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

January 7, 2009

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

SUBJECT: PILGRIM NUCLEAR POWER STATION – SAFETY EVALUATION RE: SPENT FUEL MANAGEMENT PROGRAM AND PRELIMINARY DECOMMISSIONING COST ESTIMATE (TAC NOS. MD8036 AND MD9416)

Dear Sir or Madam:

The Nuclear Regulatory Commission (NRC) staff has completed the review of the Pilgrim Nuclear Power Station's (PNPS) submittals dated June 7, 2007, titled "Spent Fuel Management Plan Submittal in accordance with [Title 10 of the *Code of Federal Regulations*] (10 CFR) 50.54(bb)," April 9, 2008, titled "Response to NRC Request for Additional Information (RAI) Regarding Pilgrim Nuclear Power Station Spent Fuel Management Plan Pursuant to 10 CFR 50.54(bb)," July 31, 2008, titled "Report Pursuant to 10 CFR 50.73(f)(3)," and October 14, 2008, titled "Response to Request for Additional Information to Support the Review of the Pilgrim Nuclear Power Station Spent Fuel Management plan Pursuant to 10 CFR 50.54(bb) and the Preliminary Decommissioning Cost Estimate Pursuant to 10 CFR 50.75(f)(3)." These submittals address how PNPS will meet the requirements set forth in 10 CFR 50.54(bb) and 10 CFR 50.75(f)(3).

The NRC staff finds that PNPS's program for the long-term storage of spent fuel and the preliminary decommissioning cost estimate for pilgrim is adequate and provides sufficient details associated with the funding mechanisms. The staff therefore concludes that the PNPS spent fuel management program complies with 10 CFR 50.54(bb) and approves the program on a preliminary basis. In addition, the staff finds that the preliminary cost estimate for PNPS pursuant to 10 CFR 50.75(f)(3) is not unreasonable.

Sincerely,

James Kim

James Kim, Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-273

Enclosure:
Safety Evaluation

cc w/encl: Distribution via ListServ

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO SPENT FUEL MANAGEMENT PROGRAM AND

THE PRELIMINARY DECOMMISSIONING COST ESTIMATE

ENTERGY NUCLEAR OPERATIONS, INC.

PILGRIM NUCLEAR POWER STATION

DOCKET NO. 50-273

1.0 INTRODUCTION

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.54(bb), 5 years before expiration of their operating license, licensees of nuclear power reactors must submit a spent fuel management and funding program to the Nuclear Regulatory Commission (NRC) for review and preliminary approval. The program should discuss the means by which the licensee intends to manage and provide funding for the management of spent fuel until the spent fuel is transferred to the Department of Energy (DOE) for permanent disposal.

10 CFR 50.75(f)(3) requires the licensee, at or about 5 years prior to the projected and of operation, to submit a preliminary cost estimate which includes an up-to-date assessment of the major factors that could affect the cost to decommission the reactor.

The NRC staff's review is based on the following Pilgrim Nuclear Power Station's (PNPS) submittals: (1) June 7, 2007, titled "Spent Fuel Management Plan Submittal in accordance with 10 CFR 50.54(bb)," (Accession No. ML071700121), (2) April 9, 2008, titled "Response to NRC Request for Additional Information (RAI) Regarding Pilgrim Nuclear Power Station Spent Fuel Management Plan Pursuant to 10 CFR 50.54(bb)," (Accession No. ML081060520), (3) July 31, 2008, titled "Report Pursuant to 10 CFR 50.73(f)(3)," (Accession No. ML082170673), and (4) October 14, 2008, titled "Response to Request for Additional Information to Support the Review of the Pilgrim Nuclear Power Station Spent Fuel Management plan Pursuant to 10 CFR 50.54(bb) and the Preliminary Decommissioning Cost Estimate Pursuant to 10 CFR 50.75(f)(3)" (Accession No. ML082910039).

2.0 BACKGROUND

PNPS is located on the western shore of Cape Cod Bay in the Town of Plymouth, Plymouth County, Massachusetts. It is 38 miles southwest of Boston, Massachusetts, and 44 miles east of Providence, Rhode Island. Approximately 60% of the area within a 50-mile radius is open water.

The facility encompasses approximately 140 acres. In addition, approximately 1,500 acres owned by Entergy is in a forest management trust. The nearest residence is 2,395 feet (0.45 miles) from the reactor.

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The nearest population centers are Boston, Massachusetts, and Providence, Rhode Island. The region within 6 miles of the site is completely within Plymouth County and includes part of the Town of Plymouth.

The principal structures at PNPS consist of the reactor and turbine buildings (each with auxiliary bays), the off-gas retention building, the radwaste building, the diesel generator building, the administration building, the intake structure, and the main stack. The reactor and nuclear steam supply system for PNPS, along with the mechanical and electrical systems required for the safe operation of PNPS, are primarily located in the reactor building.

