

**Entergy Nuclear Vermont Yankee, LLC**

**SPENT FUEL  
MANAGEMENT  
PLAN**

**Revision 4**

**June 2014**

**This Spent Fuel Management Plan for the Vermont Yankee Nuclear Power Station (“VY” or “Station”) was initially prepared and filed with the Vermont Public Service Board (the “Board”) pursuant to the requirements of Chapter 157 of Title 10, Vermont Statutes Annotated, and in particular 10 V.S.A. § 6522 (b)(3), as interpreted by the Board in its Order and accompanying Certificate of Public Good (“CPG”) issued on April 26, 2006, in Docket No. 7082. Section 6522 (b)(3) requires that prior to the issuance of a certificate of public good for a new spent-nuclear-fuel-storage facility, the Board shall find that Entergy Nuclear Vermont Yankee, LLC, and Entergy Nuclear Operations, Inc. (collectively referred to as “Entergy VY”) “has developed and will implement a spent fuel management plan that will facilitate the eventual removal of those wastes in an efficient manner.”**

**The Spent Fuel Management Plan (“Plan”) is a living document subject to revision in accordance with the requirements of Chapter 157 as interpreted by the Board, changes in federal regulation, as well as changing circumstances affecting the subject matter of the Plan.**

**In submitting this report, Entergy VY notes that, notwithstanding the provisions of state law being applied in this case, 10 V.S.A. § 6522, the NRC has “exclusive authority over [commercial nuclear] plant construction and operation.” The U.S. Supreme Court in *Pacific Gas & Electric Co. v. State Energy Resources Conservation and Development Commission*, 461 U.S. 190, 206-07 (1983) found that the NRC “was given exclusive jurisdiction to license the transfer, delivery, receipt, acquisition, possession and use of nuclear materials” and “[u]pon these subjects no role was left for the states.” “Under the federal licensing scheme . . . it is not the states but rather the NRC that is vested with authority to decide under what conditions to license a [spent nuclear fuel] storage facility.” *Skull Valley Band of Goshute Indians v. Nielson*, 376 F.3d 1223, 1250 (2004), *cert. denied*, 546 U.S. 1060 (2005). By submitting this report, Entergy VY does not waive any rights under federal law.**

**Entergy Nuclear Vermont Yankee, LLC**

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**LIST OF ATTACHMENTS**

- TAB 1 – Site Plan
- TAB 2 – 72.212 Report (Subject to Revision)
- TAB 3 – Memorandum of Understanding between Entergy VY and the Vermont Department of Public Service dated June 21, 2005

## 1.0 GENERAL

### 1.1 Definitions

- **72.212 Report** refers to the site-specific evaluation, required by 10 CFR § 72.212, that Entergy VY completed prior to operating the dry fuel storage (“DFS”) system at the Station.
- **CAB** refers to the Containment Access Building at the Station.
- **CFR** refers to the Code of Federal Regulations.
- **CPG** means a “**Certificate of Public Good**” issued by the Vermont Public Service Board.
- **CTF** refers to a cask-transfer facility.
- **DOE** refers to the U.S. Department of Energy.
- **Full Core Offload** refers to the operation of removing all fuel assemblies from the reactor vessel. This could be required during the term of the operating license if a major reactor vessel repair or certain other maintenance were required. It will be required as an early step in the decommissioning process. It will be Entergy VY’s goal to sequence dry cask loading campaigns such that Full Core Offload capability will be available during the license renewal period. Full Core Offload capability will continue to require the use of a temporary spare fuel rack.
- **FSAR** is an acronym for Final Safety Analysis Report. The FSAR for the SNF dry storage system was prepared by Holtec per requirements specified in 10 CFR Part 72, and is a compilation of information and analyses to support the NRC licensing review. The information provided in the FSAR includes a general description of the design of the dry storage system, its operation, and the supporting analyses for the demonstration of its performance under various operating, hypothetical accident and extreme environmental accident conditions, and its compliance with the regulatory requirements for the assurance of the public health and safety.
- **HOLTEC** refers to Holtec International.
- **HI-STAR** refers to Holtec’s system used to transport SNF off-site.
- **HI-STORM Overpack** or “**Storage Overpack**” means the cask that receives and contains the sealed MPCs containing SNF. It provides the radiation shielding, ventilation passages, missile protection and protection against natural phenomena and accidents for the MPC. The HI-STORM overpack is

approximately 200 tons in weight, 11 feet in diameter, and approximately 19 feet high.

