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

July 6, 2016

Mr. Bryan C. Hanson
President and Chief Nuclear Officer
Exelon Generation Company, LLC
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: OYSTER CREEK NUCLEAR GENERATING STATION - SAFETY EVALUATION RE: PRELIMINARY DECOMMISSIONING COST ESTIMATE AND IRRADIATED FUEL MANAGEMENT PROGRAM (CAC NO. MF5577)

Dear Mr. Hanson:

The U.S. Nuclear Regulatory Commission (NRC) staff has completed reviewing the submittal dated December 30, 2014,[1] by Exelon Generation Company, LLC (Exelon or the licensee), as supplemented by letter dated April 5, 2016.[2] In accordance with Title 10 of the *Code of Federal Regulations* (10 CFR), Sections 50.75(f)(3) and 50.54(bb), the licensee provided a preliminary decommissioning cost estimate and provided, for NRC review and approval, an irradiated fuel management plan for the Oyster Creek Nuclear Generating Station (OCNGS).

By letter dated January 7, 2011[3], and as required by 10 CFR 50.82(a)(1)(i) and 10 CFR 50.4(b)(8), Exelon certified to the NRC its intent to permanently cease power operations at OCNGS on December 31, 2019. Accordingly, information provided by the licensee in its December 30, 2014, submittal, responds to NRC notification and reporting requirements for licensees 5 years prior to permanent cessation of power operations.

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1 Agencywide Documents Access and Management System (ADAMS) Accession No. ML14365A067
2 ADAMS Accession No. ML16096A397
3 ADAMS Accession No. ML110070507

Details of the staff's review are delineated in the enclosed safety evaluation.

Sincerely,

John G. Lamb, Senior Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-219

Enclosure:
Safety Evaluation

cc w/enclosure: Distribution via Listserv

UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO PRELIMINARY DECOMMISSIONING COST ESTIMATE AND

IRRADIATED FUEL MANAGEMENT PLAN

EXELON GENERATION COMPANY, LLC

OYSTER CREEK NUCLEAR GENERATING STATION

DOCKET NO. 50-219

1.0 INTRODUCTION

By letter dated December 30, 2014,[1] as supplemented by letter dated April 5, 2016,[2] Exelon Generation Company, LLC (Exelon or the licensee) provided to the U.S. Nuclear Regulatory Commission (NRC) a preliminary decommissioning cost estimate (PDCE) pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.75(f)(3), and an Irradiated Fuel Management Plan (IFMP) pursuant to 10 CFR, Section 50.54(bb), for the Oyster Creek Nuclear Generating Station (OCNGS). By letter dated January 7, 2011,[3] and as required by 10 CFR 50.82(a)(1)(i) and 10 CFR 50.4(b)(8), Exelon certified to the NRC its intent to permanently cease power operations at OCNGS on December 31, 2019. Accordingly, information provided by the licensee in its December 30, 2014, submittal, responds to NRC notification and reporting requirements for licensees 5 years prior to permanent cessation of power operations.

2.0 BACKGROUND

As described in the PDCE, OCNGS is located about 50 miles east of Philadelphia, Pennsylvania, and 60 miles south of Newark, New Jersey. The reactor site is comprised of a single reactor and is authorized to operate at a maximum thermal power level of about 1,930 megawatts thermal (MWt). OCNGS received its operating license on December 1, 1969, and was designed and constructed by the General Electric Company, Atomic Power Equipment Department. The reactor is a single-cycle, forced circulation boiling water reactor. The OCNGS reactor site also houses an independent spent fuel storage installation (ISFSI).

On April 9, 1969, the Atomic Energy Commission issued a provisional operating license to OCNGS. On July 2, 1991, the NRC issued a full-term operating license to OCNGS, with a license expiration date based on the issuance of the provisional operating license. Thus, the

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[1] Agencywide Documents Access and Management System (ADAMS) Accession No. ML14365A067
[2] ADAMS Accession No. ML16096A397
[3] ADAMS Accession No. ML110070507

OCNGS license was originally set to expire on April 8, 2009. In anticipation of the 2009 license termination date, the licensee submitted a PDCE on April 14, 2004,[4] along with two supplementary submissions[5] later that year, including information on its IFMP. The NRC staff reviewed this information and communicated the results of its analysis by letter dated March 25, 2005,[6] concluding:

> The NRC staff finds that the AmerGen [an Exelon Company] program for the long-term storage of spent fuel and the preliminary cost estimate for OCNGS are adequate, and that AmerGen has provided sufficient details associated with the funding mechanisms. The staff, therefore, concludes that AmerGen's spent fuel management program for OCNGS complies with 10 CFR 50.54(bb) and approves the program on a preliminary basis.

On April 8, 2009,[7] the OCNGS license was renewed for twenty years with an April 9, 2029, expiration date. On December 9, 2010, Exelon and the New Jersey Department of Environmental Protection executed an administrative consent order (ACO). Under the terms of that ACO, the licensee agreed to permanently cease operations at OCNGS no later than December 31, 2019.

