NUCLEAR REGULATORY COMMISSION
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ENVIRONMENTAL ASSESSMENT FOR THE EXEMPTION REQUEST FOR ENTERGY NUCLEAR OPERATIONS, INC.'S VERMONT YANKEE NUCLEAR POWER STATION INDEPENDENT SPENT FUEL STORAGE INSTALLATION IN VERNON, VERMONT

1. INTRODUCTION

By letter dated November 9, 2016 (Entergy 2016), and supplemented on January 9, 2017 (Entergy 2017), Entergy Nuclear Operations, Inc. (Entergy) submitted a request to the U.S. Nuclear Regulatory Commission (NRC) for an exemption, in accordance with Title 10 of the Code of Federal Regulations (10 CFR) 72.7, from the requirements of 10 CFR 72.212(a)(2), 72.212(b)(3), 72.212(b)(5)(i), 72.214, and the portion of 72.212(b)(11) that requires compliance with the terms, conditions, and specifications of the Certificate of Compliance (CoC) No. 72-1014 for spent fuel storage at the Vermont Yankee Nuclear Power Station (VYNPS) independent spent fuel storage installation (ISFSI). This exemption would allow certain low-enriched channeled fuel classified as undamaged per the CoC No. 72-1014 to be loaded with higher enriched fuel in the same HI-STORM 100 multi-purpose canister (MPC) at the VYNPS.

The NRC staff performs both a safety evaluation and an environmental review to determine whether to grant this exemption request. The NRC staff will prepare a separate safety evaluation report (SER) to document its safety review and analysis. The NRC's safety review will evaluate the proposed mixed-enrichment fuel loading arrangement to assure continued protection of public health and safety, common defense and security, and the environment.

The environmental review is documented in this Environmental Assessment (EA), which the NRC staff prepared in accordance with 10 CFR 51.21 and 51.30(a). Additionally, the preparation of this EA is being coordinated with the development of the SER. This EA defines the NRC's proposed action in Section 2 and the purpose and need for the proposed action in Section 3. The evaluation of the potential environmental impacts of the proposed action is presented in Section 4, and the environmental impacts of the alternatives to the proposed action are found in Section 5. The NRC's conclusion is summarized in Section 7. The NRC's decision whether to grant the exemption will be based on the results of the NRC staff's review as documented in this EA and the staff's safety review to be documented in the SER

1.1 Background

VYNPS began operation in 1972, and the reactor was permanently shut down on December 29, 2014. VYNPS currently stores spent BWR fuel assemblies at its ISFSI in thirteen (13) HI-STORM 100 casks under CoC No. 72-1014, Amendment No. 2. The remaining spent fuel assemblies were removed from the reactor and transferred to the spent fuel pool. Entergy submitted the VYNPS Post-Shutdown Decommissioning Activities Report (PSDAR) (Entergy 2014) to the NRC on December 19, 2014. In the PSDAR, Entergy stated that it plans to move

all of the spent nuclear fuel assemblies into dry cask storage by 2020 and put the plant into SAFSTOR[1] until it is ready to fully decommission the facility.

Entergy plans to use Holtec's HI-STORM 100 cask system under CoC No. 72-1014, Amendment No. 10 (NRC 2016) for the dry storage of spent nuclear fuel in MPC-68M canisters at VYNPS. VYNPS's spent fuel cask loading plan for decommissioning includes a large number of assemblies that meet the definition (b) of "undamaged fuel assembly" in HI-STORM 100, CoC No. 72-1014[2]. These undamaged fuel assemblies are typically low-burned and long-cooled, and could be mixed with higher-enriched and higher-burned fuel in the same cask to reduce dose rates. Placing the low-burned, long-cooled assemblies on the periphery of the cask acts as shielding and blocks the radiation from the shorter-cooled, higher-burned fuels stored in the center of the cask. The current conditions of Amendment No. 10 of the CoC restrict mixing higher-enriched fuel with the lower-enriched undamaged fuel. The exemption would allow VYNPS to store spent fuel assemblies with higher and lower enrichments in the same MPC. Entergy requested this exemption to facilitate completion of its post-shutdown decommissioning activities. If implemented, the exemption will result in more efficient spent fuel loading and a reduction of the operational dose rate.

