance with reporting requirements.

Although most of the information contained in this report was made publicly available at different times over the course of the plant's operating history, the information may seem novel because it is the first time it has been collected and presented publicly as a single source. We understand that different constituencies in the community may have different reactions to the materials assembled here. We hope that all members of the community will find this report productive to the ongoing discussion about the future of the VYNPS site.

The most significant piece of new information presented in the Site Assessment Study is the updated cost estimate to decommission VYNPS, which is higher than previous cost estimates. The increased costs have been subject to exhaustive review, challenge, and validation. The bulk of the increased costs will be incurred in the transition period (roughly 2014 to 2020). Our goal and expectation is to do the necessary work to safely transition VYNPS to the dormancy period within the bounds of the updated, increased cost estimate. Achieving this goal will be dependent on a number of factors, including our ability to obtain U.S. Nuclear Regulatory Commission (NRC) approval of various submittals and a continued constructive relationship with the State of Vermont.

The productive future use of the VYNPS site is of interest to all parties. The most significant factor affecting the site's availability for other uses is the timing of the Federal Government's removal of the spent nuclear fuel from the site and the State of Vermont. To date, ENVY and its predecessors have paid the Federal Government over $119 million toward this end, but until the Government removes all of VYNPS' fuel, as it is obligated to do, the site cannot be released in its entirety. In the meantime, we believe that moving all of the VYNPS spent nuclear fuel into robust dry fuel storage containers on a seismically-hardened Independent Spent Fuel Storage Installation (ISFSI) in the short-term is in the best interest of all parties, and that will be our primary focus over the next several years.

ENVY will submit its Post-Shutdown Decommissioning Activities Report (PSDAR) and Site Specific Decommissioning Cost Estimate (DCE) to the NRC. The assumptions in the DCE will be consistent with NRC expectations, which do not allow ENVY to take credit for any costs it expects to be able to recover in litigation from the Federal Government for its failure to remove VYNPS' spent nuclear fuel. The base cost analysis that ENVY expects to present to the NRC will be based on the maximum SAFSTOR period, which allows ENVY up to 60 years to release the VYNPS site for unrestricted use, because that scenario shows funding adequacy with the largest margin. Under the maximum SAFSTOR scenario, dismantling and decontamination of the plant would not begin until approximately 2069, and the site would not be released for unrestricted use until approximately 2075. Under the terms of the settlement agreement, ENVY agreed to initiate the actual decontamination and dismantlement process when it was determined that there were adequate funds in the NDT. The numerous variables which must be taken into consideration (costs, interest rate/fund growth, NRC rulings, etc.) result in a wide range of outcomes as it relates to when the decontamination and dismantlement phase and site restoration will be complete. For example, cost analyses that include expected recoveries from the Federal Government for its failure to remove VYNPS' spent nuclear fuel suggest that a much earlier date, potentially as early as the 2040s, is possible for the commencement of dismantling and decontamination activities.

The VYNPS team will make every effort to continue to operate the plant safely and reliably through the end of 2014, after which they will defuel the reactor and begin transitioning VYNPS from an operating plant to one in a permanently shutdown, dormant condition. VYNPS' shutdown will mark the end of more than four decades of producing clean, reliable electricity for the people of New England and the transition to a new chapter of environmental stewardship as we begin preparing the site for other beneficial uses.

The factual statements in this Site Assessment Study have been verified through the process set forth in VYNPS site procedure AP-00138. Although this procedure is inapplicable to most of the appendices to the Site Assessment Study, where applicable, all reasonable efforts were made to ensure the accuracy of the factual statements in the appendices. All forward-looking statements are preliminary, based on information currently available and are subject to change.

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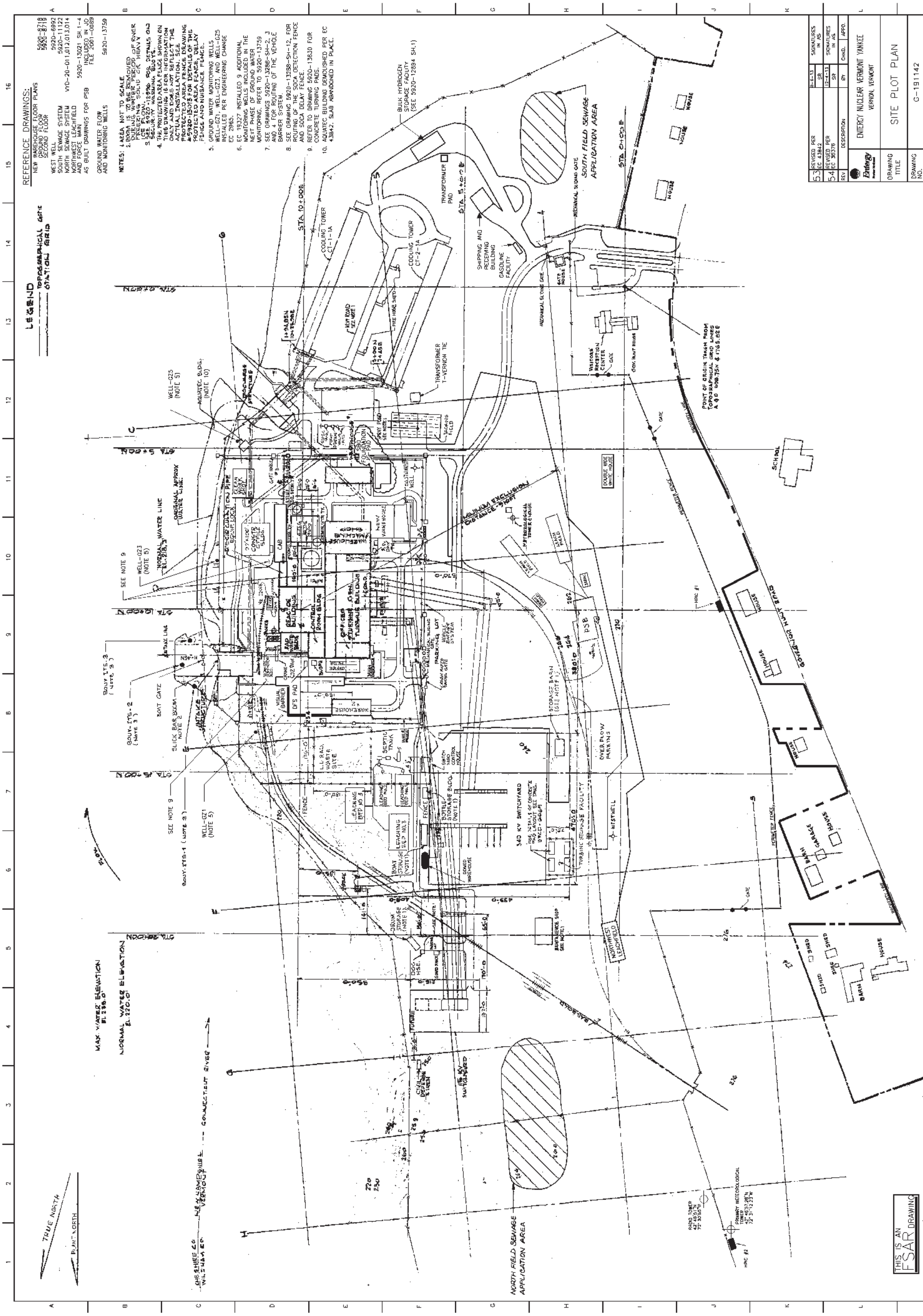


Figure 1 – Vermont Yankee Site Plot Plan

1 Vermont Yankee Site Conditions

1.1 Site Description

The site is located in the town of Vernon, VT in Windham County on the west shore of the Connecticut River immediately upstream of the Vernon Hydroelectric Station. The site contains about 125 acres owned by Entergy Nuclear Vermont Yankee, LLC (ENVY) and a narrow strip of land between the Connecticut River and the east boundary of the Vermont Yankee Nuclear Power Station property to which ENVY has perpetual rights and easements from its owner. The site is bounded on the north, south, and west by privately-owned land and on the east by the Connecticut River. Site coordinates are approximately 42° 47' north latitude and 72° 31' west longitude. The site plot plan is shown in Drawing G-191142 (Figure 1). The site's exclusion area boundary and site area boundaries for both gaseous and liquid effluents are shown on Drawing 5920-6245 (Figure 2).

About 85% of the land within a 25-mile radius of the site is undeveloped. Most of the developed land is used for agriculture and dairying, with homes scattered or grouped in small villages. The area within 10 miles of the site has only one urban area, the city of Brattleboro, VT, which is located about 5 miles upriver.

The closest site boundary is 910 feet west of the Reactor Building. The nearest homes are situated along the Governor Hunt Road just west of the site. The Vernon Elementary School is on the opposite side of the road (Governor Hunt Road) about 1,500 feet from the Reactor Building.

1.2 Site History

The Vermont Yankee Nuclear Power Station (VYNPS) has been owned and operated by a number of different entities since the time the construction permit was issued by the U.S. Nuclear Regulatory Commission (NRC). The issues identifies in this report have been gathered from diverse sources including documents provided to ENVY in conjunction with the purchase of the VYNPS. Many of the events detailed in this report occurred prior the ENVY's 2002 purchase of VYNPS.

A brief summary of the major NRC milestones related to the 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
- Power Uprate Approved: March 2, 2006
- Initial Operating License Expiration: March 21, 2012
- Renewed Operating License Expiration: March 21, 2032

By letter dated September 23, 2013, ENVY 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. Contemporaneous with the announcement of cessation of operations, ENVY chartered a Decommissioning Planning Organization to delineate the activities and costs associated with transitioning the plant from an operational status to an eventually restored site.

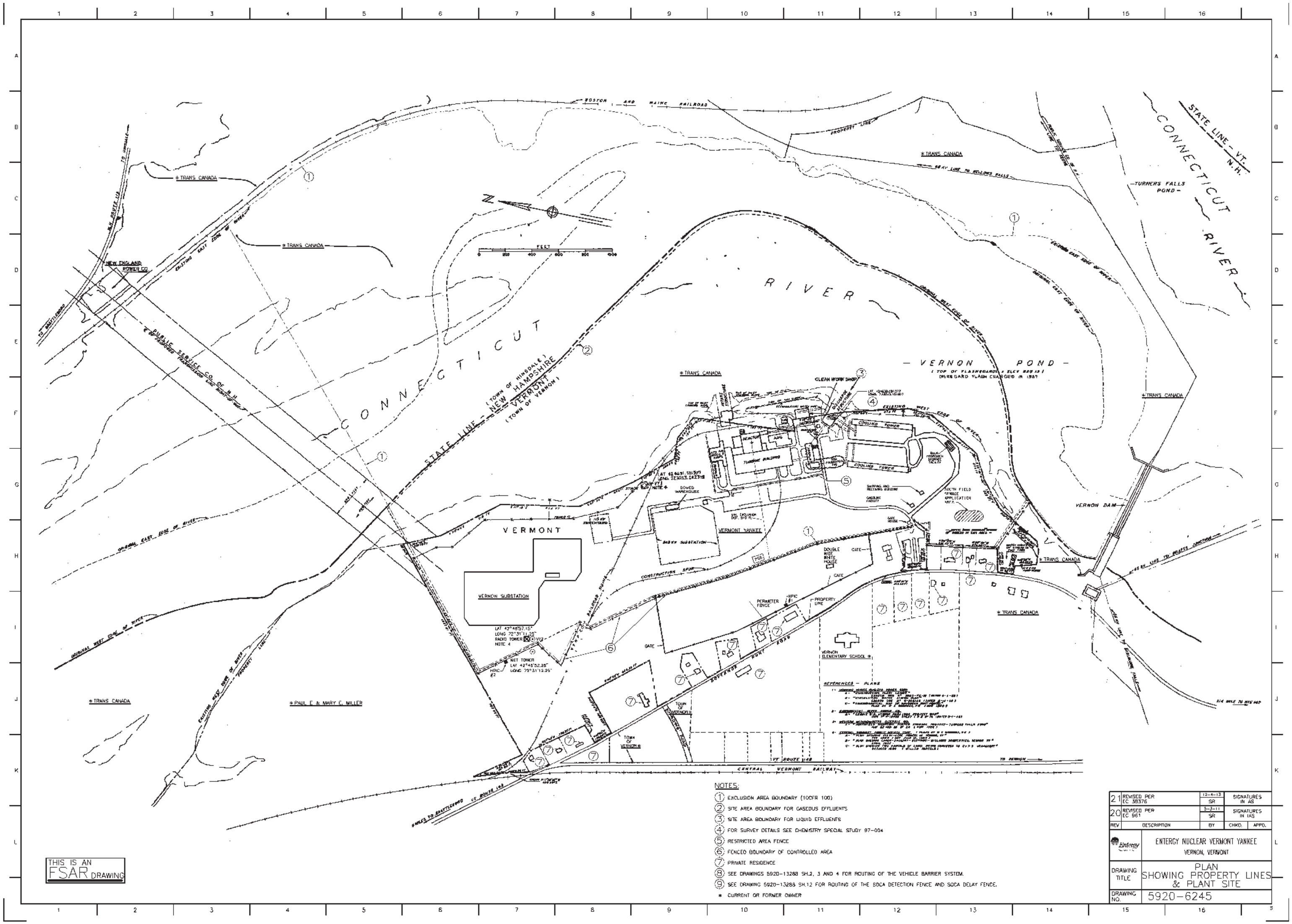


Figure 2 – Site Plan Showing Property Lines and Site Plan

1.3 Spent Nuclear Fuel On-Site

Spent nuclear fuel generated by VYNPS is currently stored on-site in the VYNPS spent fuel pool (or "wet storage") and in concrete casks located on an Independent Spent Fuel Storage Installation (ISFSI) facility (or "dry storage"). Currently, 368 fuel assemblies reside in the reactor as part of the current operating cycle, 2,628 spent fuel assemblies (SFAs) are stored in the spent fuel pool and 884 SFAs are stored in 13 dry storage casks on the ISFSI facility. At the time of shutdown in late 2014, VYNPS will have generated a total of 3,880 SFAs over the course of its operational history. As part of the decommissioning process, ENVY will eventually move all SFAs that are in wet storage to dry storage at the ISFSI facility. Those 3,880 SFAs will be stored in 58 Dry Fuel Storage Casks (Overpacks and Multi-Purpose Canisters [MPCs]) that will sit on two ISFSI pads located in the northern area of the VYNPS Protected Area (PA). The spent fuel will remain in dry storage until it is removed from the site by the U.S. Department of Energy (DOE). Thus, spent fuel stored on-site will progress through three states during the decommissioning process:

- Wet and dry storage of spent fuel (Shutdown through late 2020)
- On-site dry storage of all spent fuel (2021 through 2052[estimated])
- Removal of all spent fuel (late 2052 [estimated]).

1.4 Radioactive Materials On-Site

In compliance with NRC regulations and current license requirements, ENVY maintains a Radiological Effluent Monitoring Program (REMP) and Off-Site Dose Calculation Manual (ODCM). The REMP/ODCM requires ENVY to monitor all potential effluent release pathways and prepare annual reports summarizing the physical form and quantity of all radionuclides released to the environment. During the early years of operation, many effluent release points (such as the Turbine Building roof vents) did not require routine monitoring. At such points, the absence of monitoring allowed a gradual buildup of low level radioactivity consistent with accepted historical industry control practices. Contamination accumulated over time at such release point then migrated to other portions of the site via storm water runoff. ENVY has installed plant modifications consistent with evolving regulations to reduce or eliminate the quantities of radioactive effluent releases to comply with current regulatory limits.

