



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 11, 2019

Mr. Brian R. Sullivan
Site Vice President
Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
600 Rocky Hill Road
Plymouth, MA 02360-5508

SUBJECT: PILGRIM NUCLEAR POWER STATION – REVIEW OF UPDATE TO SPENT
FUEL MANAGEMENT PLAN (EPID L-2018-LLL-0032)

Dear Mr. Sullivan:

The U.S. Nuclear Regulatory Commission (NRC) staff has completed reviewing the submittal dated November 16, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18320A036), by Entergy Nuclear Operations, Inc. (Entergy, the licensee). In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(bb), the licensee provided an update to the spent fuel management plan (SFMP) for Pilgrim Nuclear Power Station (Pilgrim).

Pursuant to 10 CFR 50.54(bb), Entergy submitted an SFMP and preliminary decommissioning cost estimate (DCE) to the NRC on June 7, 2007 (ADAMS Accession No. ML071700121), as supplemented by letters dated April 9, 2008, and October 14, 2008 (ADAMS Accession Nos. ML081060520 and ML082910039, respectively). On January 7, 2009 (ADAMS Accession No. ML083190292), the NRC staff approved the Pilgrim SFMP on a preliminary basis.

By letter dated November 10, 2015 (ADAMS Accession No. ML15328A053), Entergy submitted to the NRC a notification of permanent cessation of power operations for Pilgrim, to prematurely and permanently cease power operations at Pilgrim no later than June 1, 2019, pursuant to 10 CFR 50.82(a)(1)(i).

By letter dated June 10, 2019 (ADAMS Accession No. ML19161A033), Entergy certified that power operations ceased at Pilgrim on May 31, 2019, and that the fuel was permanently removed from the Pilgrim reactor vessel and placed in the spent fuel pool on June 9, 2019. Entergy further acknowledged that the Pilgrim 10 CFR Part 50 license no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel.

As a result of the decision to permanently cease operations at Pilgrim and related changes to the anticipated schedule of decommissioning activities, spent fuel management activities, and decommissioning funding assumptions, Entergy is modifying the Pilgrim SFMP. The November 16, 2018, letter provides the required Section 50.54(bb) notification.

By letter dated November 16, 2018 (ADAMS Accession No. ML18320A034), as supplemented by letter dated January 9, 2019 (ADAMS Accession No. ML19015A020), Entergy submitted the Pilgrim post-shutdown decommissioning activities report (PSDAR) and the site-specific DCE.

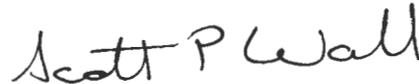
The enclosed review focuses on spent fuel management. The NRC staff is conducting a separate review of the PSDAR and site-specific DCE.

Based on its review of Entergy's SFMP submittal, the NRC staff finds that the licensee's program to manage and provide funding for the management of all spent fuel is adequate and provides sufficient detail regarding the associated funding mechanisms. Further, the staff has determined that the elected actions within the program are consistent with NRC requirements for licensed possession of spent nuclear fuel and that these actions will be implemented in a timely basis. Therefore, the staff concludes that the Pilgrim SFMP complies with 10 CFR 50.54(bb) and approves the plan on a preliminary basis. The enclosed safety evaluation documents the NRC staff's review of the updated SFMP for Pilgrim.

In accordance with 10 CFR 50.82(a)(8)(vii), the licensee must annually submit to the NRC, by March 31, a report on the status of its funding for managing irradiated fuel. Further, in accordance with 10 CFR 50.54(bb), the licensee shall notify the NRC of any significant changes to the SFMP. Accordingly, the regulations provide a means of informing the NRC staff of fluctuations in the reported fund balances and funding requirements for spent fuel, and significant changes to the SFMP.

If you have any questions, please contact me at (301) 415-2855 or via e-mail at Scott.Wall@nrc.gov.

Sincerely,



Scott P. Wall, Senior Project Manager
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-293

Enclosure:
Safety Evaluation

cc: Listserv



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

UPDATE TO SPENT FUEL MANAGEMENT PLAN

ENTERGY NUCLEAR GENERATION COMPANY

ENTERGY NUCLEAR OPERATIONS, INC.

PILGRIM NUCLEAR POWER STATION

DOCKET NO. 50-293

1.0 INTRODUCTION

The U.S. Nuclear Regulatory Commission (NRC) staff has completed reviewing the submittal dated November 16, 2018 (Agencywide Documents and Access Management System (ADAMS) Accession No. ML18320A036), by Entergy Nuclear Operations, Inc. (Entergy, the licensee). In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.54(bb), the licensee provided an update to the spent fuel management plan (SFMP) for Pilgrim Nuclear Power Station (Pilgrim).

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2.0 BACKGROUND

The Pilgrim site is a single-unit facility located in the town of Plymouth, Plymouth County, in the Commonwealth of Massachusetts. It is situated on the western coast of Cape Cod Bay, on approximately 1,600 acres of land. Pilgrim received its operating license on June 8, 1972. The Pilgrim facility employed a General Electric boiling-water reactor nuclear steam supply system licensed to generate 2,028 megawatts-thermal. The principal structures of Pilgrim are the reactor and turbine buildings, off-gas retention building, radwaste building, diesel generator building, intake structure, switchyard, main stack, trash compaction facility, and administration buildings. The Pilgrim reactor site also houses an independent spent fuel storage installation (ISFSI).