3.0 REGULATORY EVALUATION

3.1 Regulatory Requirements

The regulatory requirements and guidance that the NRC staff considered in its review are provided below.

- NRC requirement 10 CFR 50.2, "Definitions," states:

  > Decommission means to remove a facility or site safely from service and reduce residual radioactivity to a level that permits –
  >
  > (1) Release of the property for unrestricted use and termination of the license; or
  >
  > (2) Release of the property under restricted conditions and termination of the license.

- NRC requirement 10 CFR 50.54, "Conditions of licenses," paragraph (bb) states, in part:

  > For nuclear power reactors licensed by the NRC, the licensee shall, within 2 years following permanent cessation of operation of the reactor or

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[4] ADAMS Accession No. ML041130434, April 14, 2004, entitled, "Submittal of Preliminary Decommissioning Cost Estimate"

[5] June 24, 2004, entitled, "Submittal of Preliminary Decommissioning Cost Estimate" (ADAMS Accession No. ML041840125); October 29, 2004, entitled, "Submittal of Spent Fuel Management Plan" (ADAMS Accession No. ML043060471)

[6] ADAMS Accession No. ML050550242

[7] ADAMS Accession No. ML080380105

> 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 [spent fuel management plan or IFMP] 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.

- NRC requirement 10 CFR 50.75, "Reporting and recordkeeping for decommissioning planning," paragraph (f)(3) states:

> 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.

- NRC requirement 10 CFR 50.75(f)(5) states:

> 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.

- The plans for adjusting levels of funds described in 10 CFR 50.75(f)(5) is considered to be "necessary" when the situation in 10 CFR 50.82(a)(8)(iv) applies:

> For decommissioning activities that delay completion of decommissioning by including a period of storage or surveillance, the licensee shall provide a means of adjusting cost estimates and associated funding levels over the storage or surveillance period.

3.2 Regulatory Guidance Criteria for the PDCE Review

NRC NUREG-1713, "Standard Review Plan for Decommissioning Cost Estimates for Nuclear Power Reactors, Final Report," Section C.1, "Preliminary Cost Estimate," December 2004, provides guidance on the information to be addressed in the PDCE. The acceptance criteria outlined in Section C.1.3 provide that:

- The PDCE should be compared to the minimum required decommissioning funding amount required under 50.75(c) to ensure that the licensee's submittal meets the intent of the regulations given in 10 CFR 50.75, "Reporting and recordkeeping for decommissioning planning," and

- The PDCE should include an up-to-date listing of the major factors that could affect the cost to decommission and indicate that the licensee assessed these factors. The major factors considered by the NRC staff include:

- The decommissioning option/method anticipated to be used,
- The potential for known or suspected contamination of the facility or site to affect the cost of decommissioning,
- The low-level-waste disposition plan,
- The preliminary schedule of decommissioning activities, and
- Any other factors that could significantly affect the cost to decommission

As instructed by NUREG-1713 guidance, the NRC staff should review the PDCE to determine if it is sufficiently detailed to allow an assessment of the PDCE's adequacy. To make this assessment, the NRC staff should also confirm that the PDCE is provided in current year (estimate year) dollars and that the PDCE accounts for the entire decommissioning work scope.

The NRC staff should confirm that the PDCE provided costs for each of the following, or similar, major decommissioning phases:

- Pre-decommissioning engineering and planning (i.e., engineering and planning, prior to completion of reactor defueling),
- Reactor (plant systems) deactivation to place the reactor into a safe, permanent shutdown condition,
- Safe storage monitoring of the facility until dismantlement begins (separately showing any cost for spent fuel monitoring and storage separately),
- Dismantlement of systems and structures required for license termination (separately showing any cost for demolishing uncontaminated structures), and
- Low-level radioactive waste (LLW) disposition (packaging, transportation, vendor processing, and disposal)

NRC NUREG-1307, Revision 15, "Report on Waste Burial Charges: Changes in Decommissioning Waste Disposal Costs at Low-Level Waste Burial Facilities, Final Report," provides guidance on how licensees are to calculate the NRC minimum decommissioning formula fund amount, and is the appropriate source for obtaining the adjustment factor for waste burial/disposition costs. The NRC staff assesses the PDCE against the NRC minimum decommissioning formula fund amount to determine whether the PDCE is greater than or equal to the NRC minimum decommissioning formula fund amount.

Finally, the NRC staff should examine the amount of funds in the OCNGS decommissioning trust and plans included by the licensee for adjusting levels of funds assured for decommissioning. The NRC staff analysis should consider the site-specific decommissioning costs provided in Exelon's PDCE to demonstrate that adequate funding to decommission OCNGS is available. The NRC staff analysis may include a calculation of the ending balance over the permitted 60-year decommissioning period to determine if sufficient funding exists.