ENVY had an initial Radiological Historical Site Assessment (HSA) prepared to document historic radioactive material spills and leaks in order to assess their impact on the environment. The HSA process, as described by the NRC in NUREG-1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), is an iterative process in which knowledge about the site is obtained through records of past events and augmented through scoping surveys and characterization surveys. ENVY will periodically update the Radiological HSA as information is gathered. The Radiological HSA is included as Appendix E of this report. The current Radiological HSA results are based on review of historical information required to be maintained by the NRC, a review of condition reports, and interviews with current and former employees. The Radiological HSA identifies 72 areas as potentially impacted by radioactive material that may be of significance during the decommissioning. Of the 72 areas identified, none is considered a major challenge to the decommissioning project. The information developed during the Radiological HSA will be utilized to focus site characterization activities to more accurately assess the nature and extent of contamination at the site.

Most issues identified resulted from spills, leaks, or build-up over time of contamination at levels below those that could be detected by the monitoring methods that the facility employed consistent with the monitoring practices in use over time throughout the nuclear industry. Historical sampling indicates a buildup of radioactive contamination in the site Storm Drain System. This system collects surface water runoff from paved areas and building roofs in the Protected Area and the Owner Controlled Area. The sources of contamination for this system include radioactive material stored and transported on the site, fallout from atmospheric weapons testing and domestic and international nuclear accidents (Chernobyl and Fukushima-Daiichi), and fallout from the VYNPS station effluent release path (plant stack). Historic sampling indicates contamination levels are a fraction of the NRC screening level Derived Concentration Guideline Levels (DCGLs).

The dominant plant-related radioactive contaminants identified in the Protected and Owner-Controlled Areas of the site are cobalt-60 (Co-60), cesium-137 (Cs-137), and tritium (H-3). Exceptions to this generalization are: at the northeast side of the Radwaste Building where managanese-54 (Mn-54) and zinc-65 (Zn-65) were identified in samples collected in 1987; and the chemistry sample sink drain line break where cesium-134 (Cs-134), strontium-90 (Sr-90), and iron-55 (Fe-55) were identified.

As part of the Radiological HSA, areas of known or potential contamination are classified based on the potential for exceeding NRC license termination criteria. MARSSIM sets forth the NRC's accepted methodology for determining whether radiological contamination has been reduced sufficiently to permit license termination. The MARSSIM guidance recommends classifying areas of known or potential contamination into three classes:

- Class 1 is the highest classification and indicates the area is likely to require radiological remediation.
- Class 2 is an intermediate classification and indicates the area is not likely to require remediation but will receive more comprehensive characterization and final status surveys.
- Class 3 is the lowest classification and indicates the area has been exposed to plant-derived contamination at low levels and is not expected to require remediation.

Soil Impacts

The Radiological HSA identified four Class 1 Areas. Based on radiological surveys and assessments, none of these areas pose an immediate threat to human health or the environment.

1. In 1976, approximately 83,000 gallons of water from the Condensate Storage Tank (CST) was released to the Connecticut River from an overflow pipe. The release path to the river had the potential to impact surface and subsurface soil. The release occurred over a two day period via electrical conduit and underground pipe passageways. This was documented in NRC Report No: RO-76-22/1T. In addition, in 1986 a leak was discovered in the bottom of the tank that had saturated the sand layer between the tank bottom and the underlying concrete support structure. Telltale drains are embedded within the sand layer. The leak was evidenced by water from the telltale drains in the CST ante-room. The bottom of the tank was replaced with new aluminum plates and the leak was curtailed. All of the leakage from the tank was returned to the RadWaste Building via the floor drains in the CST Moat area.
2. Soil adjacent to the northeast side of the RadWaste Building was contaminated by a build-up of low level radioactivity associated with activities to package expended resin

for transport to a disposal facility. The contaminated soil nearest the cask room doors was analyzed for levels of activity and subsequently excavated, backfilled, and sealed with asphalt in August, 1987. Further sampling of this area to better characterize the extent of total soil contamination was performed in May, 1988 and found contamination at lower levels than those collected in 1987. A pathway dose assessment of this area has been completed. The contaminated soil is not a concern for on-site or off-site doses. Additional sampling was performed at the boundaries of this area in 1999 and sample results indicate the contamination has not spread beyond the originally identified boundary.

3. In 1991, a leak was discovered in the drain line from the chemistry lab sink to the chemical drain tank in the Radwaste Building. This leak contaminated the soil under the concrete floor of the lab. The volume of contaminated material was estimated to be approximately 58,000 cubic feet. Radionuclides associated with the spill included cesium-134 (Cs-134) and strontium-90 (Sr-90) and iron-55 (Fe-55). This location is the only location on the VYNPS site where these radionuclides are known to have been released to the environment. This area has been designated as an approved on-site waste disposal area under the requirements of NRC regulation 10 CFR 20.2002.
4. Soil outside of a pipe trench in the vicinity of the Augmented Off-Gas (AOG) Building became contaminated due to a pipe leak identified in January, 2010. The area between the Maintenance Shop and the AOG Building was excavated and the leak was stopped. Approximately 85 cubic yards of soil was removed as part of the remediation. The two drain lines that were leaking were isolated and abandoned following the installation of new lines. The excavated area was backfilled with flowable concrete material and clean soil from an off-site source.

The Radiological HSA identified four Class 2 Areas. Based on radiological surveys and assessments, none of these areas pose an immediate threat to human health or the environment.

1. In 1983, a pile of contaminated sand-blasting media was discovered near the south side of the North Warehouse. This material had been generated during maintenance work associated with a previous refueling outage. The material was discovered on an unpaved portion of the Protected Area. The media was packaged and disposed of as radioactive waste. The affected area was excavated and all contaminated soil was disposed of as radioactive waste. Subsequent samples collected in this area have shown only trace amounts of radioactivity, well below applicable regulatory limits.
2. The expended cask loading activities impacting the soil adjacent to the RadWaste Building described above have resulted in low level contamination migrating to an area adjacent to the Intake Structure. Soil sample results in this area indicate contamination levels well below applicable regulatory limits.
3. Storage and handling of radioactive materials in the North Warehouse have resulted in low level contamination of the grounds adjacent to the east and west entrances to the warehouse. Historic sampling indicates contamination in this area is well below regulatory limits.
4. In June 1988, VYNPS determined that the plant septage contained Co-60 and Cs-137. All off-site septage shipments were halted immediately. This is a recognized NRC Bulletin 80-10 issue (contamination of a nonradioactive system). VYNPS submitted a 10 CFR 20.302 application (now 10 CFR 20.2002) to the NRC for approval of a proposed

disposal method – specifically, spreading the septage on the North and South Application Fields - which was approved on 8/30/89. The application and approval are in Appendix B of the ODCM. In practice, the material has been spread only on the 2-acre South Field Application Area. Sampling data demonstrate that the concentrations of radioactive material spread are well below the criteria specified in the permit for the activity. No septage or other contaminated material has ever been spread on the North Field Application Area. Most of the North Field is now within the perimeter of the new VELCO substation.

The majority of the areas of the site have been assigned an initial classification of Class 3. The classification of these areas is based on past practices described above and the potential for the areas to have been impacted by low level radioactive contamination. These are generic areas of concern and not known areas requiring remediation. All areas within the Protected Area that are not designated as Class 1 or Class 2 have been classified as Class 3. The following areas outside the Protected Area have also been designated as Class 3:

1. Soil area north of the main parking lot – Contaminated asbestos materials were stored in this area in 1984 and snow was routinely piled in this area as a result of plowing the Protected Area and the parking lots in the Owner Controlled Area. Low levels of radiological contamination deposited on the site were transported to this area when the contamination became entrained in the snow.

2. Septic System and Tanks – In 1988, VYNPS determined that plant septage contained Co-60 and Cs-137. All off-site septage shipments were immediately halted. Pursuant to 10 CFR 20.2003 (formerly 10 CFR 20.302), the NRC authorized VYNPS to create an on-site waste disposal area for this material in the southern portion of the site near the Cooling Towers (outside the Protected Area). In accordance with this authorization, accumulated septic sludge is regularly pumped out for spreading on the 2-acre site at the south end of the station. The septic tanks and leach fields may contain residual contamination.

3. Cooling Tower Deep Basin Silt Storage Area – In 1993, low levels of contamination were identified in samples of the silt removed from the cooling tower deep basin. The first silt volume removed was approximately 14,000 cubic feet. Every 18 months, the Deep Basin is inspected and additional silt is removed (if necessary) as part of scheduled maintenance and inspection of the deep basin. It is estimated that approximately 4,000 cubic feet of silt are removed during each cleaning activity. VYNPS requested and received an amendment to the 10 CFR 20.2002 authorization for the septic sludge authorization described above to include spreading the silt in the same location as the septic sludge.

4. Burn Area in the north parking lot – VYNPS burned scrap wood in this area in the 1970 timeframe. The material was surveyed and released from the plant using monitoring techniques that were in accordance with industry standards at the time. These monitoring techniques may have resulted in release of trace amounts of radioactive material which was concentrated in the burn process resulting in measurable levels of contamination in the Burn Area.

5. As part of an NRC-issued Security Order, VYNPS reconfigured the Protected Area in 2006. As part of this activity, approximately 900 cubic feet of soil was removed from the Protected Area. VYNPS received NRC approval to place this material in the on-site waste disposal area used for septage removed from septic tanks described above.

Building Impacts

As part of the HSA process, initial radiological classifications have been assigned to the buildings at VYNPS. Details of the initial building classifications can be found in Section 5.4 of the Radiological HSA contained in Appendix E of this report. All buildings, structures, systems, and components associated with the VYNPS nuclear power reactor or associated with handling of related radioactive material have been classified as Class 1 areas. They include the: Reactor Building, Turbine Building, Radwaste Building, CST and CST building, Service Building, Containment Access Building, and AOG Building. Class 2 buildings include the: North Warehouse, Plant Stank, and Maintenance Machine Shop. Class 3 buildings include the: Control Building, South Warehouse, Construction Office Building, Cooling Towers, Intake Structure, and Discharge Structure.

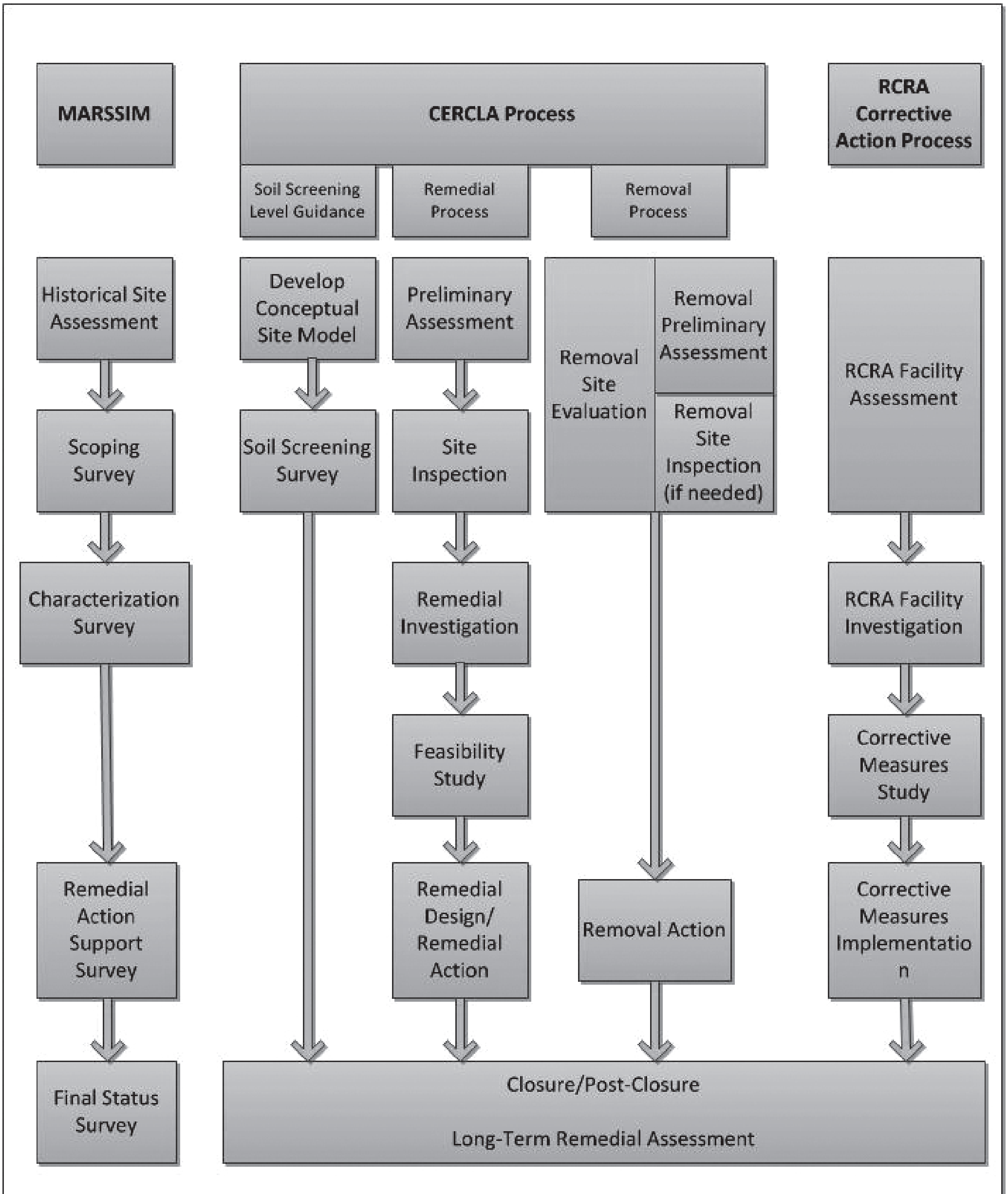
In addition, items of note from an environmental risk perspective include:

- Contamination on building roofs – As discussed above, fallout contamination has resulted in the buildup of low levels of radioactive contamination well below NRC screening level DCGLs on the building roofs. Generally, building roofs are flat and are constructed of ballast material (stone) placed over hot tar. This type of roofing material is known to trap contamination in the tar requiring disposal of the roofing material as radioactive material when it is removed.

- Soils immediately adjacent to buildings – As discussed above, precipitation may cause accumulated low level radioactive contamination on building roofs to migrate to the adjacent soils where the contamination becomes trapped in the soil and becomes concentrated. However, historical sampling has indicated the such contamination levels are well below NRC screening level DCGLs.