PNPS is a single-unit plant with a boiling-water reactor design and a turbine generator manufactured by General Electric Company. The architect/engineer and constructor was Bechtel. The unit was licensed for an output of 1,998 megawatts-thermal (MWt), and an electric rating of 687 megawatts-electric (MWe). PNPS achieved commercial operation in December 1972. In 2003, PNPS implemented a Thermal Power Optimization of 1.5 percent to achieve the current electrical rating of 715 MWe. The reactor's primary containment is a pressure suppression system consisting of a drywell, pressure suppression chamber, vent system, isolation valves, containment cooling system, and other service equipment. The containment is designed to withstand an internal pressure of 62 pounds per square inch above atmospheric pressure and act as a radioactive materials barrier. A secondary containment completely encloses both primary containment and fuel storage areas and acts as a radioactive materials barrier.

3.0 REGULATORY REQUIREMENTS AND CRITERIA

3.1 Regulatory Requirement (10 CFR 50.54(bb))

Pursuant to 10 CFR 50.54(bb), "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 (DOE) for its ultimate disposal in a repository."

3.2 Criteria to Support 10 CFR 50.54(bb) Review

For the NRC to evaluate and provide preliminary approval of the spent fuel management and funding program, the submittal should include:

- Estimated cost to isolate the spent fuel pool and fuel handling systems, or the cost to construct an Independent Spent Fuel Storage Installation (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 DOE takes possession of the fuel;
- Estimated cost for the preparation, packaging, and shipping the fuel to DOE;
- Estimated cost to decommission the spent fuel storage facility; and
- A brief discussion of each of the areas identified and the estimated time periods for these activities.

3.3 Regulatory Requirement (10 CFR 50.75(f)(3))

10 CFR 50.75(f)(3) requires that a licensee "...shall at or about 5 years prior to the projected end of operations submit a preliminary decommissioning cost estimate which includes an up-to-date assessment of the major factors that could affect the cost to decommission." Section 50.75(f)(5) requires a licensee to include plans to adjust funding levels to demonstrate a reasonable level of financial assurance, if necessary, in the preliminary cost estimate.

The preliminary cost estimate should include a comparison to the minimum decommissioning funding amount based on the formulas in 10 CFR 50.75(c), and an assessment of the major factors that could affect the preliminary cost estimate.

If necessary, as required by 10 CFR 50.75(f)(5), the preliminary cost estimate shall also include plans for adjusting levels of funds assured for decommissioning to demonstrate a reasonable level of assurance that funds will be available to cover the cost of decommissioning.

3.4 Criteria to Support the 10 CFR 50.75(f)(3) Review

NUREG-1713, entitled "Standard Review Plan for Decommissioning Cost Estimates for Nuclear Power Reactors," provides additional guidance on the information that is to be addressed in the preliminary cost estimate. The principal factors to be addressed are:

- Decommissioning option/method anticipated;
- Potential for known or suspected contamination of the facility or site;
- Low-level radioactive waste (LLW) disposition plan;
- Preliminary schedule of decommissioning activities; and
- Any other factors that could significantly affect the cost to decommission.

The cost estimate should provide costs for each of the following:

- Pre-decommissioning engineering and planning - decommissioning engineering and planning prior to completion of reactor defueling;
- Reactor deactivation - deactivation and radiological decontamination of plant systems to place the reactor into a safe, permanent shutdown condition;
- Safe storage - safe storage monitoring of the facility until dismantlement begins (if storage or monitoring of spent fuel is included in the cost estimate, it should be shown separately);

- Dismantlement - radiological decontamination and dismantlement of systems and structures required for license termination (if demolition of uncontaminated structures and site restoration activities are included in the cost estimate, they should be shown separately);
- LLW disposition - LLW packaging, transportation, vendor processing, and disposal; and
- Radiological Costs - separate the cost for radiological decommissioning from non-radiological costs.

4.0 EVALUATION

4.1 Evaluation of the Program to Manage and Provide Funding of all Irradiated Fuel

The licensee estimated the total costs associated with the long-term management of spent fuel at $328.7 million in 2007 dollars. The long-term management of the spent fuel for PNPS is divided in an initial storage of the fresh core as well as the most recent fuel cycles for 5.5 years following shutdown to provide the cooling for the final core and transfer to an ISFSI. After shut down, the first 18 months will be used for preparation of placing the plant and fuel into long-term storage. The next 5 to 6 years is a period during which the fuel will be transferred to the ISFSI. At the end of this period, the fuel will be stored in the ISFSI until the fuel is transferred to DOE and the licensee's estimated completion date of the fuel transfer to DOE is 2042. Following transfer of the fuel to DOE, decommissioning preparation will begin with decommissioning starting in 2044 and completed in 2048 and the license terminated. Following license termination, site restoration will begin and take approximately 24 months.

The $328.7 million estimate includes an estimated cost to isolate the spent fuel pool and supporting fuel handling system. The ISFSI estimated expenditures include the cost of $125.4 million for the dormancy period, 2012 - 2024, the capital cost for ISFSI construction, multi-purpose storage containers, packaging and handling and transfer from the pool to the ISFSI and from the ISFSI to DOE. In addition, a cost of $150.0 million has been estimated for maintaining the fuel in ISFSI from 2018 to 2042-approximately $6.4 million per year. The licensee has also estimated the cost to decommission the ISFSI at $4.7 million.