3.3 Regulatory Criteria for the IFMP Review

For the NRC staff to evaluate and provide preliminary approval of the spent fuel management and funding program, the submittal should address the criteria used in prior IFMP reviews of other 10 CFR Part 50 facilities, such as those performed for the

San Onofre Nuclear Generating Station, Units 2 and 3[8] and for Vermont Yankee Nuclear Power Station[9]. The principle factors to be addressed are:

- Estimated cost to isolate the spent fuel pool and fuel handling systems. For the decontamination (DECON) option, 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 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; and
- Brief discussion of the selected storage method or methods, and the estimated time for these activities.

4.0 TECHNICAL EVALUATION

The PDCE for OCNGS was prepared by TLG Services, Inc. (TLG), a company that provides support services for commercial nuclear power plant decommissioning projects. The PDCE relies upon site-specific information that was developed in 1999 and updated in 2004, 2009, and 2011. Exelon's current PDCE presents financial amounts in 2011 dollars, and, as required by 10 CFR 50.75(b)(2), the licensee provided attachments to the PDCE which escalate its 2011 cost and funding level figures to the current year (2014).

In reviewing the licensee's submittal, the NRC staff determined that additional information was required to enable the staff to make an independent assessment of the PDCE. The NRC staff issued a request for additional information (RAI) by letter dated March 7, 2016.[10] Exelon submitted further information about the PDCE in its supplemental response dated April 5, 2016.

In its RAI response, the licensee explained that the approach to increase costs to current year dollars included the use of actual escalation indices to adjust major cost components in the 2011 decommissioning cost estimate, including labor, equipment and material, energy, low-level waste disposal, and other cost components. Adjustments to the cost estimate also include slight increases reflected in the Consumer Price Index for 2014.

4.1 Comparison to NRC Minimum Decommissioning Formula Fund Amount

The regulations in 10 CFR 50.75 establish requirements for a licensee to indicate how it will provide reasonable assurance that funds will be available for the decommissioning process. Specifically, 10 CFR 50.75(c)(1) provides a table of minimum amounts (in 1986 dollars, the "base year") required to demonstrate reasonable assurance of funds for decommissioning by reactor type and power level. As defined in 10 CFR 50.2, amounts are based on activities related to the definition of "decommission," and do not include the cost of removal and disposal

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[8] ADAMS Accession No. ML15182A256
[9] ADAMS Accession No. ML15274A379
[10] ADAMS Accession No. ML16060A172

of spent fuel or nonradioactive structures and materials beyond that necessary to terminate the license.

Pursuant to 10 CFR 50.75(b)(2), nuclear power reactor licensees are also required to annually adjust the estimated decommissioning costs of their nuclear facilities to account for inflation from 1986 to the current year. The algorithm described in 10 CFR 50.75(c)(2) provides a weighted average that considers the cost of labor, energy, and nuclear waste burial costs. An adjustment factor at least equal to .65L + .13E + .22B is to be used where the variables "L," "E," and "B," are defined as escalation factors for labor, energy, and waste burial/disposal costs, respectively. The labor and energy variables may be taken from national producer price and consumer price indexes, as well as local conditions for a given site. A detailed discussion, and examples of how to calculate the NRC minimum decommissioning formula fund amount and the escalation factors, are presented in NUREG-1713 and NUREG-1307.

Pursuant to 50.75(b)(1), a licensee is allowed to provide a site-specific cost estimate amount in lieu of the NRC minimum decommissioning formula fund amount if two requirements are met: (1) the site-specific cost estimate is greater than the NRC minimum decommissioning formula fund amount (as described above) and (2) the estimate is adjusted by using a rate that is at least equal to the adjustment factor (as described above).

Using the algorithm in 10 CFR 50.75(c), as described above, and the methodology provided in NUREG-1713 and NUREG-1307, the NRC staff independently calculated the 2014 minimum decommissioning financial assurance formula amount to be $623,608,000. Exelon opted to provide a site-specific amount in lieu of using the minimum decommissioning financial assurance amount. As reported in Attachment 3 of the PDCE, "Annual SAFSTOR Decommissioning Fund Cash Flow for OCNGS," the 2014 radiological site-specific decommissioning cost estimate is $934,208,000.

In conclusion, and based on the NRC staff assessment, the OCNGS PDCE amount is greater than the NRC minimum decommissioning formula fund amount. Therefore, the NRC staff finds that the PDCE amount conforms to the guidance in NUREG-1713 and meets the regulations in 10 CFR 50.75.

4.2 Assessment of Major Factors that Could Affect the PDCE

Through TLG, the licensee indicated that it assessed each of the major factors referenced below that could affect the cost to decommission. These factors include the licensee's choice of decommissioning method, potential contamination issues and their extent, LLW disposal considerations, decommissioning schedules, and other potentially significant factors.

4.2.1 *Decommissioning Method Utilized*

NRC NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," evaluated the environmental impacts of three methods for decommissioning a nuclear power plant: (1) DECON (this method decontaminates and dismantles the reactor site to a level that permits unrestricted release shortly after cessation of operations); (2) SAFSTOR (this method places the reactor site in a safe and stable long-term storage state followed by subsequent decontamination and dismantlement, or performs some incremental decontamination and dismantlement activities before, or during, the storage period); and (3)

ENTOMB (this method encases the radioactive contaminants in a structurally long-lived material, such as concrete). The NRC staff also recognizes that some combination of these methods may also be acceptable. The choice of decommissioning option is left to the licensee, provided that the method of decommissioning can be performed according to the NRC's regulations. Finally, as required by 10 CFR 50.82(a)(3), unless a licensee receives permission to the contrary, the reactor site must be decommissioned within 60 years after the permanent cessation of operations.