Holtec submitted an application to the NRC for Amendment No. 11 of CoC No. 72-1014, dated January 29, 2016 (Holtec 2016). As is discussed in greater detail in Section 2 of this EA, Amendment 11 of CoC No. 72-1014 would permit the mixing of higher-enriched fuel with the lower-enriched undamaged spent fuel stored in the HI-STORM 100 cask system. The Holtec's Amendment No. 11 request (Holtec 2016) is more extensive in scope than the exemption request being evaluated in this EA. Entergy's exemption request relies on the safety analysis in Holtec's application as support for the safety of mixing higher-enriched fuel with the lower-enriched undamaged fuel. Sections 1.2 and 1.3 of this EA summarize Holtec's safety analysis and explain why the environmental impacts of the proposed action are bounded by previous NRC environmental reviews making further consideration in this EA unnecessary.

The NRC staff reviewed the requested exemption and determined that it does not change the fundamental design, components, or safety features of the dry cask storage system. The NRC staff evaluated the potential safety impacts of granting the exemption and assessed the potential for any danger to life or property or the common defense and security. Specifically, the NRC staff reviewed the criticality and shielding and radiation protection evaluations for the proposed action. The NRC staff' will consider the safety evaluation and this EA in its decision on whether to approve this exemption.

1.2 Criticality Considerations

Holtec performed a criticality analysis (Holtec 2016) for loading lower enriched undamaged fuel assemblies with bare fuel rods in all cells of the MPC-68M, and the results showed the system

[1] SAFSTOR is a method of decommissioning in which a nuclear facility is placed and maintained in a condition that allows the facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use.

[2] HI-STORM 100, CoC No. 72-1014, Appendix A, Section 1.1, Definitions, "UNDAMAGED FUEL ASSEMBLY is: a) a fuel assembly without known or suspected cladding defects greater than pinhole leaks or hairline cracks and which can be handled by normal means; or b) a BWR fuel assembly with an intact channel, a maximum planar average initial enrichment of 3.3 wt.% U-235, without known or suspected GROSSLY BREACHED SPENT FUEL RODS, and which can be handled by normal means. An UNDAMAGED FUEL ASSEMBLY may be a REPAIRED/ RECONSTITUTED FUEL ASSEMBLY."

is subcritical as required by the regulations. Holtec also analyzed the storage of undamaged fuel with both enrichments placed within the MPC-68M in a checkerboard-configuration. The results showed that reactivity remains subcritical for both higher and lower enrichments. In addition, the results for the higher enriched undamaged fuel in all cells provides an upper bounding limit. The bounding results for the HI-STORM 100 cask system were previously reviewed and approved by the NRC (NRC 2011, SER for Amendment No. 8 to CoC No. 72-1014). The NRC staff determined the storage of higher enrichments with low enriched channeled undamaged fuel in the MPC-68M meets the criticality safety requirements of 10 CFR Part 72 and is bounded by previous analyses.

1.3 Operational Dose

Entergy states that the proposed action will reduce the operational dose rate. Holtec performed dose rate calculations and provided the results in its supplemental information (Entergy 2017). Holtec used representative casks and calculated dose rates at various distances from a cask. It calculated the dose rate from a cask with only undamaged low-enriched fuels and the dose rate from a cask with only higher-enriched fuels, which is the current condition under CoC 72-1014, Amendment No. 10. It also calculated the dose rate from a cask filled with mixed enrichment fuel, as proposed in the exemption request. The resulting dose rates are presented in Attachment 1, Table 2 of Entergy's supplemental information. All calculated dose rates are below the 10 CFR part 20 limits. In addition, there is a net dose reduction for a cask that contains mixed enrichment fuel. The NRC staff determined that the occupational exposure rate and offsite dose rate from the storage of higher enriched fuel with low enriched channeled undamaged fuel in the MPC-68M will remain within all applicable 10 CFR part 20 limits.

2. THE PROPOSED ACTION

The proposed action requests that the NRC grant Entergy an exemption from the requirements of 10 CFR 72.212(a)(2), 72.212(b)(3), 72.212(b)(5)(i), 72.214, and the portion of 72.212(b)(11), which state the general licensee shall comply with the terms, conditions, and specifications of the CoC.

Entergy plans to use Holtec's HI-STORM 100 cask system under CoC No. 72-1014, Amendment No. 10 for the dry storage of spent nuclear fuel in MPC-68M canisters at VYNPS. Appendix B, Table 2.1-3, to the CoC sets out the characteristics of BWR fuel assemblies approved for storage in MPC-68M canisters. Note 19 of the table describes the maximum planar-average initial enrichment for storing fuel assemblies in the MPC-68M as follows:

> In accordance with the definition of UNDAMAGED FUEL ASSEMBLY, certain assemblies may be limited to 3.3 wt.% U-235. When loading these fuel assemblies, all fuel assemblies in the MPC are limited to 3.3 wt.% U-235.