The decommissioning approach that has been selected by Entergy for Pilgrim is the SAFSTOR method. Under SAFSTOR, often considered "deferred dismantling," a nuclear facility is maintained and monitored in a condition that allows the radioactivity to decay; afterwards, the plant is dismantled and the property decontaminated. In accordance with 10 CFR 50.82(a)(3), decommissioning will be completed within 60 years of permanent cessation of operations.

3.0 REGULATORY EVALUATION

3.1 Regulatory Requirement

The regulation under 10 CFR 50.54(bb) states, in relevant part:

For nuclear power reactors licensed by the NRC, the licensee shall, within 2 years following permanent cessation of operation of the reactor or 5 years before expiration of the reactor operating license, whichever occurs first, submit written notification to the Commission for its review and preliminary approval of the program by which the licensee intends to manage and provide funding for the management of all irradiated fuel at the reactor following permanent cessation of operation of the reactor until title to the irradiated fuel and possession of the fuel is transferred to the Secretary of Energy for its ultimate disposal in a repository.

3.1.1 Criteria and Information Evaluated to Support the 10 CFR 50.54(bb) Review

Similar to reviews of other SFMPs,¹ the NRC staff reviewed the following information submitted in support of the Pilgrim SFMP to evaluate and provide preliminary approval of the spent fuel management and funding program:

- Estimated cost to isolate the spent fuel pool (SFP) and fuel handling systems. For the decontamination (DECON) option, the cost to isolate the SFP and fuel handling systems may be considered part of the preparation for DECON;

¹ Recent reviews include the safety evaluations by the Office of Nuclear Reactor Regulation related to the SFMP of Southern California Edison Company, San Onofre Nuclear Generating Station, Units 2 and 3, Docket Nos. 50-361 and 50-362 (ADAMS Accession No. ML15182A256); the updated SFMP of Duke Energy Florida, Inc., Crystal River Unit 3 Nuclear Generating Plant, Docket No. 50-302 (ADAMS Accession No. ML14344A408); and the updated SFMP of Exelon Generation Company, LLC, Oyster Creek Nuclear Generating Station, Docket No. 50-219 (ADAMS Accession No. ML18226A330).

- Estimated cost to construct an ISFSI or a combination of wet/dry storage;
- Estimated annual cost for the operation of the selected option (wet or dry storage or a combination of the two) until the U.S. Department of Energy (DOE) takes possession of the fuel;
- Estimated cost for the preparation, packaging, and shipping of the fuel to the DOE;
- Estimated cost to decommission the spent fuel storage facility;
- Brief discussion of the selected storage method or methods and the estimated time for these activities; and
- Information identifying the source of funds for managing spent fuel.

3.1.2 Spent Fuel Management Strategy

As discussed in 10 CFR 50.54(bb), the NRC requires that licensees establish a program “to manage and provide funding for the management of all irradiated fuel at the reactor following permanent cessation of operation of the reactor until title to the irradiated fuel and possession of the fuel is transferred to the Secretary of Energy for its ultimate disposal in a repository.” Pending transfer of the fuel to the DOE, Entergy will store fuel on an interim basis in the SFP and/or the ISFSI located at the Pilgrim site. A licensed ISFSI is currently operating under a NRC general license at Pilgrim. Entergy stated that a consolidated ISFSI facility will be constructed that will accommodate the inventory of spent fuel remaining in the SFP at the time of permanent shutdown as well as all the spent fuel assemblies generated during the plant’s operational history. After the required cooling time, the spent fuel will be loaded in fuel storage canisters and moved to the consolidated ISFSI. Once the SFP is emptied of fuel, Entergy currently plans to place the facility in a SAFSTOR condition. The consolidated ISFSI will continue to operate until the transfer of spent fuel to the DOE is complete.

Assuming the DOE’s generator allocation/receipt schedules are based upon the oldest fuel receiving the highest priority and that the DOE begins removing spent fuel from commercial facilities in 2030 with an annual capacity of 3,000 metric tons of uranium, spent fuel is projected by Entergy to remain at the Pilgrim site for approximately 33 years after the termination of operation (spent fuel is projected by Entergy to be removed from the Pilgrim site by the end of 2062). Any delay in transfer of fuel to DOE or decrease in the rate of acceptance will correspondingly prolong the transfer process and result in spent fuel remaining at the site longer than anticipated.

By letter dated November 16, 2018 (ADAMS Accession No. ML18320A034), as supplemented by letter dated January 9, 2019 (ADAMS Accession No. ML19015A020), Entergy submitted the Pilgrim post-shutdown decommissioning activities report (PSDAR) and the site-specific DCE. Operation and maintenance costs for the storage facilities (ISFSI and SFP) are reflected in the Pilgrim DCE and include the costs for staffing the facilities, maintenance of necessary operational requirements as well as security, insurance, and licensing fees. The estimate includes the costs to purchase, load, and transfer the fuel storage canisters to the ISFSI and to decommission the ISFSI.