- **HI-TRAC transfer cask or HI-TRAC** means the transfer container used to house the MPC during MPC fuel loading, unloading, drying, sealing and on-site transfer operations to a HI-STORM storage overpack or HI-STAR storage/transportation overpack. The HI-TRAC shields the loaded MPC, allowing loading operations to be performed while limiting radiation exposure to personnel.
- **Independent Spent Fuel Storage Installation (“ISFSI” or “Facility”)** means a facility designed, constructed and licensed for the interim storage of SNF and other radioactive materials associated with spent-fuel storage in accordance with 10 CFR Part 72.
- **Multi-Purpose Canister** (or “MPC”) means the sealed canister consisting of a honeycombed fuel basket for SNF storage, contained in a cylindrical canister shell.
- **NEI** is an acronym for the Nuclear Energy Institute.
- **Non-mechanistic tip-over** is a postulated cask tip-over event that is not based on any previously observed causal event or mechanism, but which is assumed in order to provide conservatism in risk assessments to prove that no fuel damage will occur as a result of the tip-over.
- **NRC** is an acronym for the U.S. Nuclear Regulatory Commission.
- **Reactor Building** refers to the reactor building at the Station.
- **Regulatory Guides** (or “Reg. Guides”) are guidance documents drafted by NRC (and before the NRC, by the AEC) staff to provide guidance to licensees on implementing specific parts of the NRC regulations, techniques used by NRC staff in evaluating specific problems or technical issues.
- **SNF** is an acronym for Spent Nuclear Fuel.
- **Station** means the Vermont Yankee Nuclear Power Station.

## 1.2 General Facility Description

Use of the ISFSI or Facility involves several major areas at the Station owned by Entergy Nuclear Vermont Yankee, LLC, in Vernon, Vermont: the Reactor Building where the SNF is currently stored in the Station’s spent-fuel pool; the CAB, the ISFSI pad (to which the fuel will be transported for interim storage in a Storage Overpack); and the transfer path between the CAB and the ISFSI pad. The ISFSI pad is a highly-engineered structure which has been designed and

constructed to support loaded Storage Overpacks (which weigh about 200 tons each) and to ensure that no damage to the SNF occurs as a result of “non-mechanistic tip-over.” The specific soil properties, soil depths, concrete properties and pad thickness have been thoroughly evaluated; the results are documented in the 72.212 Report and the ISFSI pad has been constructed to meet these standards. See Tab 2. The transfer path between the CAB and the ISFSI pad has been evaluated, and it has been determined that the existing roadway is adequate to protect underground utilities.

### **1.3 Location**

The ISFSI pad is located north of the Reactor Building, approximately 210 feet west of the high water mark of the Connecticut River as shown on the Site Plan attached as Tab 1 to this Plan. As agreed in paragraph 1 of the Memorandum of Understanding between Entergy VY and the Vermont Department of Public Service dated June 21, 2005 (“DFS MOU”), a line-of-sight barrier has been constructed on the north and east sides of the ISFSI pad (See Tab 3).

### **1.4 Loading Campaigns**

#### **1.4.1 2008 Loading Campaign**

During the summer of 2008, Entergy VY loaded 340 SNF assemblies into five Holtec Storage Overpacks and placed them on the ISFSI pad such that any one of the five casks can be retrieved without relocation of any of the other casks, providing access to individual casks. The 2008 loading campaign restored Full Core Offload capability.

#### **1.4.2 2011 Loading Campaign**

During the summer of 2011, Entergy VY loaded 272 SNF assemblies into four Holtec Storage Overpacks and placed them on the ISFSI.

#### **1.4.3 2012 Loading Campaign**

During the summer of 2012, Entergy VY loaded 272 SNF assemblies into four Holtec Storage Overpacks and placed them on the ISFSI. These four Overpacks (#10, #11, #12 and #13) were placed south of the Overpacks (#2, #3, #4 and #5) that were placed into storage on the ISFSI pad in an earlier campaign.

### **1.5 Future Loading Campaigns**

As of June 2014, there are 2627 SNF assemblies remaining in the spent-fuel pool, configured so that high-decay-heat assemblies of SNF are surrounded by low-decay-heat assemblies of SNF, as agreed in paragraph 9 of the DFS MOU. There

are an additional 368 SNF assemblies in the Reactor Core.. The Planned Loading Schedule details VY's plan to reduce the number of fuel rods stored in the Spent Fuel Pool based on, among other factors, the normal cooling period for SNF after it is unloaded from the Reactor Core and efficient work scheduling. The current schedule for future loading campaigns is;

| <b>PLANNED LOADING SCHEDULE</b> |                                 |  |
|---------------------------------|---------------------------------|--|
| Loading Campaign Years          | Number of Casks to be Processed | SNF Assemblies Discharged to ISFSI Pad |
| 2019                            | 32                              | 2176                                   |
| 2020                            | 13                              | 820*                                   |

\*Includes one Damaged Fuel Container consisting of fuel debris

## **2.0 OPERATING PROCEDURES**

### **2.1 Design and Operational Requirements**

The Facility is sited, designed and operated in compliance with the applicable NRC licensing requirements found at 10 CFR Part 72, Subparts E, F & G, NRC Regulatory Guides and the FSAR for the SNF prepared by Holtec as well as the DFS MOU, the design and/or operational requirements set forth by the Board in its Order and CPG dated April 26, 2006, and such other requirements that were set forth in applicable permits from the Vermont Agency of Natural Resources or other governmental authority having jurisdiction over the Facility.