Note 19 states that when VYNPS loads certain low-enriched, channeled undamaged BWR fuel assemblies in an MPC-68M, all fuel assemblies in the MPC are limited to 3.3 wt.% U-235 maximum planar-average initial enrichment. Entergy's exemption request proposes to revise Appendix B, Table 2.1-3, Note 19 as follows:

> In accordance with the definition of UNDAMAGED FUEL ASSEMBLY, certain assemblies may be limited to up to 3.3 wt.% U-235. When loading these fuel assemblies, all other undamaged fuel assemblies in the MPC are limited to enrichments as specified in this table.

3. NEED FOR THE PROPOSED ACTION

Holtec requested Amendment No. 11 to CoC No. 721014, dated January 29, 2016 (Holtec 2016) and the request is currently under review by the NRC staff. Holtec's amendment requests the revision of Appendix B, Table 2.1-3, Note 19 to allow the storage of higher and lower enriched fuel assemblies. The NRC will not complete its review of Amendment No. 11 prior to the proposed initiation of VYNPS's 2017 loading campaign, as described in the PSDAR as supplemented (Entergy 2017b).

Entergy requests the exemption in order to manage its spent fuel inventory and maintain its decommissioning schedule through its loading campaigns. The exemption will allow VYNPS to load lower enriched channeled undamaged fuel assemblies (with enrichment up to 3.3 wt.% U-235) with higher enriched fuel assemblies (with planar-average initial enrichment up to 4.8 wt.% U-235, in accordance with Table 2.1-3) into the same MPC at VYNPS. The storage of higher and lower enriched fuel assemblies allows for more efficient fuel loading and reduces the operational dose rates for its decommissioning effort.

4. ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

This EA evaluates the potential environmental impacts of granting the exemption to allow loading of higher enriched fuel assemblies with certain lower enriched fuel assemblies in the HI-STORM 100 MPC-68M under CoC No. 72-1014, Amendment No. 10. The potential environmental impacts of Amendment No. 10 to the CoC for the HI-STORM 100 were evaluated by the staff prior to being added to the list of approved spent fuel storage casks in 10 CFR 72.214 (81 *FR* 13265). The only potential impacts from granting the exemption would as discussed below. Non-radiological impacts will not greater than those considered in the EA for the CoC.

On July 18, 1990 (55 *FR* 29181), the NRC amended 10 CFR part 72 to provide for the storage of spent fuel under a general license in cask designs approved by the NRC. The EA for the 1990 final rule analyzed the potential environmental impact of using NRC-approved storage casks. The EA for HI-STORM 100, Amendment No. 10, tiers off of the EA issued for the July 18, 1990 final rule. The EA for this exemption tiers off of the EA for HI-STORM 100, Amendment No. 10. Tiering off earlier EAs is a standard process under NEPA and uses the impact analyses of previous EAs to bound the impacts of a proposed action.

The EA for Holtec HI–STORM 100, Amendment No. 10, analyzed the effects of design basis accidents that could occur during storage. Design basis accidents account for human-induced events and the most severe natural phenomena reported for the site and surrounding area. Entergy's proposed exemption request does not reflect a significant change in cask design or fabrication requirements, therefore no loss of confinement or shielding will occur.

NRC staff concludes that criticality control is within regulatory requirements and the environmental impacts of the proposed action will be insignificant. NRC staff also finds that occupational exposure and offsite dose rates from this exemption request will remain within applicable 10 CFR part 20 limits. Therefore, the proposed exemption request will not result in radiological or non-radiological environmental impacts that significantly differ from impacts evaluated in the EA supporting the HI-STORM 100, Amendment No. 10 direct final rule. In addition, no significant change in the types or amounts of any effluent released, no significant increase in individual or cumulative radiation exposures, and no significant increase in the

potential for or consequences of radiological accidents will occur. For these reasons, the NRC concludes there are no significant environmental impacts associated with the exemption request for the HI-STORM 100 cask system.

5. ENVIRONMENTAL IMPACTS OF THE ALTERNATIVES TO THE PROPOSED ACTION

In addition to the proposed action, the staff also considered the no-action alternative of denial of the proposed exemption request. Denial of the exemption request would require the applicant to load and store spent fuel in accordance with the conditions of Amendment No. 10 of CoC No. 72-1014. The environmental impacts of storing fuel according to Amendment No. 10 of the CoC have already been evaluated in a previous EA. Because the NRC determined no significant environmental impacts are associated with the proposed action, there is no need to evaluate alternatives with equal or greater environmental impacts.