Exelon has not decided on a final method to decommission OCNGS but based its estimate on the SAFSTOR method of decommissioning for the purpose of meeting the NRC's regulatory requirements. As such, the NRC staff limited its review to the applicable SAFSTOR segments of the PDCE. Should the licensee change its method of decommissioning, another review will need to be conducted to ensure the chosen method complies with the regulations.

4.2.2 *Potential Contamination Factors Affecting the Cost of Decommissioning*

Although the requirements described in 10 CFR 50.75(g) for keeping records of spills or other unusual occurrences are outside the scope of this review, the NRC staff considered Exelon's evaluation of the anticipated extent of contamination to reactor site based on information presented in the PDCE. The PDCE cover letter identified soil and ground water contamination based on a report that evaluated the known or suspected contaminated soil at OCNGS as of January 2004 and the evaluation of subsequent 10 CFR 50.75(g)(1) required reports. In addition, Appendix E of the submittal, "Detailed Cost Analysis – SAFSTOR," does identify "contaminated soil removal" costs.

Of note, the PDCE states that cost elements in the estimates are based on ideal conditions, and therefore, the types of unforeseeable events that are almost certain to occur in decommissioning are addressed through a contingency applied on a line-item basis. Inclusion of contingency considerations is necessary to provide assurance that sufficient funding will be available to accomplish the intended tasks. These contingencies are considered in Section 3, "Cost Estimate," of the submittal. TLG applies contingency values ranging from 10 percent to 75 percent.

4.2.3 *Low-Level Waste Disposition Plan*

NRC regulations define a LLW classification system that is based on potential hazards and specified disposal and waste requirements for each of the general classes of waste: "A," "B," and "C." The classifications are based on the key radionuclide material that is present in the waste and their half-lives. Tables defining the classes of waste can be found in 10 CFR 61.55, "Waste classification." In general, requirements for waste form, stability, and disposal methods become more stringent from Class A to Class C. Another waste category, Greater-Than-Class-C waste (GTCC), exceeds the concentration limits in 10 CFR 61.55 and is generally unsuitable for near-surface disposal as LLW, even though it is legally defined as LLW. The NRC's regulations in 10 CFR 61.55(a)(2)(iv) require this type of waste to be disposed of in a geologic repository, unless the NRC grants approval for an alternative disposal method. The regulations in 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste," allow for storage of GTCC that is generated at a reactor site.

The PDCE provides a description of Exelon's LLW disposal plans. Appendix E of the submittal provides a line item list of radioactive waste forecast to be generated during decommissioning activities. In addition, Table 5.3 of the submittal, "Decommissioning Waste Summary – SAFSTOR)," provides volumetric measurements (in cubic feet; ft^3) of the total waste forecast to be generated at OCNGS. TLG reports that OCNGS will produce a total of approximately 318,000 ft^3 of waste as reflected in the following breakdown: Class "A" waste – 314,989 ft^3; Class "B" waste – 1,127 ft^3; Class "C" waste – 344 ft^3; and GTCC waste – 1,428 ft^3.

In its submittal, the licensee assumes that it will have access to EnergySolutions' Barnwell Low-Level Radioactive Waste Management Facility (located in Barnwell, South Carolina) and EnergySolutions' Clive Operations Facility (located in Clive, Utah) to dispose of radiological waste. As such, disposal fees were calculated using current disposal agreements. As described in the paragraph above, the majority of the material generated from the decontamination and dismantling activities is considered to be LLW (Class "A" waste). Exelon states it will perform LLW volume reduction for material that requires disposal at an LLW disposal facility resulting in reduction of LLW for disposal by 470,956 cubic feet of material. GTCC material will be packaged in the same spent-fuel canisters used for spent-fuel storage and assumed to be disposed of in a manner similar to that envisioned for spent fuel.

4.2.4 *Preliminary Schedule of Decommissioning Activities*

Exelon provided a preliminary schedule that describes decommissioning activities related to the SAFSTOR method of decommissioning. Exelon's decommissioning timeline includes four phases of license termination activities and one phase of site restoration activity, all with projected timeframes: (1) transition and preparations phase (2019 - 2021), (2) dormancy phase (2021 – 2075), (3) delayed preparations phase (2075 – 2076), (4) decommissioning phase (2076 – 2079), and (5) site restoration phase (2079 – 2081). Although the detailed decommissioning activities listed within the PDCE are titled differently than the major decommissioning phases cited in NUREG-1713, they achieve the same result of decommissioning OCNGS. These phases are further considered in Section 4.3 of this review, "Decommissioning Work Scope."