Entergy reaffirmed its commitment to seek licensee renewal for PNPS. If PNPS ceases operation in 2012, Entergy will be required to comply with existing NRC's licensing requirements, including the operation and maintenance of the systems and structures needed to support continued operation of the spent fuel pool. PNPS costs include the cost of constructing an ISFSI having storage capacity to store all spent fuel.

The NRC staff finds the spent fuel management program estimates to be reasonable based on a cost comparison with similar decommissioning reactors, while acknowledging the large uncertainties and potential site-specific variances.

The licensee reported that it had $582.6 million in the decommissioning trust fund (DTF) as of December 31, 2006. The staff applied a real rate of return of 1.471 percent identified in the licensee's July 31, 2008 submittal to project a future balance from assumed long-term earnings, and found that the DTF would provide sufficient funding to cover the cost of decommissioning and spent fuel management through 2050. In Pilgrim's July 31, 2008 submittal, Entergy acknowledged the necessity for an exemption in accordance with 10 CFR 50.12, from the requirements of 10 CFR 50.82(a)(8)(i)(A) in order to use the decommissioning trust funds for spent fuel management expenses, since the rule allows withdrawals for only decommissioning

as defined in 10 CFR 50.2. The NRC staff finds that the licensee's spent fuel management program addresses the principal areas related to the management and funding for the management of the spent fuel and preliminarily approves the PNPS's spent fuel management program conditioned upon the filing and granting of an exemption.

The NRC staff notes that the preceding analysis is based on a reported DTF balance that can fluctuate over time. Should there be a material decline in the DTF balance, the staff's analysis and preliminary findings may no longer be valid, and the licensee would be under an obligation under 10 CFR 50.9 to update the DTF balance as well as any changes in projected costs. The NRC staff would expect a licensee to update its spent fuel management program to provide any adverse material changes, in conjunction with the filing of the licensee's required report on the status of its decommissioning funding.

4.2 Evaluation of the Preliminary Decommissioning Cost Estimate

In Entergy's submittal dated July 31, 2008, entitled "Preliminary Decommissioning Cost Analysis for the Pilgrim Nuclear Power Station," the licensee estimated the total amount to decommission PNPS is $941.4 million (2007 dollars) and includes $549.8 million to cover the cost of radiological decommissioning, $328.7 million for spent fuel management, and $35.9 million for site restoration.

Before starting the detailed review of the decommissioning cost estimate, the staff reviewed Entergy's estimate to confirm that radiological and non-radiological decommissioning costs were separated and the support systems/structures necessary to support the safe operation had been identified in the estimate. The validity of the cost estimate is based on a reasonable estimate of the cost to decommission the supporting systems and structures, as well as the cost of disposal of the low-level waste (LLW). The staff also confirmed the licensee reviewed the 10 CFR 50.75(g) records, and the licensee's records did not indicate any areas of significant soil, groundwater, or soil contamination.

The licensee has divided the estimated total radiological cost of $549.8 million into the following principal categories: radioactive component removal, decontamination and dismantlement, packaging, management and engineering (staffing) support, low-level waste disposal, and administrative costs. In addition, the licensee has included a time line and annual cost projection that identifies when these activities will take place, and the cost associated with each of these items. The cost estimate developed for PNPS applied an average weighted contingency factor for the major activities of 17.3 percent. The contingency factors were as high as 75 percent for reactor segmentation, and 50 percent for decontamination.

In addition, the staff reviewed the work difficulty factors used for the TLG Services, Inc. (TLG) cost estimate and found they were reasonable. The staff reviewed Appendix A and Appendix B of TLG's cost estimate which listed the unit cost factors that were used to develop the decommissioning cost and concluded the unit cost factors were consistent with other cost estimates and in a reasonable range. The staff also recognizes that a significant uncertainty exists regarding the low-level waste disposal cost due to Barnwell no longer accepting waste from Non-Atlantic Compact members.

The staff finds the preliminary cost estimate to decommission PNPS is not unreasonable.

5.0 CONCLUSION

The NRC staff finds that PNPS's program for the long-term storage of spent fuel and the preliminary cost estimate for PNPS is adequate and provides sufficient details associated with the funding mechanisms. The staff, therefore, concludes that the PNPS spent fuel management program complies with 10 CFR 50.54(bb) and approves the program on a preliminary basis. In addition, the staff finds that the preliminary decommissioning cost estimate pursuant to 10 CFR 50.75(f)(3) for PNPS is not unreasonable.

Principal Contributor: Larry Pittglio

Date: January 7, 2009

January 7, 2009

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

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Sincerely,

/RA/
James Kim, Project Manager
Plant Licensing Branch I-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-273

Enclosure:
Safety Evaluation

cc w/encl: Distribution via ListServ

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