6. AGENCIES CONSULTED

The NRC provided the Vermont Department of Health (VDOH) a copy of this Draft EA for review by an email dated February 7, 2017 (NRC 2017a). On March 16, 2017, the VDOH provided its comments (VDOH 2017). The NRC staff responded to VDOH's comments on May 23, 2017 (NRC 2017c). NRC did not make changes to this EA as a result of VDOH's comments. However, the NRC will consider the VDOH's comments when preparing the SER.

Endangered Species Act (ESA) Section 7 Consultation

The ESA was enacted to prevent further decline of endangered and threatened species and restore those species and their critical habitat. Section 7 of the ESA requires Federal agencies to consult with the U.S. Fish and Wildlife Service (FWS) or National Marine Fisheries Service (NMFS) (collectively, "the Services") regarding actions that may affect listed species or designated critical habitats.

Pursuant to ESA Section 7, the NRC staff consulted with the Services during the NRC staff's license renewal review in 2006 regarding the potential impacts of continued operation of VYNPS pursuant to ESA Section 7. In communications with these agencies, both FWS and NMFS indicated that continued operation of VYNPS would not affect listed species (NRC 2007). Because the proposed exemption is a new federal action and because the Services regularly update the federal list of endangered species, the NRC staff conducted a search of federally listed species and critical habitats that are currently listed and have the potential to occur in Windham County using the FWS's Environmental Conservation Online System Information for Planning and Conservation system. Three Federally-listed species occur in this county: Dwarf wedgemussel (*Alasmidonta heterodon*), Northern Long-Eared Bat (*Myotis septentrionalis*), and Northeastern bulrush (*Scirpus ancistrochaetus*). However, as stated previously in this EA, the requested exemption request would not change the fundamental design, components, or safety features of the dry cask storage system. Additionally, fuel loading activities are conducted within an existing building and, therefore, have no direct nexus to the natural environment that could affect federally listed species.

The NRC staff, therefore, concludes that the proposed exemption request would have no effect on federally listed species or critical habitats. Federal agencies are not required to consult with the FWS if they determine that an action will not affect listed species or critical habitats (FWS

2016). The ESA does not require consultation for the proposed exemption, and thus the NRC staff considers its obligations under ESA Section 7 to be fulfilled for the proposed action.

National Historic Preservation Act (NHPA) Section 106 Consultation

Section 106 of the NHPA requires federal agencies to consider the effects of their undertakings on historic properties. As stated in the Act, historic properties are any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in the National Register of Historic Places (NRHP).

NRC staff consulted with the Vermont State Historic Preservation Office during the staff's license renewal review in 2006 regarding the potential impacts of continued operation of VYNPS. As described in the supplemental environmental impact statement for the VYNPS license renewal review, no prehistoric archaeological sites have been identified on the VYNPS property. However, the Governor Hunt House is a historically significant property owned and managed by the plant operator. Further, the area around the house has the potential to contain buried remains associated with the Governor Hunt House (NRC 2007).

The NRC has determined that the scope of activities described in this exemption request do not have the potential to cause effects on historic properties as the NRC's approval of this exemption request will not authorize new construction or land disturbance activities. The fuel loading activities will be the same and will be done within the existing reactor building. Therefore, in accordance with 36 CFR 800.3(a)(1), no consultation is required under Section 106 of the NHPA. The NRC staff, however, informed the Vermont State Historic Preservation Office (SHPO) by an email dated February 9, 2017 of its "no effects" determination (NRC 2017b). On February 24, Vermont SHPO provided its concurrence by an email (SHPO 2017).

7. CONCLUSION

The environmental impacts of the proposed action—an exemption to allow loading certain lower enriched fuel assemblies with higher enriched fuel assemblies in the same MCP—have been reviewed under the requirements in 10 CFR Part 51.

In this EA, the NRC determined that the environmental impacts of granting this exemption will be no greater than those described in the EA for the HI-STORM 100, Amendment 10, direct final rule. No changes are being made in the types or quantities of effluents that may be released offsite, and there is no significant increase in occupational or public radiation exposures. Accordingly, NRC has determined that a Finding of No Significant Impact (FONSI) is appropriate and an EIS is not warranted. The NRC will publish the FONSI in the *Federal Register*.