4.2.5 *Additional Factors that Could Significantly Affect the Cost to Decommission*

In preparation of the PDCE, TLG considered other potential factors that could significantly affect the cost of decommissioning. For example, the licensee intends to expand the existing ISFSI. The PDCE assumes that the ISFSI facility can be expanded to support decommissioning operations. In addition, the spent fuel is expected to be transferred from wet storage to dry storage within the first 5 ½ years following shutdown. Any delay in construction of the ISFSI or in the transfer of fuel from wet storage to dry storage may affect the cost of decommissioning. The PDCE also assumes that the ISFSI will operate from the time of final shutdown until the scheduled end date of fuel removal by the Department of Energy (DOE). TLG notes that the completion of the decommissioning process is entirely dependent on DOE's ability to remove spent fuel from the site in a timely manner. Any delay in removing the fuel from the reactor site may affect the cost of decommissioning.

TLG states that the cost estimate for OCNGS reflects a savings that is achieved from its efforts to reduce waste volume required to be disposed of at a licensed LLW disposal facility. The

reduction in the volume of LLW requiring disposal at an LLW disposal facility is speculative and may alter the cost to decommission the reactor site.

Finally, TLG also notes that the GTCC waste generated from operations is assumed to be packaged and disposed of as high-level waste, and at a cost equivalent to that envisioned for spent fuel. Any change in policy to this assumption may affect the cost to decommission OCNGS.

4.2.6 *Staff Conclusion*

In its submission, the licensee addressed all of the factors that could affect the PDCE as identified in NRC guidance. Based on its independent review of this information, the NRC staff concludes that the licensee has adequately assessed the major factors that could affect the PDCE.

4.3 Decommissioning Work Scope

In addition to the major factors that could affect the cost to decommission, the NRC staff reviewed the PDCE to confirm that costs were represented in current year (estimate year) dollars, that it accounted for the entire decommissioning work scope, and that it included costs for all activities in each of its five major decommissioning phases identified in Figure 4.4 of the PDCE, "Decommissioning Timeline: SAFSTOR." The five phases presented in Figure 4.4 are provided in lieu of the major decommissioning phases provided by NUREG-1713 and Section 3.2 of this review.

Table 6-3 of the submittal, "Summary of Decommissioning Cost Elements – SAFSTOR," provides a general overview of the cost summary. A detailed work breakdown for all the activities to be performed during decommissioning is provided in the PDCE and is located in Appendix E of the submittal. As stated in the PDCE, the licensee estimates OCNGS total decommissioning costs to be $1,193,450 (in thousands of 2014 dollars), with the following allocations (in thousands of 2014 dollars): $934,208 for radiological decommissioning, license termination, and completion of related reports; $195,770 for spent fuel management and ISFSI decommissioning costs; and $63,471 for site restoration. As provided in the PDCE, a brief summary of each major decommissioning phase follows.

4.3.1 *Transition and Preparations Phase*

The first phase is the "transition and preparations phase," which includes preparations to transition the reactor site from an operating state to long-term storage. Preparations include, but are not limited to, the planning for permanent defueling of the reactor; revision of technical specifications applicable to the operating conditions and requirements; a characterization of the facility and major components; and the development of the post-shutdown decommissioning activities report, which is the licensee's plan that outlines its decommissioning activities, expected timetables, and financial obligations.

Existing operational technical specifications are reviewed and modified to reflect plant conditions and the safety concerns associated with permanent cessation of operations. After the final plant shutdown, and in preparation for long-term storage activities, multiple activities are initiated, including, but not limited to, isolation of the spent fuel storage services and fuel

handling systems, draining and de-energizing of the non-contaminated systems not required to support continued site operations or maintenance, securing all access to radioactive or contaminated areas, and installing security and surveillance monitoring equipment.

4.3.2 *Dormancy Phase*

The second phase is the "dormancy phase," which places the reactor site into safe-storage to allow radioactive material time to decay. Dormancy activities include, but are not limited to, security, routine maintenance and radiological inspections of contaminated structures, maintenance of structural integrity, interim site and environmental characterization surveys, and transfer of spent fuel to the DOE.

4.3.3 *Delayed Preparations*

The third phase is the "delayed preparations phase," where preparations are undertaken to reactivate site services and prepare for the upcoming decommissioning phase. Preparation activities include, but are not limited to, engineering and planning; a detailed site characterization; the assembly of a decommissioning management organization and infrastructure; and the development of a license termination plan (LTP), which is the licensee's site-specific plan to terminate its license. The LTP should include a site characterization; identification of the remaining dismantling activities; plans for site remediation; detailed plans for the final radiation survey; a description of the end use of the site, if restricted; an updated site-specific cost estimate of the remaining decommissioning costs; and a supplement to the environmental report.

4.3.4 *Decommissioning Phase*

The fourth period is the "decommissioning phase," which includes the physical decommissioning activities associated with the removal and disposal of contaminated infrastructure. Decommissioning activities include, but are not limited to, construction or modification of infrastructure to facilitate decommissioning, dismantlement of site components, and decontamination (LLW disposition).

