

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO THE IRRADIATED FUEL MANAGEMENT PROGRAM AND
PRELIMINARY DECOMMISSIONING COST ESTIMATE
FOR KEWAUNEE POWER STATION (KPS)

DOCKET NO. 50-305

1.0 INTRODUCTION

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.54(bb), licensees for nuclear power plants that are within 5 years of expiration of their operating license must submit an irradiated 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 irradiated fuel until the fuel is transferred to the Department of Energy (DOE) for permanent disposal. In the same time period, the licensee is also required by 10 CFR 50.75(f)(3) 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.

By letter dated December 19, 2008 (Agencywide Document Access and Management System (ADAMS) Accession No. ML083540651), Dominion Energy Kewaunee, Inc. (DEK) submitted its "Irradiated Fuel Management Plan" and on December 18, 2008 (ADAMS Accession NO. ML090300120), submitted its "Preliminary Decommissioning Cost Estimates for Kewaunee Power Station." By letter dated July 1, 2009 (ADAMS Accession NO. ML091880773), DEK transmitted supplemental information. The following sections document the NRC staff's findings resulting from the review of these submittals.

2.0 BACKGROUND

KPS is a nuclear powered electrical generating facility consisting of one pressurized water reactor (PWR) located in east central Wisconsin on the west shore of Lake Michigan about 30 miles east-southeast of Green Bay, and about 90 miles north-northeast of Milwaukee. The plant site comprises approximately 908 acres. The power plant is a two-loop Westinghouse nuclear steam supply system and a Westinghouse turbine generator. The construction permit was issued for an initial reactor power of 1,650 MWt with an ultimate rating of 1,721.4 MWt. In 2003 a measurement uncertainty recapture power rating was performed that increased the licensed rated power from 1,650 MWt to 1,673 MWt. In 2004, an uprate was performed that increased the licensed rated power from 1,673 MWt to 1,772 MWt. The current operating license expiration date is December 21, 2013.

The facility has an existing Independent Spent Fuel Storage Installation (ISFSI). DEK's schedule estimates transfer of spent fuel into MPCs beginning in 2009 in order to maintain full-core offload capacity in the spent fuel pool.

ENCLOSURE

The licensee's study assumes that an ISFSI of sufficient capacity is constructed prior to shutdown and will be licensed under the the 10 CFR Part 72 general license.

3.0 REGULATORY EVALUATION

3.1 Regulatory Requirement (10 CFR 50.54(bb))

The requirements at 10 CFR 50.54(bb) stipulates:

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 to Support the 10 CFR 50.54(bb) Review

For the NRC staff 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. For the DECON option (as described on page viii of xv of Attachment 1 of the August 8, 2008, submittal), the cost to isolate the spent fuel pool and fuel handling systems may be considered part of the preparation for DECON;
- 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 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; and
- Brief discussion of the selected storage method or methods, and the estimated time for these activities.

3.2 Regulatory Requirement (10 CFR 50.75(f)(3) and (f)(5))

The requirements at 10 CFR 50.75(f)(3) stipulate that:

Each power reactor 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.

The requirements at Section 50.75(f)(5) stipulate that:

If necessary, the cost estimate, for power and non-power reactors, shall also include plans for adjusting levels of funds assured for decommissioning to demonstrate that a reasonable level of assurance will be provided that funds will be available when needed to cover the cost of decommissioning.

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

NUREG-1713, "Standard Review Plan for Decommissioning Cost Estimates for Nuclear Power Reactors," Section C1, 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); and
- LLW disposition - LLW packaging, transportation, vendor processing, and disposal.

4.0 TECHNICAL EVALUATION

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

As required by 10 CFR 50.54(bb), the licensee estimated the costs associated with the long-term management of spent fuel at \$322.4 million (note: all dollar values identified in this evaluation are indicated in 2008 dollars). The long-term management of the spent fuel for Kewaunee is divided between an initial storage of the fresh core, as well as the most recent fuel cycles following shutdown to provide the cooling for the final core and transfer to an ISFSI. The licensee estimates that the spent fuel pool will remain operational for an estimated 7 years. After shut down, the first 15 months will be used for isolation of the spent fuel pool and supporting fuel handling systems at a total estimated cost of \$22.8 million. The next period has

an estimated duration of approximately 6 years and a total estimated cost of approximately \$119.0 million, which includes transferring the fuel to the ISFSI. Following this period, the fuel will be stored in the ISFSI for an estimated 30 years until the fuel is transferred to the DOE in 2050. The licensee estimated that completion of the fuel transfer to the DOE in 2050, and estimated the total annual cost associated with dry storage for the period from 2031 to 2050 at \$174.0 million. The licensee stated that, following transfer of the fuel to the DOE, the ISFSI will be decontaminated and dismantled, and that will take approximately 4/5 months at an estimated cost of \$6.2 million.