1.5 Non-Radiological Contaminants On-Site

ENVY also had an initial Non-Radiological HSA prepared to identify areas of VYNPS where environmental media may have been impacted by non-radiological contaminants throughout the operating history of the plant. The Non-Radiological HSA is provided as Appendix F to this Site Assessment Study. As discussed above, the Radiological HSA was conducted using a process adapted from MARSSIM guidance. Although MARSSIM was intended to address radiological contamination, ENVY chose to maintain the MARSSIM terminology for purposes of assessing non-radiological contaminants in this study. The HSA process, as described in MARSSIM, is an iterative process in which knowledge about the site is obtained through records of past events and augmented over time through scoping surveys and characterization surveys. ENVY will periodically update the Non-Radiological HSA as information is gathered. Consistent with the priorities of MARSSIM, Class 1 areas will receive the most comprehensive level of characterization and are most likely to require remediation, Class 2 areas are judged to be less likely to require remediation but will still receive a high level of characterization, and Class 3 areas are judged as unlikely to require remediation. A comparison of the MARSSIM process with the U.S. Environmental Protection Agency's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA) Corrective Action process is shown below (extracted from MARSSIM Appendix F).



MARSSIM Figure F1 -
Comparison of the MARSSIM Process with CERCLA Superfund Process
and RCRCA Corrective Action Process

The Non-Radiological HSA included review of reports related to incidents of non-radiological contamination, review of the file required by federal regulation 10 CFR 50.75(g) to maintain a record of contamination incidents important to decommissioning; review of selected inspection reports prepared by American Nuclear Insurers (ANI); search of company records describing equipment leaks, spills of hazardous materials and an inventory of components containing elemental mercury, review of the spills database maintained by the Waste Management Division of the Vermont Agency of Natural Resources (Table1-1); review of various permits related to environmental regulation of the plant; interviews of current or former long-time plant employees to identify incidents that may not have been documented in plant records; review of Phase I and II Environmental Site Assessment of Vermont Yankee Nuclear Power Corporation in 2001; and inspection of the site to observe each identified potentially impacted area.

The assessment identified one hundred thirty four (134) areas on or adjacent to the VYNPS site where current or former activities may have resulted in non-radiological impacts potentially significant to the decommissioning effort. The potentially impacted areas are subdivided into twelve categories as follows: septic systems (7), owner-controlled areas (16), underground and above ground storage tanks (29), transformers and breakers (21), miscellaneous containers (24), switchyards (3), storm drainage systems (5), water supply wells (4), chemical storage areas (4), small satellite chemical and flammable material storage areas (10), compressed gas storage areas (6), and nearby off-site areas owned by Entergy (5).

Eleven of the 134 potentially impacted areas have been classified as Class 1, 52 areas as Class 2, and 71 areas as Class 3. Each area will be characterized as it becomes more accessible during decommissioning to determine the extent to which it may have been impacted.

None of the 134 potentially impacted areas identified is considered to pose an imminent threat to human health or the environment that would require immediate corrective action. It should be noted that the two Class 1 areas where petroleum products were released have been designated Site Management Activities Complete (SMAC) sites by the Vermont Department of Environmental Conservation (VTDEC). Similarly, a finding of "no significant impact" has been issued by the NRC regarding the chemistry laboratory drain leak. As to the remaining Class 1 areas, those where lead-based paint, asbestos or elemental mercury exist are within buildings, not exposed to the environment, and are being properly managed. Both the Main and Auxiliary Transformers are within concrete containment structures that drain to an oil/water separator. The Spare Main Transformer has been removed from site and the soil below the Auto Transformer was remediated to the extent possible without undermining in-use equipment. Most of the oil released from these transformers during past incidents has been captured and removed from the site and is not a continuing source of contamination. All of the spills listed in the Vermont Waste Management Database (Table 1-1) for Vermont Yankee have been closed.

Each area will be further characterized as it becomes more accessible during decommissioning, to determine the extent to which it may have been impacted. As prescribed in MARSSIM, those areas classified Class 1 will receive a relatively higher level of scrutiny.

Each of the non-radiological Class 1 areas is described below.

Structural Component Materials - Areas Containing Lead-Based Paint, Asbestos or Elemental Mercury

Three (3) Class 1 locations are generic and apply to relatively wide-spread areas of the plant where lead-based paint, asbestos or components containing elemental mercury are present. Use of lead-based paint was not required to be controlled prior to 1978 and it was widely used during plant construction. In addition, lead blankets and blocks are currently used for shielding in parts of the radiologically controlled area (RCA). In addition to lead, the potential presence of other RCRA metals (i.e., chromium) will be evaluated to determine their appropriate disposition during future site decommissioning activities. Investigations will be performed to determine whether asbestos is a structural component (e.g., the Mechanical Cooling Tower bay divider walls) or is a component of building materials (e.g., caulk, flooring, or paint). Asbestos containing materials will require removal by licensed personnel using appropriate personal protective equipment and control of the removed asbestos. Components containing elemental mercury; including switches, gauges, fluorescent bulbs, and light ballasts; will require special handling and disposal as universal waste under U.S. Environmental Protection Agency (EPA) regulations.

Former 5,000-Gallon House Heating Boiler Fuel Oil Underground Storage Tank

The former 5,000-gallon house heating boiler fuel oil underground storage tank (UST) was located near the roll up door on the southwest side of the turbine building. The tank was removed in 1994 and was confirmed to have leaked. A buried fill pipe runs westerly more than 200 feet from the fuel oil pump room near the 75,000-gallon main fuel oil tank, under the maintenance building and then northerly under the new warehouse to the UST. The pipe failed a tightness test after the UST was removed indicating a potential for leakage. The fill pipe was drained and capped but not removed because most of it was inaccessible.

Nine (9) groundwater monitoring wells were installed in the vicinity of the UST to characterize the extent of contamination. Free-phase fuel oil accumulated in two of the nine monitoring wells. A groundwater monitoring program and a recovery system to remove the accumulated oil were approved by the Vermont Department of Environmental Conservation (VTDEC), Sites Management Section (SMS Site No. 99-2617) and operated for several years. In September, 2008 the SMS issued a "SMAC" (sites management activity complete) designation for Site 99-2617. This designation effectively closed the spill incident, even though low levels (below applicable regulatory limits) of fuel oil constituents and chlorinated solvents were still detectable in some groundwater samples. The nine monitoring wells associated with the spill were permanently abandoned. Although recent guidance for tank closure and investigation published by the VTDEC was not available at the time of the tank leak, the associated investigation and remediation appear to have been conducted effectively in accordance with that later guidance.

The chlorinated solvents detected were tetrachloroethylene (PCE) and its degradation products. The source of the PCE was likely a dry cleaning operation that had been located in the nearby turbine building truck bay during the mid-1980s. When the turbine building and new warehouse are dismantled, soil in the vicinity of the truck bay, the former UST, and inaccessible portions of the fill pipe will be characterized in accordance with applicable Vermont guidance.

Main, Spare Main, Auxiliary, and Auto Transformers

Multiple switchyards, substations, and transformers are located at the site. Most of the larger transformers (Main Transformer, Auxiliary Transformer, Auto Transformer, and two Start-up Transformers) are contained within secondary containment vaults whose drainage pass through an oil/water separator and is managed and monitored by Procedure OP 2160, Oil and Hazardous Materials Spill Prevention and Control. Those transformers where releases of oil to the environment are known to have occurred are discussed below.

The Main, Spare Main, Auxiliary, and Auto Transformers are oil-cooled and have capacities of 27,400, 26,500, 4,920, and 17,200 gallons of oil, respectively. Because of their dielectric and thermal conductivity properties, oils containing polychlorinated biphenyl compounds (PCBs) were commonly used in transformers. Their use was banned in 1979 due to their environmental toxicity and persistence. All transformers at VYNPS now contain non-PCB oil, but because the plant was constructed before 1979, residual PCBs may still be detectable.

An oil spill was reported at the Main Transformer in 1996. Sampling conducted in 2001 during the Phase I and II Environmental Site Assessment of the VYNPS site identified PCBs in oil in the oil/water separator (MH-A) to which the containments for the Main and Auxiliary transformers drain. Soil staining was noted at that time in the vicinity of the Main transformer and an active leak was indicated by the presence of sorbent pads within its containment. In June 2004 there was a fire at the Main Transformer and transformer oil and fire-fighting foam were spread outside of the transformer containment.

Soil staining that appeared to be weathered and not from an active oil leak was also observed in the vicinity of the Spare Main transformer during the 2001 Phase I and II Environmental Site Assessment of the VYNPS site. An oil leak from that transformer was reported in 2005 and the transformer was removed from the site in 2007. No soil staining has been observed in the vicinity of the Auxiliary Transformer. However, during the employee interviews conducted during April and May 2014 it was reported that a fire occurred in the Auxiliary transformer prior to 1975 and oil sprayed on the ground beyond the transformer containment. A leak in the Auto Transformer located within the fenced area of the 345kV switchyard occurred in 2003. The spill was remediated by excavation and removal of approximately 25 cubic yards of impacted soil. However, inaccessible impacted soil may remain beneath the concrete pad on which the Auto Transformer sits.

The areas in the vicinity of each of these transformers, including their containments and oil/water separator MH-A, to which the Main and Auxiliary Transformers drain, will be fully characterized during decommissioning.

Chemistry Laboratory Sink Drain Leak

The sink drain in the Turbine Building chemistry laboratory was discovered to be leaking under the floor slab in 1991. A limited subsurface investigation was conducted in 1991 by drilling one soil boring through the lab floor near the location of the leaking drain. Three soil samples from the depth interval between 2 and 13 feet below the floor were analyzed for both radiological and non-radiological contaminants. A monitoring well was installed to the bottom of the soil boring (15.75 feet below the floor), where bedrock was encountered, but no groundwater entered the well.

Non-radiological contaminants (volatile organic compounds, semi-volatile organic compounds, total metals, ammonia, chloride, nitrite and pH) were not detected in the soil samples at concentrations greater than regulatory limits. Several radionuclides, as described in the Radioactive Materials On-Site section above, were detected in the soil throughout the sampled depth interval. VYNPS submitted a permit application to the NRC in 1991 to leave low levels of radionuclides in place in accordance with federal regulation 10 CFR 20.302. On March 7, 1996 the NRC approved the application and published a Finding of No Significant Impact in the Federal Register (61 FR 8984). In 1997, the NRC revised 10 CFR 20 and renumbered 10 CFR 20.302 to 10 CFR 20.2002.

The drain pipe was abandoned and a new pipeline was installed. Although no non-radiological contaminants were detected by the 1991 investigation, the inquiry was limited in scope due to limited accessibility. A more thorough characterization of the area will be conducted during decommissioning to determine if non-radiological contamination associated with disposal of laboratory chemicals in the leaking drain remains in the adjacent soil.

Nearby Off-Site Properties Owned by Entergy

Two (2) Class 1 areas are not located on the VYNPS site, but are properties owned by ENVY near the plant on Governor Hunt Road. The former Evelyn Edson residence at 298 Governor Hunt Road has been a residential property since it was constructed in approximately 1955. A Phase I environmental site assessment of the property was completed in November 2009, shortly before its purchase by Entergy and no "recognized environmental conditions" (RECs) were identified at that time. The house is in use by the Town of Vernon as their Emergency Operations Center. A property inspection was completed in May, 2014. The floor in one room in the south end of the basement contains approximately 9-inch square floor tiles. Based upon their size (which is characteristic of floor tiles containing asbestos) and the age of the house, it is likely that these tiles are "asbestos-containing material" (ACM). Also based on the age of the house, lead-based paint may be present. Both the suspected asbestos floor tiles and lead-based paint will require characterization and possible remediation.

The second property is the former Edson's Gulf property at 306 Governor Hunt Road, which is immediately north of the former Evelyn Edson residence. The property was a gasoline filling station and automobile repair facility that was developed in 1967, after the property was subdivided from the 298 Governor Hunt Road property. A Phase I environmental site assessment of the property was completed in October, 2001, shortly before it was purchased by ENVY.

Two (2) USTs containing gasoline were removed from the property in 1990 and were found to be leaking. The incident was reported to VTDEC and is listed as SMS Site No. 93-1485. Seven (7) groundwater monitoring wells were installed during a site investigation in 1993. A soil vapor extraction (SVE) system was operated from December 1994 until August 1999 to remediate contaminated soil and groundwater. Deeper water supply wells were drilled in the bedrock to replace contaminated shallow wells at the nearby Evelyn Edson and Bailey residences. During and after operation of the SVE system a groundwater monitoring program was undertaken to demonstrate further remediation of the spill by natural attenuation. Concentrations of two volatile organic compounds (constituents of gasoline) were still greater than the Vermont Primary Groundwater Quality Standards (PGQS) in one monitoring well in 2006.

In addition to the leaking USTs, an oil-stained floor drain in the northern garage bay formerly drained to a drywell located northeast of the garage. An in-ground hydraulic lift in the garage bay may have contained PCB oil. These areas of concern were the subject of a Phase II investigation in November 2007. The upper components of the hydraulic lift (but not the in-ground cylinder) were removed and the floor drain and lift pit were sealed with concrete. A January 20, 2009 letter from VTDEC designated SMS Site No. 93-1485 Site Management Activities Complete (SMAC), and no additional activity regarding the gasoline leak was required. The drywell to which the former floor drain flowed and the hydraulic lift cylinder apparently have not been removed and may require remediation.

A property inspection was completed in May 2014. The garage bays were occupied by various pieces of maintenance equipment. The back room was occupied by various containers of virgin and waste oil staged on secondary containment skids, a 275-gallon above-ground storage tank containing fuel oil for space heating, two steel cabinets for storage of non-flammable chemicals and two steel cabinets for storage of flammable material. A sea-van storage container in the south yard contained additional maintenance equipment and several polyethylene 55-gallon drums filled with water were stored at the exterior rear of the building. All containers appeared to be in good condition, with no indication of spills or leaks.

Currently, the former Edson's Gulf property is used by the VYNPS Maintenance Department.