4.3.5 *Site Restoration Phase*

The fifth and final phase identified by TLG is the "site restoration phase," which begins after decommissioning operations have ceased, the NRC license has been terminated, and the release of the property for unrestricted use has been granted by the NRC. This period includes activities such as dismantlement of the site facilities, removal of top soil to a nominal depth of 3 feet below grade, removal of excess materials, and filling of all backfill voids.

4.3.6 *Staff Conclusion*

In its submission, the licensee addressed in sufficient detail the entire scope of work required to complete decommissioning OCNGS as identified in NRC guidance, and has evaluated costs associated with all phases of decommissioning OCNGS. Based on its independent review of this information, the NRC staff concludes that the licensee has adequately addressed and evaluated the scope of work and costs associated with all phases of decommissioning OCNGS.

4.4 Analysis of the Funds Available to Decommission OCNGS

In addition to the elements discussed in Sections 3 and 4 of this review, the NRC staff considered the adequacy of available funding to safely decommission OCNGS. The NRC staff's yearly closing balance calculations (discussed below) can be found in Attachment 1 of this review, "OCNGS Closing Balance Calculations." The NRC staff used the annual costs for license termination activities found in the PDCE (Attachment 3) to calculate a positive ending balance of its trust fund at the end of the projected decommissioning schedule (2079) to determine that there is sufficient funding to decommission OCNGS. In order to attain the most conservative estimate possible, the NRC staff only considered the lowest estimated funding levels, and the highest estimated costs, throughout its analysis.

In the PDCE's cover letter, the licensee stated that the reported trust fund balance as of November 30, 2014, was $869,900,000. The NRC staff notes that the balance reported to the NRC to meet the biennial reporting requirements of 10 CFR 50.75(f)(2), as of December 31, 2014, was $861,564,000. In this assessment, the NRC staff evaluated the lesser of the two values to determine if adequate funding was currently provided by the licensee to cover the decommissioning costs reflected in the PDCE.

In order to determine that adequate funds would be available, the NRC staff needed to forecast a December 2019 starting balance (the date Exelon intends to permanently cease power operations and enter into decommissioning at OCNGS) for decommissioning trust funds held by the OCNGS decommissioning trust fund and reported to the NRC as of December 31, 2014. Accordingly, the NRC staff escalated the December 31, 2014, biennial funding amount figure reported by the licensee, into December 2019 dollars; the NRC staff escalated the reported $861,564,000 trust fund balance (2014 dollars) to December 2019 dollars, resulting in an initial, December 2019, balance of $951,236,000. This projected fund forecast assumes a 2 percent annual return on the December 31, 2014, trust fund balance of $861,564,000, compounded for 5 years, between December 2014 and December 2019. Exelon's balance of funds forecast as reported in its submittal, reflects an escalated trust fund balance of $960,460,000 in 2019 dollars. The NRC staff evaluated the lesser of the two values ($951,236,000) to determine if adequate funding, based on current funding levels, would be provided by the licensee for decommissioning activities.

Using the starting balance of $951,236,000, the staff first subtracted the license termination cost from the opening fund balance. The NRC staff then applied a 2-percent annual real rate of return to this value, as prescribed by 10 CFR 50.75(e)(1)(ii), to calculate a yearly ending balance. This methodology was applied for each year over the span of the 60-year decommissioning period. The NRC staff concluded that a positive ending balance is achieved in the last year of decommissioning (2079), indicating that sufficient funding is available to decommission OCNGS using the SAFSTOR method.

Pursuant to 10 CFR 50.82(a)(3), decommissioning must be completed within 60 years of permanent cessation of operations of a power reactor. In its initial application, the licensee indicated that costs to complete radiological decommissioning would be realized through year 2081, 62 years beyond permanent cessation of operations. Exelon later clarified, through its RAI response, that, "Exelon intends to complete Radiological Decommissioning of OCNGS within the 60-year requirement of 10 CFR 50.82(a)(3)." In its RAI response, the licensee also stated that:

> There is a total of $229k (2014 dollars) of Radiological Decommissioning costs included in the submitted cost estimate that occur after the 60 year decommissioning period of the plant ($148k in 2080 and $81k in 2081, 2014 dollars). These costs represent the administrative expenses associated with submitting a final report to the NRC following license termination, and do not include any physical decommissioning work.

In its RAI response, Exelon also stated:

> [t]he site-specific decommissioning cost estimate will be periodically updated and adjusted as deemed appropriate by OCNGS and in compliance with applicable regulatory requirements. Currently, Exelon performs a comprehensive update to site-specific decommissioning cost estimates at least once every 5 years in accordance with Regulatory Guide 1.159, Revision 2, Section 1.4.3, "Frequency of Adjustment." In addition, an escalation study is performed on an annual basis and the cost estimate is adjusted to account for inflation.