### **2.2 Facility Security**

Security for the Facility is established and operated in compliance with the NRC licensing requirements found at 10 CFR Part 72, Subpart H and Part 73, and other applicable NRC Regulatory Guides.

### **2.3 Staffing**

The operators of the Facility are trained in compliance with the training and certification requirements found at 10 CFR Part 72, Subpart I.

### **3.0 LONG TERM PLANNING FOR STORAGE OF SPENT NUCLEAR FUEL**

#### **3.1 Construction of Separate ISFSI Pad**

The ISFSI described in Section 1.2 is an 8 x 5 array that was constructed to support 36 Storage Overpacks. (NOTE: Four storage locations were to be unused to allow retrievable of any casks should the need arise). At shutdown in late 2014, VY will need 58 total Storage Overpacks to store the 3879 SNF assemblies that were generated during VY's lifetime. Hence, an additional ISFSI pad is required. VY is in the process of submitting a CPG Request for a separate ISFSI pad to be constructed as part of decommissioning activities. All necessary regulatory approvals will be obtained prior to construction of this new ISFSI. The SNF remaining in the spent-fuel pool will be transferred to one of the two ISFSI pads and managed pursuant to the operating procedures outlined in Section 2.0 above, pending removal by the federal government. The DOE has not provided a schedule to accept SNF that would realistically preclude the need for the new pad.

The specific location of the new ISFSI pad is being evaluated at this time and is expected to be within close proximity of the existing ISFSI pad.

#### **3.2 Station Shutdown; Amendment of Spent Fuel Management Plan**

This Spent Fuel Management Plan is being amended to take into account the new ISFSI referenced in Section 3.1 and other changed circumstances, including updated information regarding the DOE's removal schedule for SNF from Vermont Yankee. VY is evaluating multiple cask vendors (and casks) to identify the most efficient means to address SNF storage. The current long range plan is based on the DOE starting to accept spent fuel from VY in 2025 and be complete by 2052. The amended Plan will also take into account the management of SNF remaining in the spent-fuel pool pending transfer to dry casks.

#### **3.3 License Renewal; Amendment of Spent Fuel Management Plan**

Since VY will permanently shut down in late 2014, there is no need to amend the Spent Fuel Management Plan for the obtained License Renewal.

#### **3.4 Long Term Storage of Spent Nuclear Fuel at the Station**

It is uncertain when DOE will begin taking fuel from the Station. In its April 26, 2006, Order and accompanying CPG in Docket No. 7082, the Board required VY to address the possibility that SNF could remain at the Station through 2082. Because of the uncertainty of future events over the relevant time period, it is expected that this section will need to be amended over time to address changed circumstances as they arise.



To address the Board's requirements in Docket No. 7082, Entergy VY will perform the following actions:

- Entergy VY will comply with all applicable NRC requirements for the storage of SNF in dry or wet storage until DOE meets its obligation under the federal law to take title to the SNF.
- By 2018 (ten years after the first fuel loading into an MPC/Overpack) Entergy VY will develop a formal inspection and maintenance program for the MPC/Overpack assemblies with recognition that MPC/Overpack assemblies could be stored on site as long as 75 years.
- In advance of 2028 (twenty years after the first fuel loading into an MPC/Overpack), Entergy VY will undertake a program to seek renewal of applicable cask Certificates of Compliance as provided in 10 CFR 72.212 if the Certificate of Compliance has not been renewed by Holtec.
- If all SNF is not removed from the Station by 2047 (forty years after construction of the ISFSI pad), aging-management procedures for the ISFSI pad will be developed consistent with the NRC License Renewal requirements for concrete structures for reactors.
- If all SNF is not removed from the Station by 2048 (forty years after placing into service of the ISFSI temperature monitoring system) aging management procedures for the ISFSI pad temperature monitoring system will be developed consistent with the NRC License Renewal requirements for similar instrumentation systems for reactors.

## **4.0 TRANSFER AND CLOSURE PROCEDURES**

### **4.1 General**

Under federal law, removal of SNF from the Station is the legal responsibility of DOE. VY has agreed in memoranda of understanding with the State of Vermont in Docket Nos. 6545 and 7082 to use its commercial best efforts to ensure that high-level SNF stored at the Station is removed from the site in a reasonable manner and as quickly as possible to an interim or permanent location outside of Vermont. Entergy VY, individually and through the NEI, also continues to work with state and federal officials and authorities to support the prompt implementation of a federal repository for SNF.

## 4.2 Transfer Procedure from ISFSI to Long-Term Repository

Entergy VY would likely construct a CTF to facilitate transportation of SNF off site. The transportation sequence would be as follows:

- The HI-TRAC would be placed over the Overpack;
- The MPC would be raised out of the Overpack and into the HI-TRAC;
- The HI-TRAC/MPC would be placed over the HI-STAR;
- The MPC would be lowered into the HI-STAR; and
- The HI-STAR would be removed from the chamber, if used, and readied for shipment.
- The HI-STAR would then be loaded on either specially designed rail or over-road transportation vehicles for transportation to the designated federal SNF repository.