Table 1 - Summary of Vermont Waste Management Division Spills Database for Vermont Yankee

Spill No.	Date Reported	Nature of Incident	Quantity (gallons)	Date Closed
36	2/6/1993	Mineral oil spill	<1	2/8/1993
53	7/2/1975	Tank overfill	700	1/1/2000
54	3/6/1991	Radioactive waste leak		3/6/1991
76	8/5/1978	Overflow in Turbine Vent	100	1/1/2000
121	5/30/1991	Oil leak to River	5	5/31/1991
167	6/14/1993	Drum found at dam		8/24/1993
200	8/19/1991	Penetrant release	0.25	8/19/1991
218	9/17/1990	Oil spill	10	9/17/1990
241	9/8/1992	Drum tipped over	55	9/8/1992
267	9/15/1993	Gasoline Tank leak	0.25	9/16/1993
279	12/13/1991	Spill during transfer	2	12/17/1991
WMD 012	1/18/1994	Diesel fill line broke	10	1/18/1994
WMD 016	1/17/1997	Equipment failure on truck	6	1/27/1997
WMD 018	1/16/1996	Spill in Cooling Tank area	1	1/15/1996
WMD 022	1/14/2010	Hydraulic oil leak	<1	1/15/2010
WMD 042	1/23/2013	Motor oil from truck	3.5	1/23/2013
WMD 069	3/4/2005	Mercury leak	4 lbs	3/7/2005
WMD 136	5/8/2003	Transformer leak	2	5/8/2003
WMD 137	4/1/2013	Hydraulic hose on truck	4	4/1/2013
WMD 163	5/13/1994	Delivery spill	1	5/13/1994
WMD 174	6/6/2003	Hydraulic leak	4	6/6/2003
WMD 193	6/24/1996	Leak to moat		6/26/1996
WMD 194	5/16/2000	Leak from propane tank	40 lbs	5/16/2000
WMD 210	6/18/2004	Transformer fire	10	6/18/2004
WMD 236	7/27/2004	Lawn mower line failure		7/27/1994
WMD 237	8/5/2003	UST overfill	16	4/9/2004
WMD 263	8/12/2002	Oil leak at fan	15	8/12/2002
WMD 312	10/14/1994	Dump truck leak	5	10/31/1994
WMD 315	6/18/2008	Diesel spill from pump	5	6/18/2008
WMD 394	12/3/2003	Transformer leak		2/11/2004
WMD 409	11/16/1999	Spill in driveway	5	11/16/1999
WMD 413	11/25/1997	Hydraulic line leak	10	11/25/1997
WMD 419	11/24/1999	Gasoline tank overfill	5	11/24/1999
WMD 559	11/19/2008	Equipment maintenance	<1	11/19/2008
WMD 577	12/1/2008	Diesel spill during delivery	5	12/1/2008
WMD 586	12/1/2008	AST release	5	12/1/2008

1.6 Groundwater

Summary of Groundwater Impacts

ENVY maintains an extensive groundwater monitoring system. Monitoring results indicate that known contamination events do not create an immediate threat to public health or the environment. The known impacts to groundwater at the VYNPS site can be summarized as follows:

1. Tritium is the only plant-generated radionuclide detected in groundwater at the site. A comprehensive hydro-geologic investigation of the site completed in 2010 found tritium in shallow groundwater extending approximately 400 feet down-gradient from the source at the AOG Building pipe chase to the Connecticut River. The width of the tritium plume increases from approximately 100 feet at the source area to approximately 300 feet along the bank of the river. Tritium concentrations in the shallow sand aquifer have rapidly decreased at the source area from approximately 2,500,000 picoCuries per liter (pCi/L) in February 2010 when the leak was terminated to less than 2,000 pCi/L in April 2010. For comparison purposes, the EPA Drinking Water Standard limit for tritium is 20,000 pCi/L. Similar attenuation has also occurred within the shallow plume down-gradient of the source, as the center of the residual contaminant mass migrates to the east. Attenuation is occurring at a slower rate in a deeper silt sand aquifer and an intervening silt aquitard where the hydraulic conductivities and related seepage rates are lower.

2. With one exception, no tritium, gamma-emitting or hard-to-detect radionuclides have been identified in groundwater from any wells in other areas of the plant, including the drinking water wells located west of the Turbine Building, the REMP wells, and the wells in the six septic system leach field areas. The one exception is the Construction Office Building (COB) well located at the northeast corner of the COB and within the area of the tritium plume. The COB well was one of four drinking water supply wells for the plant that produce water from the bedrock aquifer. Low levels (approximately 2,000 pCi/L) of tritium were detected in the COB well during the investigation of the leak from the AOG Building pipe chase; however, this detection was attributed to the sampling method that purged water from the well before sampling and induced the migration of tritium contaminated shallow groundwater into the well. The COB well was conservatively removed from service as a drinking water source and no samples identified tritium contamination while the well was in service. The COB well has since been permanently abandoned and, following a grab sample test of the deep bedrock aquifer that showed tritium levels below minimum detectable levels, was filled with a cement grout to reduce the potential for drawing tritium into the bedrock aquifer.

3. No non-radiological impacts to groundwater related to the permitted disposal of sanitary wastewater in septic system leach fields on-site or spreading of septic system sludge in the South Land Application Area have been detected by groundwater monitoring in these areas. No data is available to evaluate the impact to groundwater (if any) that may have resulted from the leak in the chemistry laboratory sink drain discovered in 1991, or from fires at the Main transformer (in 2004) and the Auxiliary transformer (in 1973) that released transformer oil on the ground beyond their containment structures.

4. Non-radioactive contamination of groundwater was identified in 1994 when the 5,000-gallon underground storage tank containing fuel for the house heating boiler

was found to be leaking and was removed. Free-phase fuel oil was detected in two of nine monitoring wells installed during the investigation and remediation of the leak. A buried fill pipe for the 5,000-gallon tank that runs more than 200 feet from the fuel oil pump room near the 75,000-gallon main fuel oil storage tank failed a tightness test after the tank was removed. The fill pipe was blanked off but not removed because overlying buildings made it inaccessible. In 2008, the VTDEC issued a finding of "site management activities complete" regarding the tank leak, although low levels of fuel oil constituents and solvents were still detectable in nearby monitoring wells. The source of the solvents was likely a dry cleaning operation formerly located in the nearby Turbine Building truck bay during the mid-1980s. Impacts to soil beneath the Turbine Building truck bay or along the buried fuel oil fill pipe that were not investigated because these areas are effectively inaccessible.

5. It should be noted that the four underground storage tanks containing fuel oil or diesel fuel that are currently in use on site are double-walled, with electronic interstitial leak monitoring. The above-ground tanks storing petroleum products are either double-walled or within concrete containment structures. There has been no indication of leakage from the four in-use underground storage tanks. Similarly, transformers with large oil capacities are located within concrete containment structures or are on concrete pads with a perimeter concrete berm. These design features reduce the likelihood of groundwater contamination caused by a release from these structures.

<u>Groundwater Monitoring Programs</u>

Groundwater monitoring programs at VYNPS have been developed to meet various regulatory guidance and permit requirements. The key programs include:

- Groundwater Protection Initiative in accordance with Nuclear Energy Institute's (NEI) Groundwater Protection Initiative (NEI 07-07); the program is currently designed for operating plants.
- The REMP monitors groundwater used for drinking water.
- Groundwater monitoring to meet permit requirements for the septic tank sludge and septic leach field permits.

After VYNPS ceases operation, the technical bases of the groundwater monitoring programs will continue to be evaluated throughout the phases of decommissioning to ensure groundwater monitoring is commensurate with the activities and conditions of the station.

VYNPS implemented NEI 07-07 as part of a fleet-wide effort to comply with the Groundwater Protection Initiative (GPI). This program was first implemented in November 2007 when three monitoring wells were installed at locations along the eastern boundary of the site to screen for the presence of radionuclides in groundwater down gradient from the plant. Tritium was detected in a groundwater sample collected in November 2009 from one of these wells. A comprehensive hydrogeological investigation was commenced in January 2010 to determine the source, fate and transport of the tritium. Twenty nine (29) additional groundwater monitoring wells were installed at the site during that investigation to characterize the hydrogeological flow domain and allow collection of groundwater samples.

In addition to groundwater from the 30 monitoring wells routinely sampled as part of Vermont Yankee's response to NEI 07-07, groundwater from other wells is sampled as part of the VYNPS REMP. These wells include two on-site potable water wells producing drinking water from the bedrock aquifer west of the protected area. A third well, the Southwest Well, also taps into the bedrock aquifer but is no longer used as a potable water well. Water from the Southwest Well is also sampled quarterly in compliance with the VYNPS ODCM.

Septic tank sludge is periodically land spread in the South Land Application Area in accordance with a Vermont Agency of Natural Resources (VANR) permit for residuals management and an NRC septage spreading permit under federal regulation 10 CFR 20.2002, as outlined in Appendix B of the VYNPS ODCM. Four shallow wells, located adjacent to the South Land Application Area are sampled quarterly for gross beta activity, gamma-emitting radionuclides and tritium. No plant-generated radionuclides have ever been found in the samples from these wells.

Groundwater from approximately 21 shallow monitoring wells distributed within six septic leach field areas located in various parts of the plant and septic system effluent from the three systems within the Protected Area are sampled semi-annually. The samples are analyzed by a contract laboratory for indicators of biological impacts, including E. coli, chloride, nitrate, sulfate, phosphorus and pH, in accordance with Vermont Yankee's Indirect Discharge Permit issued by the VANR. The sample results from each location are in compliance with the permit requirements. Although not required by the permit, groundwater and effluent samples are analyzed for radioactivity by the VYNPS on-site Chemistry Laboratory before shipment off-site for analysis by the contract lab. No plant-generated radionuclides have ever been found in the samples from these wells.

2 Spent Nuclear Fuel Management

2.1 Wet Storage of Spent Nuclear Fuel

Spent fuel will remain in the spent fuel pool (SFP) until it meets the criteria for transfer to dry storage, the existing ISFSI is expanded and the spent fuel can be transferred in an efficient manner to the expanded ISFSI. Spent fuel transfer from wet to dry storage is expected to be complete by late 2020

2.2 Dry Storage of Spent Nuclear Fuel

Once all spent fuel has been transferred from wet to dry storage, the spent fuel will remain at VYNPS in dry storage until DOE accepts the fuel and removes it from the site. In total, 3,880 SFAs will be stored in 58 Dry Cask Systems and stored on two ISFSI pads located in the northern area of the VYNPS Protected Area. DOE's current estimate for start of acceptance of spent fuel from the industry is 2025, with the first shipment from VYNPS in 2026. Based on these projections, the final shipment of VYNPS spent fuel to the DOE is anticipated to be in 2052.

2.2.1 ISFSI Pad Expansion

The Second ISFSI Storage Pad Project involves the construction of a second, highly-engineered concrete storage pad located approximately 30 feet immediately to the west of the existing ISFSI pad. The design of the pad will be similar to the presently installed pad and will fully comply with the requirements specified in the Holtec Final Safety Analysis Report, or "FSAR," in order to support the loaded storage casks, which weigh approximately 395,000 lbs. each. The Second ISFSI pad is currently being currently designed for storage of 25 casks in a five by five arrangement and, when combined with the existing ISFSI storage pad, a total of 58 dry fuel storage casks can be stored on the pads, which will allow removal of all spent nuclear fuel from the Vermont Yankee Spent Fuel Pool. In addition, the pads will allow storage of up to three casks of "greater than Class C" waste. Greater than Class C waste consists of non-fuel, low-level radioactive waste that the NRC considers not generally acceptable for near surface disposal.

The existing ISFSI storage pad currently has an elevated concrete apron at the same height as the pad with an access ramp on either end to allow the Vertical Cask Transporter (VCT) to access the pad. The existing ISFSI storage pad's west-facing ramp will be removed to accommodate construction of the second ISFSI pad. A new west-facing concrete apron and ramp structure will be installed for the Second ISFSI storage pad to allow the VCT to access that pad. The design and dimensions of the apron and ramp for the Second ISFSI storage pad will be similar to the apron and ramp presently installed for the existing pad. In addition, an approximately 30 foot long by 24 foot wide concrete connecting structure (connector) will be installed between the two aprons to allow the VCT to transit between the pads.

The concrete pad will be a three foot thick monolithic structure containing steel rebar and concrete constructed during a continuous concrete pour. The finished elevation of the pad will be 254 feet above mean sea level which is the same elevation as the existing ISFSI pad.

2.2.2 Certificate of Public Good

On June 30, 2014, ENVY submitted a petition to the Vermont Public Safety Board for a certificate of public good to construct the second ISFSI pad.

2.3 DOE Acceptance Situation and Assumptions Used for Spent Fuel Management

ENVY is required to store spent fuel assemblies on site due to DOE's breach of the Standard Contract, which obligates DOE to remove spent fuel from the site. For planning purposes, and based on the U.S. Department of Energy's January 2013 *Strategy for the Management and Disposal of Used Nuclear Fuel and High-Level Radioactive Waste*, ENVY assumes the DOE will start transferring spent fuel from the site beginning in 2026 and will complete removal of all fuel from VYNPS in 2052.

2.3.1 Impact on Site Operations

Due to the DOE breach of contract, ENVY must maintain an on-site storage location for spent fuel assemblies until DOE satisfies its obligation to remove all fuel from VYNPS. Pursuant to NRC requirements, spent fuel must be maintained in wet storage in the spent fuel pool to allow sufficient cooling time before the fuel assemblies can be moved to dry storage. This requirement results in the need for ENVY to maintain cooling and level control systems for the spent fuel pool until all of the fuel assemblies can be transferred to the ISFSI. The Standby Spent Pool Cooling System will be operated and maintained during the period of wet fuel storage to provide cooling for the spent fuel pool. The Torus (a high capacity storage vessel used for emergency cooling of the reactor and not needed following permanent defueling of the reactor) will be used as a source of makeup water and letdown for spent fuel pool level control. Use of these systems requires maintaining power to many areas of the Reactor Building and Intake Structure to operate large pump motors.

2.3.2 Impact on Decommissioning

Maintaining fuel assemblies in wet storage in the spent fuel pool has a significant impact on the schedule and cost of decommissioning the station. During the period of wet fuel storage, station staffing levels must be maintained at a higher level to monitor the fuel, maintain the systems required for fuel pool cooling and level control, and provide security around the spent fuel pool. Following transfer of all spent fuel assemblies to dry storage in the ISFSI, modifications will be made to the facility Protected Area to shrink the size of the Protected Area to an area immediately adjacent to the ISFSI pads. At that time, ENVY will be able to further reduce staffing (including Security staffing) levels, commensurate with the reduced Protected Area. At the time decontamination and dismantlement are scheduled to start, ENVY assumes all spent fuel will have been removed from the site and therefore will not affect the decommissioning activities. If DOE's removal of spent fuel is delayed beyond the assumed completion date or the decontamination and dismantlement activities are accelerated and start before the removal of the fuel, the presence of the fuel may inhibit demolition or restrict the methodologies available for demolishing the Reactor Building and/or structures adjacent to the stored spent fuel.

3 Radiological Remediation

3.1 Existing Radiological Source Term

With the exception of the spent fuel assemblies stored on the current ISFSI pad, the majority of the existing radiological source term at the station is contained in the buildings that support power generation, specifically: the Reactor Building, the Turbine Building, the RadWaste Building, and the Augmented Off-Gas Building. These buildings contain piping, valves, filters, ion exchangers, and tanks that contain radioactive materials as well as tools and equipment used to perform maintenance on the facility. As part of the decommissioning process, after the plant is shutdown, ENVY plans to place VYNPS in a safe, stable condition and maintain it in a "dormant" state until it begins decontamination and dismantlement activities. During the preparation for dormancy, radioactive liquids will be drained from systems not required for Spent Fuel Pool operations and collected in the Condensate Storage Tank, RadWaste Tanks, and the Torus. A plant modification will be installed that allows use of the Torus as a makeup water source to control water level in the spent fuel pool. Following installation and testing of this modification, the CST and the liquid waste tanks located outside the Radwaste Building will be drained and abandoned. At this point, all radioactive water in the facility will be stored in the Reactor Building. The water will be maintained in the Torus for future use during the reactor vessel internals segmentation project.

To prevent the spread of contamination during the dormancy preparation period, monitored ventilation systems will remain in operation in the Turbine and RadWaste Buildings until such time as all systems are drained and placed in a safe condition. Monitored ventilation in the Reactor Building will remain in operation until all of the spent fuel is removed from the spent fuel pool and stored in the ISFSI.