Exelon also indicates that:

> [d]ecommissioning funding assurance will be reviewed and reported to the NRC annually during the SAFSTOR period. The latest site-specific decommissioning cost estimate will be adjusted for inflation, in accordance with applicable regulatory requirements, and will be used to demonstrate funding assurance. If the funding assurance demonstration shows the decommissioning trust fund is not sufficient, then an alternate funding mechanism allowed by 10 CFR 50.75(e) and the guidance provided in Regulatory Guide 1.159 (applicable revision at the time) will be put in place at an appropriate time.

In summary, and as presented in Attachment 1, a positive ending trust fund balance is achieved after the 60-year decommissioning period. The NRC staff concludes that the decommissioning trust fund balances reported by the licensee are sufficient to meet the anticipated costs of radiological decommissioning as presented in the PDCE during the 60-year SAFSTOR period.

4.5 Summary Conclusion on Staff Assessment of PDCE

The NRC staff assessed the OCNGS PDCE as submitted by the licensee, and has concluded that it meets all NRC regulatory requirements. As required, the OCNGS PDCE amount is greater than the NRC minimum decommissioning formula fund amount. The licensee addressed all of the factors that could affect the PDCE as identified in NRC guidance and adequately and comprehensively assessed the major factors that could affect the PDCE. The licensee also has comprehensively addressed the entire scope of work required to complete decommissioning OCNGS as identified in NRC guidance, and has evaluated costs associated with all phases of decommissioning OCNGS. Finally, the NRC staff concluded that the decommissioning trust fund balances reported by the licensee are sufficient to meet the anticipated costs of radiological decommissioning as presented in the PDCE during the 60-year SAFSTOR period.

4.6 Evaluation of the IFMP

With regard to the IFMP, the NRC staff notes that the licensee provided written notification to the NRC in response to this requirement in its letter dated October 29, 2004, previously cited. In response, NRC staff concluded in its March 25, 2005, letter, that the NRC staff found the AmerGen program for the long-term storage of OCNGS spent fuel adequate and, therefore, concluded that the spent fuel management program for OCNGS complied with 10 CFR 50.54(bb). The NRC staff approved the program on a preliminary basis.

The NRC staff's review of the licensee's submittal included that of spent fuel management activities and associated cost elements of the recently updated OCNGS IFMP submittal as part of its current review of the PDCE (performed in the 2015 to 2016 timeframe). The IFMP and spent fuel management costs estimated by the licensee total $188,471,000 (2014 dollars) for all spent fuel management activities. The NRC staff reviewed estimates for major spent fuel management activities and funding requirements, including capital for spent fuel management infrastructure; spent fuel pool operation, maintenance, and isolation costs; ISFSI expansion and operating costs; emergency planning costs; security and utility staffing costs; and spent fuel transfer costs.

With regard to spent fuel removal from the reactor site, the licensee indicates that its plan for spent fuel removal remains dependent upon DOE's ability to remove spent fuel from the site in a timely manner. Exelon maintains its position that DOE has a contractual obligation to accept fuel from OCNGS in a timely manner, and staff accepts these assumptions with regard to the final disposition of OCNGS spent fuel. Consistent with the IFMP, the OCNGS ISFSI serves to address interim storage requirements of spent fuel at the site.

Based on its review, the NRC staff concludes that the activities and associated costs of the OCNGS spent fuel management program appear reasonable and the preliminary approval of the OCNGS IFMP continues to be appropriate.

5.0 CONCLUSION

Based on the NRC staff's review of the OCNGS PDCE, the NRC staff finds that the licensee has demonstrated reasonable assurance that funding will be available to decommission OCNGS pursuant to the SAFSTOR method. The NRC staff considered the adequacy of available funding to decommission OCNGS to ensure that sufficient funds exist to safely decommission OCNGS. The NRC staff verified that sufficient information has been provided in the PDCE to address applicable requirements in 10 CFR 50.75 and 10 CFR 50.82. The PDCE demonstrated that the site-specific estimate amount was more than the decommissioning financial assurance formula amount required by 10 CFR 50.75(c). The PDCE included an up-to-date listing of major factors that could affect the cost to decommission and these factors were assessed by the licensee as required by 10 CFR 50.75(f)(3). The PDCE is provided in current year (estimate year) dollars and accounts for the entire decommissioning work scope, and the PDCE provided plans to adjust the level of funding and costs as required by 10 CFR 50.75(c)(2), 10 CFR 50.75(f)(5), and 10 CFR 50.82(a)(8)(iv).

In addition, the NRC staff reviewed estimates for major spent fuel management activities and funding requirements and found the activities and associated costs of the OCNGS IFMP appear reasonable. The NRC staff also concludes that the activities and associated costs of the

OCNGS spent fuel management program appear reasonable and the preliminary approval of the OCNGS IFMP continues to be appropriate in accordance with 10 CFR 50.54 (bb).