8. REFERENCES

The documents referenced in this EA are all publically available. The references are available for public inspection and copying at NRC's Public Document Room, One White Flint North, 11555 Rockville Pike, Rockville, Maryland 20852. Documents available through the NRC's electronic reading room (ADAMS) at http://www.nrc.gov/reading-rm/adams.html have an Accession No. provided.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, Energy, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, D.C.

10 CFR Part 72. *Code of Federal Regulations*, Title 10, Energy, Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste." Washington, D.C.

55 *FR* 29181. Final Rule: Storage of Spent Fuel in NRC-Approved Storage Casks at Power Reactor Sites. *Federal Register* Volume 55, Issue 138. July 18, 1990.

81 *FR* 13265. Direct Final Rule: List of Approved Spent Fuel Storage Casks: Holtec International HI-STORM 100 Cask System; Certificate of Compliance No. 1014, Amendment No. 10. *Federal Register* Volume 81, Issue 49. March 14, 2016.

Endangered Species Act of 1973, as amended. 16 USC §1531 et seq.

Entergy 2014. Vermont Yankee Post-Shutdown Decommissioning Activities Report. December 29, 2014. ADAMS Accession No. ML14357A110.

Entergy 2016. Letter from Entergy Nuclear Operations, Inc. to NRC, "Exemption Request from certain requirements of 10 CFR 72.212 and 10 CFR 72.214, Vermont Yankee Nuclear Power Station, License No. DPR-28, Docket Nos. 50-271, 72-59 and 72-1014." November 9, 2016. ADAMS Accession No. ML16319A102.

Entergy 2017a. Letter from Entergy Nuclear Operations, Inc. to NRC, "Response to Request for Supplemental Information Related to Exemption Request from certain requirements of 10 CFR 72.212 and 10 CFR 72.214 Vermont Yankee Nuclear Power Station, License No. DPR-28, Docket Nos. 50-271, 72-59 and 72-1014." January 9, 2017. ADAMS Accession No. ML17010A300.

Entergy 2017b. Presentation slides at January 24, 2017 public meeting, "Vermont Yankee Nuclear Power Station Decommissioning." January 24, 2017. ADAMS Accession No. ML17019A145.

FWS 2016. Endangered Species Consultations Frequently Asked Questions. ADAMS Accession No. ML16120A505.

Holtec 2016. Letter from Holtec International to NRC, "Holtec International HI-STORM 100 Multipurpose Canister Storage System Amendment Request 1014-11." January 19, 2016. ADAMS Accession No. ML16029A529.

National Historic Preservation Act of 1966. 16 USC §470 et seq.

NRC 2007. NUREG-1437, Supplement 30, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Regarding Vermont Yankee Nuclear Power Station – Final Report." August 2007. ADAMS Accession Nos. ML072050012 and ML072050013.

NRC 2011. Safety Evaluation Report, Docket No. 72-1014, Holtec International HI-STORM 100 Cask System, Certificate of Compliance No. 1014, Amendment No. 8. August 2011. ADAMS Accession No. ML112160627.

NRC 2016. Letter from NRC to Holtec International, "Certificate of Compliance No. 1014, Amendment No. 10 for the HI-STORM 100 Cask System (CAC No. L24979)." May 25, 2016. ADAMS Accession No. ML16144A177.

NRC 2017a. Email from NRC to Vermont Depart of Health, "Draft Environmental Assessment: Exemption Request for Vermont Yankee Independent Spent Fuel Storage Installation." February 7, 2017. ADAMS Accession No. ML17038A468.

NRC 2017b. Email from NRC to State Historic Preservation Office, "FYI: No effects determination for NRC's exemption request review at Vermont Yankee Nuclear Power Station." February 9, 2017. ADAMS Accession No. ML17040A337.

NRC 2017c. Email from NRC to Vermont Department of Health, "Response Vermont Department of Health Comments: Draft Environmental Assessment—Exemption Request for Vermont Yankee Independent Spent Fuel Storage Installation." Month Date, 2017. ADAMS Accession No. ML17144A045.

SHPO 2017. Email from Vermont State Historic Preservation Office to NRC, "Entergy Nuclear Vermont Yankee." February 24, 2017. ADAMS Accession No. ML17055A594.

VDOH 2017. Email from Vermont Department of Health to NRC, "RE: Followup: Draft Environmental Assessment: Exemption Request for Vermont Yankee Independent Spent Fuel Storage Installation." March 16, 2017. ADAMS Accession No. ML17080A475.