3.2 Facility Dismantlement

As one of the conditions for an operating license, the NRC requires the licensee to decommission the nuclear plant after it ceases power operations. This requirement is based on the need to reduce the amount of radioactive material at the site to ensure public health and safety as well as protection of the environment. To decommission a nuclear power plant, the radioactive material on the site must be reduced to levels that permit termination of the license. This involves removing the spent fuel (the fuel that has been in the reactor vessel), dismantling any systems or components containing activation products (such as the reactor vessel and primary loop), and decontamination and/or dismantlement of contaminated structures and areas. All activated materials generally have to be removed from the facility and shipped to a waste processing, storage or disposal facility. Contaminated materials may either be cleaned of contamination onsite, or the contaminated sections may be cut off and removed (leaving most of the component intact in the facility), or they may be removed and shipped to a waste processing, storage, or disposal facility. The licensee decides how to decontaminate material, and the decision is usually based on the amount of contamination, the ease with which it can be removed, and the cost to remove the contamination versus the cost to ship the entire structure or component to a waste-disposal site.

Facility dismantling may be deferred under the NRC-approved "SAFSTOR" decommissioning method. Accordingly, the level of planning required today for future facility dismantling is much less than the planning that would be required for decommissioning that occurs on a more accelerated basis under another NRC-approved decommissioning method ("DECON"). (SAFSTOR and DECON are described in more detail in Section 7 below.) Prior to the time of facility dismantling, the licensee will perform the detailed engineering necessary to execute the decommissioning, based on facts that exist at that time.

3.2.1 Reactor Vessel Internals

During VYNPS' operating period, the internal components of the reactor vessel were neutron irradiated and became highly radioactive. ENVY contracted WMG, Inc. to perform an activation analysis of the reactor vessel and internal components to determine the radioactivity content and waste disposal classification of the materials at the time of permanent removal from the site. Results of this analysis indicate that VYNPS shold have one cask system containing Greater Than Class C (GTCC) material.

In addition to the identified GTCC material, the reactor vessel contains other highly irradiated components – 89 control rod blades and 30 power range nuclear instrument strings. The 89 control rod blades currently installed in the reactor vessel are likely to be Class B waste in accordance with 10 CFR Part 61 radionuclide concentration limits. Due to the high dose rates of the irradiated blades (tens of thousands of Rem/hr on contact), it is expected the blades will be compacted in the spent fuel pool to maximize the amount of water shielding available to reduce worker exposure. All remaining reactor vessel components and the nuclear instruments can be segmented and packaged using only the reactor cavity and equipment pit.

The 30 power range nuclear monitoring instruments installed in the reactor vessel contain small quantities of special nuclear material and are planned for removal soon after fuel is removed from the reactor vessel. The nuclear instruments are likely to be Class B waste in accordance with 10 CFR Part 61 radionuclide concentrations. Once removed from the reactor vessel, the nuclear instruments will be transferred to the spent fuel pool for storage. The nuclear instruments will eventually be loaded into a shipping cask and transferred to a waste disposal site.

The installed reactor vessel internal components are not special nuclear material. The reactor vessel internal components are typically constructed of carbon steel. A reactor vessel activation analysis to determine 10 CFR Part 61 waste classifications of the vessel and internal components was performed. The analysis estimated the quantity (volume and weight) of waste to be generated when the vessel internals are removed. The vessel and internals are not considered waste until such time as they are permanently removed from their installed locations.

Following reactor vessel and cavity re-flood (refilling the reactor vessel, the reactor cavity, and the moisture-separator pit with water), the reactor vessel internals will be removed from the reactor vessel and cut apart (or "segmented"), if necessary, for packaging, transport and disposal, or to separate GTCC waste. Internals classified as GTCC waste will be segmented and packaged into containers similar to spent fuel canisters for transfer to the DOE.

Disassembly and segmentation of the reactor vessel internals 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.

3.2.2 Reactor Vessel

In addition to the reactor vessel internals, the reactor vessel itself has become irradiated during the operating period. Removal of the reactor vessel follows the removal of the reactor internals during the active decontamination and dismantlement phase of the decommissioning. 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 at VYNPS due to transportation size and weight restrictions. If the reactor vessel is required to be segmented for disposal, then it is likely that the work would be performed remotely in-air, using a contamination control envelope.

3.2.3 Systems and Equipment

After permanent cessation of operations and transfer of the fuel from the reactor vessel, plant systems and equipment that are no longer needed to support wet fuel storage or decommissioning activities will be removed from service. Specific systems will continue to be used during the different phases of the decommissioning process although in some cases in reduced roles.

Following a period of safe-storage, it is likely that the majority of the plant systems and equipment would be removed prior to dismantling of the structures. Residual fluids that had not been removed in the initial plant layup would be drained and any hazardous materials (asbestos containing gaskets, insulation, PCB coatings, mercury switches, etc.) remediated, prior to the removal. Commodities with intrinsic value (e.g., copper) may be recovered in-situ, if easily assessable, or removed wholesale for off-site processing.

Non-contaminated components and commodities would be set aside for salvage or scrap, depending upon market conditions and demand. Components and commodities that were located within a radiological control area or exposed to contamination during plant operations would be surveyed prior to disposition. Partial or complete disassembly may be required for confirmation of internal radiological conditions. Material determined to be free of contaminants would be designated for salvage or scrap. Components and commodities with detectible contamination would be designated for controlled disposal or additional processing, if deemed effective and economical (for material recovery or volume reduction).

Contaminated components and commodities would be removed using appropriate radiological controls. Depending upon the waste handling capabilities and waste acceptance criteria of the disposal site, and the radiological characteristics of the waste, contaminated components and commodities would be packaged in containers, and/or bulk-loaded into gondolas, railcars or sealand containers for controlled disposal. Large components may be shipped intact, if transport routes permit.

Vermont is a member of the Texas Low-Level Radioactive Waste Disposal Compact and, as such, may be able to dispose of the majority of the waste generated during decommissioning at the Andrews County facility in Texas, operated by Waste Control Specialist. However, the dismantling of the components residing closest to the reactor core may generate radioactive waste that is 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) as defined by 10 CFR 61.55).

Today, there are no disposal options for GTCC waste. Several decommissioned reactors (for example, Maine Yankee, Yankee Rowe, and Connecticut Yankee) have packaged GTCC waste in the same canisters that were used for on-site spent nuclear fuel storage and have placed the GTCC waste at their on-site ISFSIs to await removal and disposal by the DOE.

3.2.4 Structures

The principal buildings requiring decontamination and dismantlement in order to terminate the VYNPS operating license are the Reactor Building, Turbine Generator Building, AOG Building, and RadWaste Building. These buildings contain essentially all of the activated or radioactively contaminated material and equipment within the plant.

Historically, decontamination and dismantling of the Reactor Building has been the greatest challenge in facility dismantling. The VYNPS Reactor Building completely encloses the primary containment. It also houses the refueling and reactor servicing equipment (platforms and cranes), new and spent fuel storage facilities, and other reactor auxiliary or service equipment, including the reactor core isolation cooling system, standby gas treatment system, reactor cleanup demineralizer system, standby liquid control system, control rod drive system equipment, the reactor core and containment cooling systems, and electrical equipment components.

The Reactor Building is a seismic Class 1 structure, constructed of monolithic reinforced concrete floors and walls to the refueling level. Above the refueling level, the structure consists of steel framing covered by insulated siding and roof decking. A biological shield, which is an integral part of the Reactor Building, encircles the primary containment. The shield has a variable thickness of four to six feet. A steel drywell vessel which houses the reactor primary system is fixed to the building along its lower portion, and is laterally supported by the building along its upper portion. Within the drywell, a cylindrical sacrificial shield structure surrounds the reactor vessel. The hollow cylinder is comprised of ordinary reinforced concrete having a wall thickness of approximately 2 feet. The inside and outside surfaces of the concrete are formed with steel plate which is increased in thickness opposite the elevation of the core for extra shielding. The cylindrical shield is supported on the same structural concrete that supports the reactor vessel.

It is likely that the majority of the equipment will be removed from the Reactor Building prior to its dismantling. Removal of the equipment will eliminate higher sources of radioactivity that could mask lower levels that may be present within the concrete and steel structure, and improve access and working conditions. Activated concrete (from neutron streaming) will be removed by controlled demolition techniques along with the drywell steel, torus and pool liners. Major sources of contamination will also be remediated at this time, including contamination on building surfaces and contamination that may have migrated into the concrete matrix. Remediation may include spot decontamination and/or commodity removal and disposal. Decontamination and removal techniques will vary with the type and extent of contamination present.

Activated concrete and contaminated concrete and steel will be sent off-site to a controlled (licensed) disposal facility. Truck and rail are typically used to move the large quantities of waste material, depending upon the off-loading capabilities of the disposal facility and the facility's waste acceptance criteria, for example on bulk or packaged material.

Once the contamination levels have been reduced to allow open air demolition, the structure is dismantled by conventional techniques, employing tooling such as hydraulic hammers, thermal lance, hydro-jet, ball and chain, diamond wire, and explosives for the steel superstructure and heavily reinforced structure containment structure. Debris produced in the demolition is designated for off-site disposal. Contaminated material (exceeding the release criteria) would be send to a controlled disposal facility (or licensed landfill). Non-contaminated material may be suitable as scrap and/or recovery (including concrete reinforcing bar and aggregate) and could be processed locally.

ENVY does not intend to use any construction debris (either contaminated or non-contaminated) as below-grade fill material. Any fill required for below-grade voids will be brought in from off-site local sources.

Decontamination and dismantling of the other buildings on site would follow a similar process: gross remediation and demolition. Radiological and/or hazardous wastes would be segregated and sent off-site for controlled disposal. Non-contaminated materials would be designated for recycling, recovery or disposal as construction debris.

3.2.5 Subsurface Soil and Building Foundations

The site would be characterized to support the development of a license termination plan and planning for additional remediation. Areas of concern would be excavated (based upon a historical site assessment or sample analysis) and remediated. Material that did not meet the site release criteria would be designated for off-site disposal.

The power blocks buildings would be removed to an assumed depth of approximately 3 feet below grade. This is generally consistent with the site practices at the decommissioned Maine Yankee, Yankee Rowe, and Connecticut Yankee reactors. Gravel from off-site sources would be brought in to fill the below grade portions of the buildings and any other voids produced by the demolition.

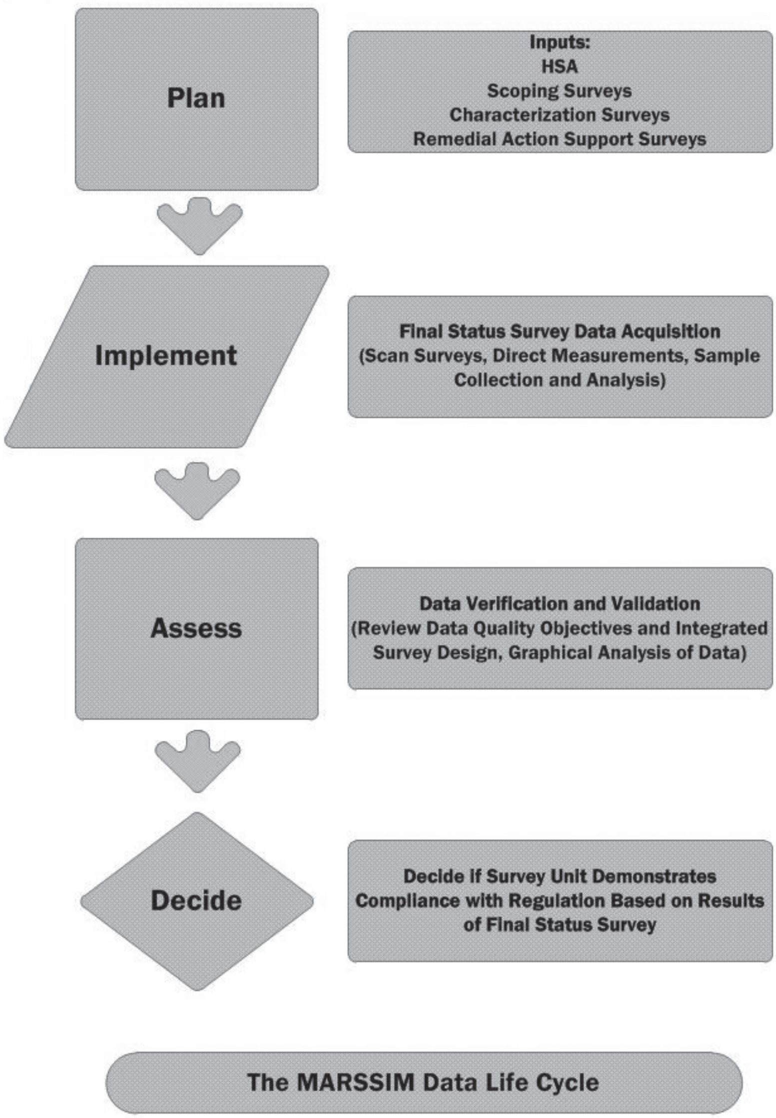
The remaining buildings that are not designated for reuse or preservation would be dismantled. Without the massive, subsurface foundations, many of the structures would be removed in their entirety.

A significant amount of the below grade piping (storm drains) and other commodities at the site (duct bank, conduit and any near-surface grounding grid) are located around the perimeter of the power block. Easily accessible commodities would be excavated and removed. Large concrete piping, located at a depth of less than 20 feet, would most likely be excavated, breeched and backfilled. Large concrete piping, located at a depth greater than 20 feet would most likely be abandoned in place (with access ways sealed). The restoration process would be dictated by the requirements and principles in effect at that time.

The overburden from the excavation would be surveyed for any radiological contamination. Uncontaminated overburden or material with contamination below regulatory limits would be stockpiled on site for future use in backfilling the below-grade voids. Material that did not meet the site release criteria would be designated for off-site disposal.

3.3 NRC License Termination Process

Following the dismantling of the VYNPS buildings that are not designated for reuse or preservation, ENVY will proceed with the license termination process. As noted above, the NRC describes an acceptable methodology for terminating licenses for power reactor sites in MARSSIM. The process can be described as consisting of four broad-based phases: Planning; Implementing; Assessing; and Deciding. The MARSSIM approach results in dividing the site into contiguous survey units which will be evaluated against the release criterion for the site. Although the MARSSIM approach as described in NUREG-1575 is intended for radiological contamination, a similar process can also be used for non-radiological contaminants. Section 1.5 above includes a diagram that compares the MARSSIM approach, the CERCLA Remedial and Removal Process, and the RCRA Corrective Action Process. The four MARSSIM phases are described in more detail below.



Planning Phase:

During this phase of the project, information is gathered to identify contaminants of concern (COCs), determine the areal extent of the contamination, determine the variability of contamination levels, identify areas that require remediation, and divide the site into survey units. Activities conducted during the planning phase may include scoping surveys, characterization surveys, and remedial action surveys. The output of the planning phase is the Quality Assurance Program Plan (QAPP) which describes the processes used for collection, analysis, and evaluation of the survey data.

Implementation Phase:

During this phase of the project, radiological and hazardous material samples are collected on a survey unit by survey unit basis. Survey design and data collection are performed in accordance with standard operating procedures and the QAPP. Survey packages are developed which prescribe the number of sample data points that will be collected as well as describing the survey instruments required to achieve the appropriate analytical sensitivity. Field samples include duplicates, splits, spiked samples, and field blanks to verify laboratory instruments are capable of achieving minimum detectable activity/minimum detectable concentrations required by the QAPP.