Principal Contributor: Richard Turtil

Date: July 6, 2016

ATTACHMENT 1: OCNGS CLOSING BALANCE CALCULATIONS (thousands of 2014 Dollars)				
Year	**Opening Balance**	**License Termination Costs**	**2% Interest**	**Closing Balance**
2019 *	$951,236	$176	$19,021	$970,081
2020	$970,081	$65,146	$18,099	$923,034
2021	$923,034	$62,592	$17,209	$877,651
2022	$877,651	$7,277	$17,407	$887,781
2023	$887,781	$7,277	$17,610	$898,114
2024	$898,114	$7,297	$17,816	$908,634
2025	$908,634	$7,204	$18,029	$919,458
2026	$919,458	$7,133	$18,247	$930,572
2027	$930,572	$7,133	$18,469	$941,908
2028	$941,908	$7,152	$18,695	$953,451
2029	$953,451	$7,133	$18,926	$965,244
2030	$965,244	$7,133	$19,162	$977,273
2031	$977,273	$7,133	$19,403	$989,543
2032	$989,543	$7,152	$19,648	$1,002,039
2033	$1,002,039	$7,133	$19,898	$1,014,804
2034	$1,014,804	$7,133	$20,153	$1,027,824
2035	$1,027,824	$7,133	$20,414	$1,041,105
2036	$1,041,105	$7,152	$20,679	$1,054,632
2037	$1,054,632	$7,100	$20,951	$1,068,483
2038	$1,068,483	$7,100	$21,228	$1,082,611
2039	$1,082,611	$7,100	$21,510	$1,097,021
2040	$1,097,021	$7,120	$21,798	$1,111,699
2041	$1,111,699	$7,100	$22,092	$1,126,691
2042	$1,126,691	$7,100	$22,392	$1,141,983
2043	$1,141,983	$7,100	$22,698	$1,157,580
2044	$1,157,580	$7,120	$23,009	$1,173,469
2045	$1,173,469	$7,100	$23,327	$1,189,697
2046	$1,189,697	$7,100	$23,652	$1,206,249
2047	$1,206,249	$7,100	$23,983	$1,223,132
2048	$1,223,132	$7,120	$24,320	$1,240,332
2049	$1,240,332	$7,100	$24,665	$1,257,897
2050	$1,257,897	$7,100	$25,016	$1,275,813
2051	$1,275,813	$7,100	$25,374	$1,294,087

Attachment

ATTACHMENT 1: OCNGS CLOSING BALANCE CALCULATIONS (thousands of 2014 Dollars)				
Year	**Opening Balance**	**License Termination Costs**	**2% Interest**	**Closing Balance**
2052	$1,294,087	$7,120	$25,739	$1,312,706
2053	$1,312,706	$7,100	$26,112	$1,331,718
2054	$1,331,718	$7,100	$26,492	$1,351,111
2055	$1,351,111	$7,100	$26,880	$1,370,891
2056	$1,370,891	$7,120	$27,275	$1,391,046
2057	$1,391,046	$7,100	$27,679	$1,411,625
2058	$1,411,625	$7,100	$28,091	$1,432,616
2059	$1,432,616	$7,100	$28,510	$1,454,026
2060	$1,454,026	$7,120	$28,938	$1,475,844
2061	$1,475,844	$7,100	$29,375	$1,498,119
2062	$1,498,119	$7,100	$29,820	$1,520,839
2063	$1,520,839	$7,100	$30,275	$1,544,014
2064	$1,544,014	$7,120	$30,738	$1,567,632
2065	$1,567,632	$7,100	$31,211	$1,591,743
2066	$1,591,743	$7,100	$31,693	$1,616,336
2067	$1,616,336	$7,100	$32,185	$1,641,420
2068	$1,641,420	$7,120	$32,686	$1,666,986
2069	$1,666,986	$7,100	$33,198	$1,693,084
2070	$1,693,084	$7,100	$33,720	$1,719,704
2071	$1,719,704	$7,100	$34,252	$1,746,856
2072	$1,746,856	$7,120	$34,795	$1,774,530
2073	$1,774,530	$7,100	$35,349	$1,802,779
2074	$1,802,779	$7,100	$35,914	$1,831,593
2075	$1,831,593	$37,974	$35,872	$1,829,491
2076	$1,829,491	$103,487	$34,520	$1,760,524
2077	$1,760,524	$122,204	$32,766	$1,671,086
2078	$1,671,086	$106,601	$31,290	$1,595,775
2079	$1,595,775	$58,238	$30,751	$1,568,288
Total		**$933,979**		

*** OCNGS' reported trust fund balance as of December 31, 2014 was $861,564,000 (see ADAMS Accession No. ML15097A537). Escalated by 2% annually, this dollar figure provides a 2019 opening balance of $951,236,273.**

Details of the staff's review are delineated in the enclosed safety evaluation.

Sincerely,

/RA/

John G. Lamb, Senior Project Manager
Plant Licensing Branch I-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-219

Enclosure:
Safety Evaluation

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DATE	5/10/2016	5/12/2016	5/11/2016	5/6/2016
OFFICE	OGC	DORL/LPL4-2/BC	DORL/LPL4-2/PM	
NAME	MYoung	Sanderson (A)	JLamb	
DATE	6/20/2016	6/24/2016	7/6/2016	

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