The licensee reaffirmed its commitment to seek license renewal for Kewaunee. If Kewaunee ceases operation in 2013 when the current license expires, the licensee has committed to comply with existing licensing requirements, including the operation and maintenance of the systems and structures needed to support continued operation of the spent fuel pool. The licensee's costs also include the cost of expanding the ISFSI to have sufficient storage capacity to store all spent fuel.

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

As of July 1, 2009, the DEK has a parent company guarantee in place that commits \$60.0 million to be available upon permanent cessation of operations in 2013, and an additional parent company guarantee in the amount of \$171.1 million that would be available in 2016. DEK has estimated that an additional \$200.0 million will be available in 2026 following completion of decommissioning, if needed. The licensee applied a real rate of return of 2.0 percent.

In summary, the DEK estimated that the total costs associated with the long-term management of spent fuel will be \$322.0 million. This estimate is based on the transfer of fuel to DOE to be completed in 2050, with decommissioning of the ISFSI to be completed in 2060. The spent fuel management and funding program estimated the cost for the storage, security, and insurance to store the fuel, the cost to purchase, load, and transfer the fuel storage canisters, as well as the decommissioning cost of the ISFSI. The total funds contributed and the supplemental funds following completion of decommissioning of Kewaunee in 2026 will cover the \$322.0 million estimated cost for spent fuel management.

The NRC staff finds that the licensee's spent fuel program addresses the principal areas related to the management and funding of the spent fuel, and preliminarily approves DEK's spent fuel management program.

4.2 Evaluation of the Preliminary Decommissioning Cost Estimate

The licensee estimated the total decommissioning cost of Kewaunee to be approximately \$380.6 million in 2008 dollars. The licensee has elected immediate dismantlement although the licensee has stated that, before transferring all spent fuel post-shutdown, the fuel will be required to remain in the spent fuel pool for 6/7 years to decrease the heat loading before transferring the fuel to the ISFSI.

Prior to starting the detailed review of the cost estimate, the NRC staff reviewed the estimate to confirm the supporting systems/structures necessary to support 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 confirming that all of the major equipment necessary to support operation was included.

The licensee has divided the estimated total cost of \$380.6 million into the following principal categories/activities: decommissioning planning; post-shutdown modifications and preparations; major component removal; building decontamination; removal of the fuel from the pool; and completing the balance of decontamination and completing the final survey. In addition, the licensee included a time line and annual cost projection that identifies when these activities will take place, and the costs associated with each of these items. The duration of the DECON period is estimated to be approximately 8 years.

The Energy Solutions cost estimate developed for Kewaunee identified contingency factors for the major activities that range from 15 percent to as high as 75 percent for an activity. The NRC staff also reviewed Appendix A – F, which identified the systems and structures requiring cleanup, identified spent fuel shipping estimated dates, provided detailed project schedules, listed the annual cash flows, and provided a detailed break out of the annual cash flows. The NRC staff concluded that the supporting components, projected schedules and supporting costs are consistent with other cost estimates and in a reasonable range.

The NRC staff also recognized that a significant uncertainty exists regarding the low-level waste disposal cost since Barnwell no longer accepts waste from Non-Atlantic Compact members. The NRC staff concluded that the waste volume estimates were in a reasonable range.

For disposal cost estimating purposes, the disposal rate is reasonably based on the mix of waste and the available disposal options. However, when new disposal facilities become available, or if the South Carolina disposal site reopens to members outside its compact, disposal rates will likely be significantly higher. In addition, the DTF balance could be subject to decline, at least in the short run. The licensee's decommissioning cost analysis was based on the DTF balance for radiological decommissioning of \$370.0 million as of December 31, 2008. The NRC staff allowed an earnings credit, as stated by the licensee, thru the DECON period, approximately 8 years, and deducted the annual DECON expenses. If there is change in the DTF balance that materially impacts the licensee's cost analysis, or if new disposal rates are significantly higher, given these considerations, the licensee would be under an obligation under 10 CFR 50.9 to update any changes in the projected cost or available funds.

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

5.0 CONCLUSION

The NRC staff finds that DEK's program for the long-term storage of spent fuel and the preliminary cost estimate for Kewaunee are adequate and provide sufficient details associated with the funding mechanisms. The NRC staff, therefore, concludes that the licensee's spent fuel management program for Kewaunee complies with 10 CFR 50.54(bb) and approves the

program on a preliminary basis. In addition, the NRC staff finds that the preliminary cost estimate for Kewaunee complies with the requirements of 10 CFR 50.75(f)(3), and that the preliminary cost estimate for Kewaunee is not unreasonable.

However, if there are changes in the DTF balance that materially impact the licensee's cost analysis, or if new disposal rates are significantly higher, given these considerations, the licensee would be under an obligation per 10 CFR 50.9 to update any changes in projected cost, or available funds.

Principal Contributor: Clayton L. Pittiglio

Date:

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