Assessment Phase:

During this phase of the project, sample results undergo verification and validation to data used for release decisions are of sufficient quality and quantity to support the decision. The evaluation includes both the average concentrations and the variability of the contamination within the survey unit. The variability is compared to the planning assumptions to verify the survey was adequate for the survey unit. MARSSIM provides two statistical tests that can be used to evaluate the data set. The presence or absence of the contaminant of concern in background determines which of the statistical tests are used for the survey unit evaluation.

Decision Phase:

During this phase of the project, a final decision regarding suitability for release is made for each survey unit. The MARSSIM approach uses the base assumption that the survey unit contains residual contamination above the release limit. Using this approach requires a statistically robust data set to reject the assumption and decide the survey unit is suitable for release.

4 Hazardous Materials Remediation

4.1 Hazard Reduction Immediately Following Cessation of Operations

During the preparation for site dormancy, an extensive campaign will be performed to reduce the hazards associated with the site. Many of the hazardous materials used at the station support systems that will not be required when the station is permanently shut down. Large oil reservoirs associated with plant equipment (e.g., main turbine lubrication oil) will be drained and disposed of at an off-site facility. Large batteries that support emergency systems will be removed from the station and disposed of at an appropriate off-site facility. Additionally, ready-issue stores of oils and chemicals required to support plant operations will be transferred to other Entergy stations or disposed of at appropriate hazardous disposal sites. The hazard reduction activities will support changes to the on-site fire protection systems needed to achieve a dormant state for buildings that no longer have operational heating systems.

4.2 Hazard Abatement to Support Decommissioning

During the decontamination and dismantlement phase of the project, materials that pose adverse health effects to workers or the environment will be abated prior to or as part of the dismantlement activities. For example, surfaces coated with lead paint will have the lead paint abated at locations where torch cutting will be performed and ACM containing insulation will be removed from system piping before the piping is sectioned and size reduced for disposal. The detailed site characterization ENVY will perform prior to the start of dismantlement activities will include sampling for hazardous materials. This information will be incorporated into the dismantlement planning to ensure all identified hazards are appropriately abated or controlled during decommissioning activities.

5 Site Restoration

5.1 Federal Regulations Applicable to VYNPS Decommissioning

The State of Vermont is part of the Environmental Protection Agency (EPA) Region 1 (New England) which is headquartered at 5 Post Office Square - Suite 100 in Boston, Massachusetts.

In order to support regulatory compliant site restoration standards there are a number of potentially applicable federal programs that apply to VYNPS decommissioning.

The first set of programs is associated with the RCRA which is the primary federal law governing the disposal of solid and hazardous waste. The RCRA sets goals for:

- Protecting human health and the environment from the potential hazards of certain wastes.
- Conserving energy and natural resources.
- Reducing the amount of waste generated.
- Ensuring that waste streams are managed in an environmentally sound manner.

To meet these goals, the RCRA establishes three (3) comprehensive programs that are administered by the EPA:

- The Solid Waste Program, under RCRA Subtitle D, encourages the development of comprehensive plans to manage non-hazardous industrial solid waste.
- The Hazardous Waste Program, under RCRA Subtitle C, that establishes a system for controlling hazardous waste from the time it is generated until its disposal (cradle to grave concept).
- The Underground Storage Tank (UST) program, under RCRA Subtitle I, which regulates underground storage tanks that contain hazardous substances and petroleum products.

VYNPS currently has several permits issued under the RCRA (including EPA ID VTR000504167 and VTR000504175) and will likely need to maintain certain permits for hazardous waste storage areas, and USTs during the decommissioning process.

In addition to the RCRA programs, VYNPS may also be subject to the EPA's National Pollutant Discharge Elimination System (NPDES) program during decommissioning. VYNPS has maintained an NPDES permit from the state of Vermont and EPA for the discharge of storm water, circulating water, service water and non-contact cooling water since inception of the program (EPA Permit VT0000264/Vermont Discharge Permit #3-1199). The State of Vermont has assumed the NPDES program from the federal government. The state issues its permits through the Vermont Department of Environmental Conservation.

The VYNPS NPDES permit is currently the subject of an amendment and is in a "draft" status and has a proposed expiration date of December 31, 2015. An application for a new permit will be submitted in mid-2015, a minimum of 180 days prior to the expiration of the amended permit of record.

The third program that has a potential to impact VYNPS during decommissioning is the EPA's Toxic Substances Control Act (TSCA) program. TSCA regulates the production, importation, use, remediation and disposal of specific chemicals including polychlorinated biphenyls (PCBs), asbestos, radon and lead-based paints. While there is no current evidence of these types of chemicals that would require invoking this program at VYNPS, there are known or previously documented PCB-containing materials that exceed the greater than 50 ppm total PCBs. The most common sources are in paints used at industrial sites.

5.2 Future Use Criteria

Following the completion of radiological decommissioning at the site (with the exception of the ISFSI), ENVY will begin site restoration activities. ENVY has yet to identify which portion of the site property it expects to retain to maintain the ISFSI until the ISFSI is no longer needed for onsite spent fuel storage. This would define the industrial footprint of the site and define the Security Owner Controlled Area (OCA/SOCA) of the site prior to, during, and potentially after decommissioning. The areas outside of the Owner Controlled Area (OCA) have been or will be characterized to document environmental conditions and to confirm that there have been no adverse impacts from industrial operations.

On December 23, 2013, ENVY, the Vermont Department of Public Service (DPS), and VANR filed with the Vermont Public Service Board (PSB) a Memorandum of Understanding (MOU) among the parties. In the MOU, the parties agreed, among other things, that they would work together in good faith to determine appropriate standards for site restoration. ENVY will be developing a plan for the ultimate release of the VYNPS property based on the site restoration standards agreed upon by the parties.

With the commitment on the part of ENVY to fund the site restoration, it is envisioned that the property may be released for conservation, open space, or economic redevelopment of the site. To support property disposition, ENVY will be subject to those regulations imposed by federal agencies (e.g. NRC, EPA), state agencies (Vermont) and relevant agreements such as those documented in various memoranda of understanding (e.g. PSB Docket No. 6545 MOU).

The future reuse of the VYNPS site and the associated site restoration standards, including the timing of site restoration, may be influenced if the property or any portion of the property is to be used solely for industrial, commercial or other similar uses. This scenario may not require the immediate or full completion of site restoration to accommodate that type of use of the property, but would require an agreement between ENVY, DPS, ANR and/or the Vermont Department of Health (VDH) as documented in the MOU.

5.3 Site Restoration Standards

As previously discussed, ENVY is the subject of and committed to compliance with the regulatory requirements of both federal law as it pertains to license termination and state law as it pertains to site restoration. Site restoration will commence in accordance with the site restoration standards established between ENVY and the State promptly after the completion of radiological decommissioning and license termination. As agreed to by ENVY and the Vermont state agencies, the period of site restoration applies only to the period of time after radiological decommissioning and license termination has been completed to the NRC's satisfaction. ENVY understands and acknowledges that the State of Vermont has jurisdiction over site restoration. ENVY also recognizes the existence of current state regulations, procedures, and standards including the Investigation and Remediation of Contaminated Properties (IRCPP) which may apply to site restoration at VYNPS, as collaboratively agreed upon by ENVY and the applicable State agencies.

As noted above, ENVY, with the completion and submittal of this Site Assessment Study (SAS) to the Vermont DPS, ANR and VDH, will continue to work in good faith to determine in a timely and cost-effective means a set of site restoration standards required and necessary to support future use of the VY property without limitation. This commitment excludes the ISFSI and any property/perimeter that is required as part of the facility in the event it is in place at the time of site restoration. As a general matter, the site restoration process must always be mindful of the safe management of the spent fuel stored on the site until such time as it is removed by the Federal Government. More specifically, the established site restoration standards will address the removal of structures at the VYNPS site and associated levels of remediation, as required. For example, pursuant to the MOU, decommissioning and site restoration practices shall exclude the use of "rubblization" at the VYNPS site. Rubblization is defined as the demolition of above-grade decontaminated or "clean" concrete structures into rubble that is used as fill and/or buried at the site.

ENVY is committed to an integrated approach to site restoration with final closure of the VYNPS site starting with the end state in mind. Defining the end state sets the course for defining the standards for site closure and future re-use. Communications with the State of Vermont and other key stakeholders will be paramount in aligning expectations for site restoration. This will be an ongoing and dynamic effort throughout the project.

ENVY's goal is to establish a transparent and collaborative approach to integrate key stakeholder requirements so that site restoration is conducted in a safe, responsible, reliable and beneficial manner.

6 Remaining Site Assets

6.1 VELCO Switchyards and Substation

In May, 2009, ENVY entered into an asset sale agreement with Vermont Transco, LLC. (VELCO) to transfer the above ground equipment in the VYNPS 345KV Switchyard, the 115 KV Switchyard, and the Vernon Substation to VELCO control. As part of the asset sale agreement, ENVY leased the land associated with the switchyards and substation to VELCO for a period of 99 years.

6.1.1 Equipment

The asset sale agreement transferred ownership, maintenance responsibilities, and liability for all equipment installed in the switchyards and the substation to VELCO. The switching equipment in the 345 KV and 115 KV Switchyards will be required to provide power to the station during the period of wet fuel storage. The Vernon Substation will continue to be used following completion of the power plant decontamination and dismantlement activities. ENVY has an access agreement in place with VELCO to allow VELCO personnel to enter the switchyards as needed to perform inspections and maintenance on the equipment.

6.1.2 Land

ENVY maintains title to the land on which the switchyards and substation reside. ENVY maintains responsibility for any required remediation below the ground surface.

6.2 Rail Spur

To support the transfer of spent fuel to the DOE and transfer of radioactive waste associated with the decommissioning process to a licensed disposal facility, ENVY will reactivate an on-site rail spur. The on-site portion of the rail spur will follow the existing rail line on the northwest side of the property and additional track will be installed to a point inside the current Protected Area. Following completion of decommissioning activities, the rail spur may be left in place, abandoned in place, or removed to support future use of the site.

6.3 Plant Support Building

The Plant Support Building is a three-story office building located on the western edge of the site. The building consists of offices, conference rooms, and a cafeteria. The building is serviced by separate power and water supplies and a separate septic system. ENVY staff will be housed in the Plant Support Building during the preparation for dormancy and the dormancy period. The ultimate disposition of the building (retain for use or dismantle) will be made at a later date.

6.4 Governor Hunt House

The Governor Hunt House (GHH) is a historic building. Modifications have been made to the structure to allow use as a meeting area while retaining the character of the original building. The building will be used for administrative purposes during the preparation for the dormancy period. Following this period, a final disposition (retain or transfer) will be made.

7 SAFSTOR versus Prompt DECON

"Decommissioning" is defined by 10 CFR 50.2 as the removal of a nuclear facility from service and reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. NUREG-0586, "Final Generic Environmental Impact Statement [GEIS] on Decommissioning of Nuclear Facilities," evaluated the environmental impact of three methods for decommissioning. The methods are as follows:

1. DECON: The equipment, structures, and portions of the facility and site that contain radioactive contaminants are removed or decontaminated to a level that permits termination of the license after cessation of operations. It is the only decommissioning alternative that leads to termination of the facility license and release of the facility and site for unrestricted use (exclusive of the ISFSI) shortly after cessation of facility operations.
2. SAFSTOR: The facility is placed in a safe, stable condition and maintained in that state until it is subsequently decontaminated and dismantled to levels that permit license termination. During SAFSTOR, a facility is left intact, but the fuel has been removed from the reactor vessel and radioactive liquids have been drained from systems and components and then processed. Radioactive decay occurs during the SAFSTOR period, thus reducing the levels of radioactivity in and on the material and, potentially, the quantity of material that must be disposed of during decontamination and dismantlement.
3. ENTOMB: ENTOMB involves encasing radioactive structures, systems, and components in a structurally long-lived substance, such as concrete. The entombed structure is appropriately maintained, and continued surveillance is carried out until the radioactivity decays to a level that permits termination of the license. Because most power reactors will have radionuclides in concentrations exceeding the limits for unrestricted use even after 100 years, this option will generally not be feasible.

The GEIS found DECON and SAFSTOR to be acceptable methods of decommissioning. The NRC also recognized that some combination of the DECON and SAFSTOR methods would also be acceptable. For example, the licensee could conduct a partial decontamination of the plant followed by a storage period, followed by the completion of the decontamination and dismantlement.

7.1 Differences in Preparation for Decommissioning Based on Approach

The DECON and SAFSTOR methods accomplish the same goal; release of the site or portions of the site for unrestricted use. The major difference between the methods is the timeframe within which this goal is achieved - approximately ten years for the DECON method (excluding the ISFSI) and up to 60 years for the SAFSTOR method. For a large commercial nuclear plant the processes to terminate the license with the SAFSTOR method are similar to those that would be employed in the DECON method if SAFSTOR is used.

Preparations for decommissioning following the permanent cessation of operations are more extensive if the licensee has elected the DECON method. Near-term dismantling requires the continued operation or reconfiguration of plant systems, equipment, and the site infrastructure, comparable to a major outage. In SAFSTOR, plant systems and site services are prepared for long-term storage, with site activities focused on removing plant systems from service, de-energizing non-essential electrical components and circuits, reducing hazards, minimizing on-going caretaking requirements, and establishing preventative maintenance plans for essential services and site facilities.

The SAFSTOR method was initially conceived of as having three successive stages: (1) a short period of preparation for safe-storage; (2) a variable safe-storage period of continuing care consisting of security, surveillance, and maintenance during which much of the reactor's radioactivity decays; and finally, (3) a relatively short period of decontamination and dismantling concluding with the termination of the facility's operating license.

7.2 Benefits of SAFSTOR

The choice of the decommissioning method is left entirely to the licensee. However, the NRC would require the licensee to re-evaluate its decision if the choice (1) could not be completed as described, (2) could not be completed within a defined period after the permanent cessation of plant operations, (3) included activities that would endanger the health and safety of the public by being outside of the health and safety regulations, or (4) would result in a significant impact to the environment.

While the NRC has found DECON and SAFSTOR to be acceptable methods of decommissioning, it recognizes that there are advantages and disadvantaged to the two methods. The NRC has identified the benefits of SAFSTOR to include:

- a substantial reduction in radioactivity as a result of the radioactive decay that results during the storage period;
- a reduction in worker dose (as compared to the DECON alternative);
- a reduction in public exposure because of fewer shipments of radioactive material to the low-level waste site (as compared to the DECON alternative);
- a potential reduction in the amount of waste disposal space required (as compared to the DECON alternative);
- lower cost during the years immediately following permanent cessation of operations; and
- a storage period compatible with the need to store spent fuel onsite.

7.2.1 Personnel Exposure to Ionizing Radiation

The NRC issued Supplement 1 to the GEIS ("Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors,") for use in evaluating environmental impacts during the decommissioning of nuclear power reactors as residual radioactivity at the site is reduced to levels that allow for termination of the NRC license. The GEIS considered radiological doses to workers and members of the public when evaluating the potential consequences of decommissioning activities.

ENVY intends to maintain the occupational radiation exposure to plant personnel 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 would be reduced. Thus, it is expected that the occupational dose to plant personnel would significantly decrease after the plant is shut down and defueled. The station ALARA program will be maintained during dormancy and the delayed decommissioning periods to ensure that occupational dose is maintained ALARA and well within 10 CFR Part 20 limits.