4.0 TECHNICAL EVALUATION

4.1 Evaluation of the SFMP Estimated Costs

As previously stated, by letter dated November 16, 2018, the licensee provided an update to its 2007 SFMP in accordance with 10 CFR 50.54(bb). In connection with this updated SFMP, the DCE describes the bases for the assumptions regarding the U.S. Department of Energy's (DOE) acceptance of spent fuel from the industry and from Pilgrim. As discussed in the DCE (and subject to the assumptions, qualifications, and reservations stated therein), the SFMP is based on the assumption that DOE will commence acceptance of Pilgrim's 4,114 assemblies of spent fuel in 2030 and complete removal of all spent fuel from the site in 2062, consistent with the current DOE spent fuel management and acceptance strategy.

The NRC staff's review of the licensee's submittal included the spent fuel management activities and associated cost elements found in the Pilgrim updated SFMP and site-specific DCE, and those costs previously provided in Entergy's 2007 submittal. The SFMP and associated costs estimated by the licensee total \$420.3 million (2018 dollars). The NRC staff reviewed estimates for major spent fuel management activities and funding requirements including capital for spent fuel management infrastructure; SFP operation, maintenance, and isolation costs; ISFSI expansion and operating costs; emergency planning costs; security and utility staffing costs; and spent fuel transfer costs. The estimates include the cost for labor and equipment to load and transfer the spent fuel canisters to the ISFSI from the wet storage pool, based upon Holtec's HI-STORM dry storage system.

Regarding spent fuel removal from the reactor site, the licensee indicated that its plan for spent fuel removal remains dependent upon the DOE's ability to remove spent fuel from the site in a timely manner. Accordingly, this plan is based upon the order by which DOE plans to retrieve spent fuel from individual nuclear power facilities including that from Pilgrim. The licensee maintains its position that DOE has a contractual obligation to accept fuel from Pilgrim in a timely manner. The NRC staff accepts these assumptions regarding the final disposition of Pilgrim spent fuel as the DOE, per the Nuclear Waste Policy Act of 1982 (the Act), authorizes the DOE to ultimately enter into contracts with owners and generators of commercial spent nuclear fuel to begin taking title to (legal ownership of) spent nuclear fuel. Consistent with the SFMP, the Pilgrim ISFSI serves to address interim storage requirements of spent fuel at the site.

Regarding the cost estimate for the SFMP and related activities at Pilgrim, the NRC staff evaluated the \$420.3 million (2018 dollars) estimated cost for reasonableness. In doing so, the NRC staff considered cost information from independent sources and compared that data against information provided by other licensees. One such study, "Blue Ribbon Commission on America's Nuclear Future" (Blue Ribbon Commission report), published in January 2012 for the DOE, provides cost and cost considerations for the operation and maintenance of spent fuel storage at shutdown sites. Costs cited in that report² range from \$4.5 million to \$8 million per year (2012 dollars) for spent fuel management at shutdown sites. These costs adjusted for inflation (2017 dollars) are \$4.9 million and \$9 million, respectively. Accounting for inflation, and considering the SFMP operational period, the NRC staff determined that the cost estimate provided by Entergy, on the average (approximately \$ 5 million) is within range of costs cited in the study. In addition, the NRC staff determined that the licensee's cost estimate was

² See page 35 of Blue Ribbon Commission report.

comparable with a range of other licensee SFMP cost estimates previously reviewed by NRC staff. The NRC staff acknowledges that potential site-specific variances may exist among individual SFMPs. Based on the foregoing, the NRC staff finds that the \$420.3 million cost estimate for spent fuel management to be reasonable.

4.2 Evaluation of the Program to Manage and Provide Funding of all Spent Fuel

According to Entergy, to the extent that the trust fund balance exceeds costs required for radiological decommissioning, trust fund monies will be used to pay for spent fuel management costs. The NRC staff's review of an exemption request that would allow Entergy to use excess funds from the Pilgrim decommissioning trust is currently under review.

Reimbursements from the DOE to fund SFMP activities are an additional potential source of funding for Pilgrim spent fuel management costs. Entergy has chosen not to include any DOE reimbursements in its SFMP as submitted to the NRC.

Based on Entergy's plan to fund spent fuel management costs with excess funds from the Pilgrim decommissioning trust (pending exemption request approval), the NRC staff concludes that Entergy's SFMP complies with 10 CFR 50.54(bb).

5.0 CONCLUSION

The NRC staff reviewed estimates for major spent fuel management activities and funding requirements and found the activities and associated costs of the Pilgrim SFMP appear reasonable. The NRC staff also concludes that the activities and associated costs of the Pilgrim SFMP appear reasonable, and the NRC staff does not have information that challenges the preliminary approval of the SFMP previously granted by NRC.

Principal Contributors: R. Turtill
M. Dusaniwskyj

Date: June 11, 2019

SUBJECT: PILGRIM NUCLEAR POWER STATION – REVIEW OF UPDATE TO SPENT FUEL MANAGEMENT PLAN (EPID L-2018-LLL-0032) DATED JUNE 11, 2019

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