It is expected that the occupational dose required to complete the decommissioning activities would be reduced significantly by radioactive decay during the SAFSTOR period. The dose estimates for dormancy periods greater than 10 years are provided in Table 4-1 of the GEIS (834-326 person-rem). 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 (the estimated exposure for the DECON option in the GEIS is 1,874 person-rem).

7.2.2 Radioactive Waste Inventory

The radioactive waste inventory includes plant equipment, commodities, structural components, demolition debris, and sometimes soil that, due to their radiological characteristics, requires controlled disposal. Radionuclide decay, in SAFSTOR, can provide a reduction in the overall inventory requiring controlled disposal or, at a minimum, a decrease in the hazards associated with the handing of the inventory.

There are two sources of radioactive material: contamination and activation. Contaminated materials are unintentionally transported through the facility by workers, equipment, and, to some degree, air movement. Although many precautions are taken to prevent the movement of contaminated material in a nuclear facility and to clean up any contaminated materials that may be found, it is likely that contamination will occur in the Reactor Building, around the spent fuel pool, and around specific systems, structures and components in other buildings. Radioactive contamination may be deposited from the air or dissolved in water and subsequently deposited onto material such as concrete. Radioactive contamination is generally located on or near the surface of materials such as metals, high-density concrete, or painted walls. It can travel farther into unpainted surfaces or lower-density concrete. Radioactive contamination can usually be removed from surface areas by washing, scrubbing, spraying, or, in extreme cases, by physically removing the outer layers of the surface material.

Activation products are also formed during reactor operation. Activation products are radioactive materials created when stable substances are bombarded by neutrons. Concrete and steel surrounding the core of the reactor are the most common types of activated products. Activation products cannot be removed by the processes used to remove contamination. Activation products are incorporated into the molecular structure of the material and cannot be wiped off or removed. The entire structure (or portions) that have been activated must be removed and treated as radioactive waste. Activated metal and concrete contain the single largest inventory of radionuclides with the exception of the spent fuel, in facilities that are being decommissioned. The radioactive decay of activation products, both of structures as well as corrosion products, is the main source of radiation exposure to plant personnel.

The NRC's "Standard Review plan for Decommissioning Cost Estimate for Nuclear Power Reactors," NUREG-1713, provides typical waste burial volumes for their reference BWR. The projections are based upon the work of Pacific Northwest National Laboratory (PNL) in their "Revised Analyses of Decommissioning for the Reference Boiling Water Reactor Power Station," NUREG/CR-6174.

PNL's analyses provide a range of radioactive waste volumes for the SAFSTOR method, depending upon the extent of the decay of the radioactive materials present at the cessation of plant operations. If decay does not result in the unrestricted release of the plant inventory, the waste volume for SAFSTOR is similar to DECON (15,115 m3 or 533,781 ft^3). If decay of all radioactive materials (except the reactor pressure vessel and sacrificial shield) to unrestricted release levels is assumed, the volume is reduced significantly, to about 1,094 m^3 (38,634 ft^3).

It should be noted that waste disposal volumes are also contingent on the waste disposal and treatment options available to the licensee, and the associated economics. For example, in situations where the cost of disposal is high, volume reduction techniques may be effective in minimizing the volume of material requiring controlled disposal. These techniques could include crushing, sorting, spot decontamination or repackaging to achieve higher waste densities. Licensees have also utilized lower-cost, hazardous waste disposal facilities (RCRA Subtitle C facilities) or licensed landfills for the disposal of material containing very low levels of radioactivity.

There are limited options available for the disposal of the highly activated components, for example, from the segmentation of the reactor vessel and internal assemblies. The majority of this material can be disposed of at the WCS Texas site; however a small volume of material will need to be eventually transferred to the DOE for disposal. In the interim, licensees that have decommissioned their reactors have placed this material in storage along with the spent fuel at the site.

8 Decommissioning Cost Estimates

8.1 USNRC Financial Assurance Requirements

The NRC has regulations regarding the methods used to reasonably ensure that funds will be available to decommission the facility (or "financial assurance"). The NRC requires nuclear power plant licensees to report to the agency the status of their decommissioning trust funds at least once every two years, annually within five years of the planned shutdown, and annually once the plant ceases operation.

Estimating the minimum amount of funds needed for decommissioning is important to prevent funding shortfalls that could adversely affect public health and safety. Requirements for establishing the minimum funding amounts for decommissioning are set out in 10 CFR 50.33(k), 10 CFR 50.75, 10 CFR 50.82(a)(4), 10 CFR 50.82(a)(8), and 10 CFR 50.82(a)(9). These include the following:

1. An initial certification amount established at the operating license stage (for existing licensees, by July 26, 1990), is required under 10 CFR 50.75(b), and 10 CFR 50.75(c)(1).
2. Adjustments to the certification amount are also required over the operating life and storage period, if any, of the facility. Specifically, 10 CFR 50.75(b) requires each licensee to adjust the initial certification amount annually by use of the equation in 10 CFR 50.75(c)(2), which provides for escalation factors for labor, energy, and waste burial. In addition, 10 CFR 50.75(f) requires each licensee to submit, at or about five years prior to the projected end of operation, a preliminary decommissioning cost estimate that includes an up-to-date assessment of the major factors that could affect the cost to decommission.
3. A post-shutdown decommissioning activities report (PSDAR) must be submitted by the licensee to the NRC, with a copy to the affected States. This must be done prior to or within two years following permanent cessation of operations. The PSDAR must include a description of the planned decommissioning activities, along with a schedule for their accomplishment, an estimate of expected costs, and 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 (10 CFR 50.82(a)(4)).
4. A site-specific decommissioning cost estimate must be submitted to the NRC prior to the licensee using any funds in excess of those described in 10 CFR 50.82(a)(8)(ii). In addition, the licensee must submit such a cost estimate within two years following permanent cessation of operations, if not already submitted (10 CFR 50.82(a)(8)).
5. A licensee is required by 10 CFR 50.82(a)(9)(ii)(F) to provide "[a]n updated site-specific estimate of remaining decommissioning costs" as part of a license termination plan. In addition, 10 CFR 50.82(a)(9)(i) requires a licensee to submit its license termination plan at least two years before the date of termination of the license.

Licensees may demonstrate financial assurance for decommissioning by one or more of the following:

1. Prepayment: In this case, at the start of operations, the licensee deposits enough funds to pay the decommissioning costs into an account. The account is segregated from the licensee's other assets and remains outside the licensee's control of cash or liquid assets. Prepayment may be in the form of a trust, escrow account, government fund, certificate of deposit, or deposit of government securities.

2. External sinking fund: An external sinking fund is established and maintained by setting funds aside periodically into an account segregated from licensee assets and outside the licensee's control. The total amount of these funds will be sufficient to pay decommissioning costs when it is anticipated that the licensee will cease operations. An external sinking fund may be in the form of a trust, escrow account, government fund, certificate of deposit, or deposit of government securities.

3. Surety method, insurance, or other guarantee method: A surety method may be in the form of a surety bond, letter of credit, or line of credit. Any surety method or insurance used to provide financial assurance must be open-ended or, if written for a specific term, such as five years, must be renewed automatically. An exception is allowed when the issuer notifies the NRC, the beneficiary, and the licensee of its intent to not renew within 90 days or more preceding the renewal date. The surety or insurance must also provide that the full face amount be paid to the beneficiary automatically preceding the expiration date without proof of forfeiture if the licensee fails to provide a replacement acceptable to the Commission within 30 days after receipt of notification of cancellation. In addition, the surety or insurance must be payable to a trust established for decommissioning costs, and the trustee and trust must be acceptable to the NRC. The surety method or insurance must remain in effect until the NRC has terminated the license.

8.1.1 VY/TLG Maximum SAFSTOR Estimate

TLG prepared an updated estimate to decommission VYNPS. The 2014 TLG decommissioning cost analysis relied upon site-specific, technical information from the earlier evaluation issued in February 2012, updated to reflect current assumptions pertaining to the disposition of the nuclear unit and relevant industry experience in undertaking such projects. The 2014 estimate was prepared for ENVY to comply with the requirements of 10 CFR 50.82(a)(4)(i).

The estimate is based upon a SAFSTOR scenario and encompasses two major time periods: 1) the end of 2014 after operations have ceased through 2020 when all spent fuel has been relocated to the ISFSI, and 2) 2021 through 2075, which encompasses dormancy, dismantlement and decontamination, and completion of site restoration activities.

The estimate for the initial time period was based upon detailed planning performed by the site and supporting corporate organizations and the associated budget projections for the projects and site-support activities required to move the spent fuel from the wet storage pool in the reactor building into dry storage and to ready the facility for long-term storage. The estimate for the later time period was based upon the modeling assumptions for dormancy and deferred dismantling traditionally used for compiling costs, for example, in the 2012 analysis, for these decommissioning phases.

In general, the 2014 decommissioning cost estimate is presented by major activity and major decommissioning phase or time period. The cost estimate accounts for the entire decommissioning work scope, including items that are outside the NRC's scope of the decommissioning process. Examples of activities outside the NRC's scope of decommissioning include, but are not limited to, (1) the maintenance and storage of spent fuel, (2) the design and/or construction of a spent fuel dry storage facility, and (3) restoration of the site following the termination of the operating license. As required by the NRC, these items are identified separately.

The 2014 estimate provides costs for each of the following (or similar) major activities and phases, with a level of detail appropriate to the type of cost estimate:

(1) major radioactive component removal (reactor vessel and internals and other large components that are radioactive to a comparable degree);

(2) radiological decontamination and decommissioning (removal of remaining radioactive plant systems, including radiological decontamination);

(3) management and support (expenses such as labor costs for licensee and decommissioning contractor staffs, energy costs, regulatory costs, small tools, insurance, and others);

(4) waste packaging/shipping (placing waste in packages and shipping to waste vendors or burial site);

(5) waste burial or waste vendor (waste burial charges, including waste vendors' processing fees; and

(6) contingency (allowance for unplanned costs).

The 2014 cost estimate also includes the assumptions, references, and bases for the unit costs used in developing the estimate.

The 2014 TLG estimate assumes that the existing ISFSI is expanded so that the entire inventory of spent fuel (generated over the reactor's operating life) can be accommodated. The spent fuel will remain in storage until it can be transferred to a DOE facility. Based upon an assumed 2025 start date for DOE receiving spent fuel from commercial reactors for interim storage or disposal (based on current DOE projections), removal of spent fuel from the site could be completed by the end of year 2052.

The decommissioning periods and milestone dates for the analyzed SAFSTOR decommissioning alternative are identified in Table 8-1. For purposes of the analysis, the plant was assumed to cease operations at the end of 2014 and remain in safe-storage until 2068, at which time major decontamination and dismantlement activities would commence. The 2068 start date for major decommissioning activities allows sufficient time to accomplish the activities required to terminate the operating license within the required 60-year time period. The scenario, and in particular the decommissioning schedule, was selected for illustrative purposes and for bounding the cost estimate. It does not imply any decision on the part of ENVY to actually wait until 2068 to commence major decontamination and dismantlement activities.

The cost elements are assigned to one of three subcategories in Table 8-2: 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 10 CFR Part 50.2. 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 the unit's operating license.

The "Spent Fuel Management" subcategory contains costs associated with the construction of a second ISFSI pad, maintaining the wet storage capability in the spent fuel pool until such time as the fuel has cooled sufficiently for loading into dry storage containers, 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 significant spent fuel management expenses incurred prior to the cessation of plant operations, nor does it 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. This includes the demolition of 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. Designation 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, the activities within these subcategories may not be performed separately. 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.

The 2014 estimate is also segregated into the following decommissioning phases (time periods):

- Pre-decommissioning engineering, planning/plant deactivation and relocation of the spent fuel from the wet storage pool to the ISFSI (activities from pre-decommissioning engineering and planning through defueling, plant layup, placement of the reactor into a permanent shutdown condition, and relocation of the spent fuel to dry storage);
- Extended safe storage operations (safe storage monitoring of the facility until the spent fuel is removed from the site and beyond, until dismantlement begins);
- Final radiological decontamination and dismantling (radiological decontamination and dismantling of radioactive systems and structures required for license termination, including demolition for the purposes of reducing residual radioactivity);
- Site Restoration (demolition of the remaining structures and restoration of the site).

The 2014 estimate was developed and costs are presented in 2014 dollars, consistent with the NRC's prescribed method for presenting decommissioning costs in current dollars. The estimate does not reflect the escalation of costs (due to inflationary and market forces) over the safe-storage and decommissioning period.

Presentation of the decommissioning estimate in current year dollars is consistent with the expectations of the NRC, as delineated their "Standard Review Plan for Decommissioning Cost Estimates for Nuclear Power Reactors," (NUREG-1713).

Cost escalation is addressed separately from the decommissioning estimate, typically, in a financial or funding analysis.

TABLE 8-1

MAXIMUM SAFSTOR 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	2021	5.2
Dormancy w/Dry Fuel Storage	2021	2052	31.5
Dormancy w/No Fuel Storage	2052	2068	15
Decommissioning Preparations *			
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	---------	--------	59

* Subject to the commitments regarding the commencement of radiological decommissioning in the Settlement Agreement with the Vermont Public Service Department

TABLE 8-2

MAXIMUM SAFSTOR DECOMMISSIONING COST SUMMARY

Decommissioning Periods	License Termination	Spent Fuel Management	Site Restoration
Planning and Preparations	$119,981	$23,069	na
Dormancy w/Wet Fuel Storage	$45,746	$217,244	na
Dormancy w/Dry Fuel Storage	$137,229	$128,034	na
Dormancy w/No Fuel Storage	$54,016	na	na
Site Reactivation	$43,277	na	$578
Decommissioning Preparation	$36,238	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 (thousands of 2014 dollars)

8.1.2 Vendor Estimates for 2015 Start

In accordance with the Settlement Agreement among ENVY, the Vermont Public Service Department, and Vermont Department of Health signed on December 23, 2013, ENVY developed a request for proposal (RFP) and identified industry leaders in the preparation of cost estimates for complex decommissioning projects. The RFP was sent to seven firms with five of the firms responding with bids and the two of the firms teaming with another respondent. ENVY selected three of the five respondents to perform a prompt decommissioning cost estimate. The scope of work for the vendors was to estimate costs associated with NRC license termination activities under the DECON alternative. The scope of work was essentially limited to estimating the labor and waste costs associated with decontamination and dismantlement activities. The vendor scope of work specifically eliminated costs associated with management of spent fuel and owner costs such as security, taxes, fees, insurance, etc. The assumed start date for the decontamination and dismantlement activities was set at January 1, 2015.

The vendors selected to perform the prompt decommissioning cost estimate provide a diversity of experience and perspectives for completing the cost estimate. One vendor team is led by a nuclear steam system supplier with boiling water reactor decommissioning experience in Europe. One vendor team is led by an architect-engineer firm with pressurized water reactor decommissioning experience in the United States. The third vendor team is led by an experienced waste management firm with pressurized water reactor decommissioning experience in the United States.

The vendor cost estimating methodology is similar to the methodology employed by TLG for past ENVY decommissioning cost estimates. Specifically, the vendors use a unit cost method with modifiers applied based on the specific work area conditions (e.g., use of personal protective equipment, access restrictions, etc.) to develop an area by area cost. Each vendor provided an estimate of the duration of the project schedule that was used to normalize the estimates to reflect the true cost of the decommissioning project to ENVY.

As discussed above, the vendor scope of work for the estimates was limited to costs associated with physical decontamination and dismantlement of the VY station. The key assumption used for the vendor cost estimates is that ENVY would provide oversight activities for a decommissioning general contractor. This assumption reflects the project management model employed at the Maine Yankee, Connecticut Yankee, and Yankee Rowe decommissioning projects.

Differences in vendor costs can be explained by the following:

1. Volume of contaminated soil estimated to require remediation. ENVY has not started the comprehensive site characterization that will be performed as part of the decontamination and dismantlement activities. For purposes of the cost estimates, each vendor provided an assumption for the amount of soil remediation that will be required as part of the decommissioning activities based on their previous decommissioning experiences.

2. Volume of radioactive waste requiring package, transport, and disposal at a licensed radioactive waste disposal facility. ENVY has not started the comprehensive site characterization that will be required to fully plan the decontamination and dismantlement activities. For purposes of the cost estimate, each vendor provided an assumption for the amount of radioactive waste that will be generated as part of the decommissioning activities based on their previous decommissioning experience.

3. The duration of the vendor schedule. Each vendor provided a schedule of decommissioning activities as part of the basis of estimate for the project. Differences in vendor approach are reflected in the overall cost of each vendors estimate.

4. The management staff assumed by each vendor. Each vendor provided a summary of the management and support staff required to complete the project based on their experience managing large, complex decommissioning projects.

8.2 Normalization of Decommissioning Cost Estimates

To reflect the combined ENVY and contractor scope of work cost of decommissioning the Vermont Yankee site, the staff normalized the three vendor contractor scope estimates with ENVY responsibility costs that were excluded from the vendor scope of work. The ENVY responsibility costs were extracted from the VY/TLG estimate, adjusted as necessary, and added to the contractor scope estimates. Normalizing the vendor cost estimates to include certain ancillary activities in the VY/TLG SAFSTOR estimate allows comparison of the DECON and SAFSTOR scenarios which include all ENVY costs associated with either scenario.

The following costs from the VY/TLG estimate were adjusted and added to the vendor estimates as part of the normalization process:

1. ENVY costs associated with spent fuel management due to the DOE contract breach.

2. Owner responsibility costs that were outside the vendor contractual scope of work.

3. Increase in the on-site Project Management staff during the decontamination and dismantlement period. The increase in staff is required to provide oversight of the decommissioning general contractor activities. The increase in staff reflects additional resources for: Project Management, Project Coordinators, Industrial Safety, Materials Procurement & Contracts, Licensing, Environmental Compliance, Work Management, Radioactive Waste, Radiation Protection, Communications, External Affairs, and Administration.

4. Increase in the off-site Project Management Organization (PMO) staff during the decontamination and dismantlement period. The increase in staff is required to provide corporate level oversight during this phase of the decommissioning period.

6. Security staff required to support decommissioning general contractor activities during the decontamination and dismantlement period. Accelerating the major decommissioning activities requires additional security staff to support security inspections of vendor equipment and waste disposal transport vehicles.

7. NRC inspection fees associated with decontamination and dismantlement work. Using experience gained during the Maine Yankee, Connecticut Yankee, and Yankee Rowe decommissioning projects, additional NRC inspections and oversight activities will be performed during the decontamination and dismantlement work.

8. ENVY non-security and security staff were added to maintain the ISFSI following completion of the building decontamination and dismantlement work.

9. Project financing costs were added to the vendor estimates.

10. Project contingency was revised to reflect the structure of the estimates.

11. Corporate Administrative & General allocations were added based on the staffing levels of ENVY personnel that were added to the vendor estimates.

8.3 Cost Estimate Results

The following table summarizes the four cost estimates that have been performed for the VYNPS site.

	Prompt Decommissioning – January 2015 Start			SAFSTOR
	Vendor 1	Vendor 2	Vendor 3	ENVY/TLG
License Termination Cost for Prompt Start (January 2015)	$833,690*	$627,177*	$842,492*	na
Total Cost to ENVY (License Termination, Spent Fuel, Site Restoration)	$1,529,779	$1,321,603	$1,597,016	$1,242,712
Duration of License Termination (excluding SFM)	9 years	8.5 years	13.1 years	7 years
Year D&D Complete	2024	2024	2028	2073
All Site Work Complete	2052	2052	2052	2075

All costs in thousands of dollars (2014).

* Vendor estimates do not include any profit margin and would be subject to an adjustment during bidding

9 Funding Strategy for SAFSTOR

9.1 NRC Regulatory Requirements for License Termination

Under NRC regulations (10 CFR § 50.75), 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 the purpose of demonstrating financial assurance. The trust was transferred with the liability as part of the sale transaction when ENVY acquired the plant. The trustee is The Bank of New York Mellon. The trust had a balance of approximately $653 million as of the end of August 2014. This excludes a $40 million guarantee from Entergy Corporation that was provided before the NRC granted license renewal. It also excludes the Site Restoration Trust that Entergy created and to date has funded with $10 million as part of the Settlement Agreement.

The last financial assurance filing that EVY made was for 1/1/14 and showed an "NRC minimum" amount of approximately $624 million for a shutdown at the end of 2014. Using the methodology Entergy has used for financial assurance filings with the NRC (and which the NRC has accepted on previous occasions), the 10 CFR § 50.75 funding requirement for the SAFSTOR scenario that ENVY will file with the PSDAR is approximately $427 million (refer to Appendix I for calculation). For the purposes of meeting that funding requirement, the NDT is overfunded by approximately $200 million.

9.2 NRC Regulatory Requirements for Spent Fuel Management

Under separate NRC regulations (10 CFR § 50.54(bb)), a licensee must provide a program by which the licensee intends to manage and provide funding for spent fuel management, but the regulations do not require licensees to demonstrate "financial assurance" using the accepted methods specified in 10 CFR § 50.75. In practice, this means that a licensee has more flexibility in the kinds of products or assurances it uses in its spent fuel management funding plan. For example, licensees are permitted to commingle their license termination and spent fuel management funds in their NDTs and have routinely been allowed to cite the projected difference between license termination costs and the NDT balance as a source of spent fuel management funding, even though an NRC exemption is required (and yet to be obtained by the licensee) to withdraw money from the NDT for the purpose of spent fuel management. ENVY considers its NDT to be commingled and will continue to cite excess funds in the NDT as a funding source for spent fuel management as it has in previous filings. In addition, in a previous spent fuel management plan filed by ENVY, ENVY cited overfunding of its commingled NDT combined with a commitment on the part of the licensee to obtain additional funding in 2026. This was preliminarily accepted by the NRC without having an explicit credit facility or parent guarantee in place.

The bulk of a licensee's spent fuel management costs after shutdown result from the DOE's breach of its contract to pick up spent nuclear fuel, which requires the licensee to incur the costs of storing the fuel until DOE removes it. ENVY is incurring such costs and has prevailed in litigation with the Federal Government for recovery of damages. The NRC does not, however, allow licensees to cite expected recoveries from the Federal Government associated with DOE's breach as a funding source for spent fuel management costs.

The SAFSTOR scenario cost estimate that will be filed with the PSDAR shows \$368 million in SFM costs. Using the same methodology as the previous section, the funding requirement for these costs is approximately \$307 million (refer to Appendix I for calculation using LT&SFM - LT). ENVY expects to cite the more than \$200 million of overfunding discussed in Section 9.2 in combination with additional mechanisms to demonstrate an acceptable plan under NRC regulations (10 CFR § 50.54(bb).

9.3 Likely NRC Filings Associated with NRC Funding

ENVY expects to file a PSDAR and Site Specific DCE for a SAFSTOR scenario approximately 60 days after this report is transmitted to the State of Vermont. After a 90 day waiting period following submission of the PSDAR, presuming that the NRC does not find the PSDAR and DCE deficient, ENVY will have access to the remaining approximately 97% of the NDT to reimburse License Termination spending, but not to reimburse spent fuel management spending (3% of the NRC generic decommissioning funding amount specified in 10 CFR Part 50.75 is available now for decommissioning planning).

Following the PSDAR and DCE submittal, ENVY expects to make a Financial Assurance filing per 10 CFR § 50.82(a)(8), which will reflect the funding status referenced above.

Following the Financial Assurance filing, ENVY expects to submit a request for a Commingled Funds exemption to use NDT funds for spent fuel management, as referenced above. Separately, ENVY also expects to submit an updated Spent Fuel Management Plan, which will address how ENVY will fund the gap without including expected litigation proceeds from the Federal Government associated with DOE's breach for not taking SNF from the VYNPS site.

9.4 Options for Addressing the Funding Gap

ENVY could commit to obtain funding on the order of \$100 million at a future point when the funding is required. This is consistent with previous filings by ENVY under 10 CFR § 50.54(bb). If the commingled funds exemption were granted on this basis, ENVY would expect to use future spent fuel litigation recoveries as the source of the future funding.

Another option to address the funding gap would depend upon an Entergy Corporation guarantee. ENVY currently relies on a \$40 million guarantee from Entergy Corporation as part of its decommissioning financial assurance demonstration. This guarantee will not be cited or relied upon in the decommissioning Financial Assurance filing under 10 CFR § 50.82(a)(8) and for that reason, NRC regulations permit Entergy Corporation to cancel it after the filing. In order to address the funding gap created by spent fuel management costs, ENVY could solicit Entergy Corporation to maintain this guarantee and increase it to a sufficient level to meet the gap and to satisfy 10 CFR 50.82(a)(8)(vii)(C)'s requirement to have a "plan to obtain additional funds to cover the cost [to manage spent fuel]". If the exemption were granted on this basis, ENVY would expect to use future spent fuel litigation recoveries as the source of funding to replace the Entergy Corporation guarantee.

The SAFSTOR costs estimate contains approximately $368 million in costs categorized as spent fuel management costs. Of these costs, approximately $140 million are associated with the construction of the second ISFSI pad and the purchase and loading of casks for the dry storage of fuel on the existing and second ISFSI pads. As this set of costs can be reasonably segregated from other costs and are reasonably certain to be recovered from the Federal Government, ENVY may elect to finance some or all of these costs through a credit facility. This facility will likely require some level of credit enhancement or guarantee from Entergy Corporation, which has yet to be obtained. In this case, ENVY would be requesting the commingled funds exemption with the condition that the costs for the ISFSI construction or the purchase and loading of casks onto the ISFSIs will not be funded from the NDT, but instead will be funded from the credit facility. If the exemption were granted on this basis, ENVY would expect to use future spent fuel litigation recoveries to repay the credit facility and after the credit facility was completely repaid, it would be cancelled and the Entergy Corporation credit enhancement or guarantee would be released.

ENVY could obtain funding from either a third party (with Entergy Corporation guarantees) or from Entergy Corporation directly and to place that funding in a provisional trust associated with the NDT to meet the gap. If the exemption were granted on this basis, ENVY would expect to use future litigation recoveries as the source of funding to fund a separate Provisional Trust that would replace the first, thereby releasing the funds back to the third party or Entergy Corporation.

9.5 Expected Recovery of Damages from the Federal Government Associated with Spent Fuel Management

Of the approximately $368 million in costs categorized as spent fuel management costs, ENVY estimates that it may seek to recover the vast majority from the Federal Government. For purposes of this illustration, the figure of $275 million will be used with an assumed recovery rate of 90% with a three-year lag. These are reasonable assumptions, given that ENVY was able to recover approximately 86% of the damages claimed in the initial round of DOE litigation (recovered $40.7 million of $47.4 million claimed, which included over $5.6 million in Clean Energy Development Fund payments found not to be recoverable and the balance of which is not included in the future SFM costs that ENVY estimates it may seek to recover) and that many of the legal issues that may arise in future litigation will have already have been litigated and resolved during the first round of litigation.

Assuming this litigation recovery pattern, the 2% real growth rate provided by the NRC and a start date of 2068 for dismantling and decontamination (i.e. the SAFSTOR case), there would be an excess of on the order of $300 million in 2076, implying an earlier start date to dismantling and decontamination is viable (refer to Appendix I for calculation).

Under the December 23, 2013 Settlement Agreement with Vermont, any funds from the NDT that are used for spent fuel management and that are recovered from the Federal Government will be retained by ENVY to meet its decommissioning, spent fuel management, site restoration, and other liabilities. With that requirement and based on the above assumptions regarding recoveries from DOE, the 2% real growth rate provided by the NRC and a start date of 2053 for dismantling and decontamination (i.e. the year after DOE is assumed to remove the last of the SNF), there would be an excess on the order of $200 million in 2060, indicating that a start date to commence major decommissioning activities before 2053 may be realistic (refer to Appendix I for calculation).

In the calculation above, the 2053 commencement date for major decommissioning activities is selected because of the assumption (based on DOE pronouncements) that the DOE will complete picking up SNF from the VYNPS site in 2052. The removal of all spent nuclear fuel makes the performance of major decommissioning activities substantially less complicated and materially reduces overall security issues on the site. For that reason, a simple adjustment to the TLG estimate is not advisable for a scenario that assumes that dismantling and decontamination begin while fuel remains on the site. Accordingly, the financial feasibility of start dates for major decommissioning activities before 2053 is not presented here. The three cost estimates for immediate DECON, which assume completion of major decommissioning activities with fuel on the site (but do not account for the added complexity of having fuel movement campaigns in parallel with dismantling and decontamination work) are more appropriate estimates for this purpose.

Please note that "approximate" and "on the order of" have been used to describe the amounts in this section. Appendix I provides a set of detailed calculations based on a specific set of assumptions, and which provides a precise set of outputs. Since these calculations are based on inputs such as the balance of the NDT, which typically changes daily, fluctuations in the precise outputs at different points in time are expected.

Given all of these considerations, if all the spent fuel were removed from the site by the 2040s, it is possible, and perhaps even likely, that major decommissioning activities could start at that time. If, however, dismantling and decontamination must occur with fuel on the site, such costs would be higher, and the start date for major decommissioning activities will most likely be later.

9.6 Early Start of Decontamination and Dismantlement Phase

Consistent with the settlement agreement between ENVY and State of Vermont agencies, ENVY agreed to initiate the actual decontamination and dismantlement process when it was determined that there were adequate funds in the NDT. The numerous variables which must be taken into consideration (costs, interest rate/fund growth, NRC rulings, etc.) result in a wide range of outcomes as it relates to when the decontamination and dismantlement phase and site restoration will be complete. Appendix I further describes how the variables affect the potential start of the D&D and site restoration.

Appendices on Attached CD:

A	Settlement Agreement between Entergy Nuclear Vermont Yankee, LLC and State of Vermont
B	Spent Fuel Management Plan
C	Draft Post Shutdown Decommissioning Activities Report (PSDAR)
D	TLG Maximum SAFSTOR Cost Estimate
E	Radiological Historical Site Assessment
F	Non-Radiological Historical Site Assessment
G	Current Permits and Historical Release Information
H	Pollution Legal Liability Policies and Other Pollutant Related Insurance Policies
I	Funding Strategy Financial Scenarios

Vermont Yankee
Site Assessment Study
Appendices