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10 CFR 50.82(a)(4)

RA-18-054

May 21, 2018

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Oyster Creek Nuclear Generating Station
Renewed Facility Operating License No. DPR-16
NRC Docket Nos. 50-219 and 72-15

Subject: Oyster Creek Nuclear Generating Station - Post-Shutdown Decommissioning Activities Report

Reference:

1) Letter from Keith R. Jury, Exelon Generation Company, LLC to U.S. Nuclear Regulatory Commission - *"Permanent Cessation of Operations at Oyster Creek Nuclear Generating Station,"* dated January 7, 2011 (ML110070507)
2) Letter from Michael P. Gallagher, Exelon Generation Company, LLC to U.S. Nuclear Regulatory Commission - *"Certification of Permanent Cessation of Power Operations for Oyster Creek Nuclear Power Station,"* dated February 14, 2018 (ML18045A084)
3) Regulatory Guide 1.185, Revision 1, "Standard Format and Content for Post-Shutdown Decommissioning Activities Report," dated June 2013 (ML13140A039)
4) Letter from Michael P. Gallagher, Exelon Generation Company, LLC to U.S. Nuclear Regulatory Commission - *"Update to Spent Fuel Management Plan for Oyster Creek Nuclear Generating Station,"* dated May 21, 2018 (ML18141A486)

Pursuant to 10 CFR 50.82(a)(4)(i), Exelon Generation Company, LLC (Exelon) is submitting the post-shutdown decommissioning activities report (PSDAR) for Oyster Creek Nuclear Generating Station (OCNGS). On January 7, 2011, Exelon informed the U.S. Nuclear Regulatory Commission (NRC) that OCNGS will permanently cease power operations by December 31, 2019 (Reference 1). On February 2, 2018, Exelon announced that it now plans to retire OCNGS no later than October 31, 2018, at the end of the current two-year operating cycle. Exelon informed the NRC of this change in Reference 2.

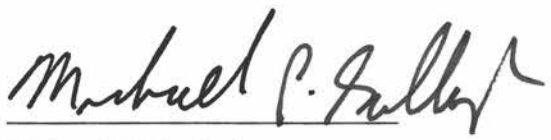
The Attachment to this letter provides the OCNGS PSDAR. The PSDAR has been developed consistent with Regulatory Guide 1.185, Revision 1, "Standard Format and Content for Post-Shutdown Decommissioning Activities Report" (Reference 3). The OCNGS PSDAR includes: 1) a description of the planned decommissioning activities; 2) a schedule for their accomplishments; 3) a site-specific decommissioning cost estimate; and 4) a discussion that provides a basis for concluding that the environmental impacts associated with site-specific decommissioning will be bounded by appropriate, previously issued, environmental impact statements. The PSDAR also includes a discussion of the schedule and costs associated with the management of spent fuel and site restoration. Funding for irradiated fuel management will be addresses in a separate submittal as an update to the Spent Fuel Management Plan pursuant to 10 CFR 50.54(bb) (Reference 4).

In accordance with 10 CFR 50.82(a)(4)(i), a copy of the OCNGS PSDAR is being provided to the State of New Jersey by transmitting a copy of this letter and its supporting attachment to the designated State Officials.

This letter contains no new regulatory commitments.

If you have any questions concerning this submittal, please contact Paul Bonnett at (610) 765-5264.

Respectfully,



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Exelon Generation Company, LLC

Attachment: Oyster Creek Nuclear Generating Station - Post-Shutdown Decommissioning Activities Report

cc: w/Attachment

Regional Administrator - NRC Region I
NRC Senior Resident Inspector - Oyster Creek Nuclear Generating Station
NRC Project Manager, NRR - Oyster Creek Nuclear Generating Station
Director, Bureau of Nuclear Engineering - New Jersey Department of Environmental Protection
Mayor of Lacey Township, Forked River, NJ

POST-SHUTDOWN DECOMMISSIONING ACTIVITIES REPORT

OYSTER CREEK
GENERATING STATION

May 21, 2018

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ACRONYMS

AIF	Atomic Industrial Forum
ALARA	As Low as Reasonably Achievable
BMP	Best Management Practices
BNE	New Jersey Bureau of Nuclear Engineering
BWR	Boiling Water Reactor
CFR	Code of Federal Regulations
CWA	Clean Water Act
D&D	Decontamination and Dismantlement
DCE	Decommissioning Cost Estimate
DTF	Decommissioning Trust Fund
DOE	Department of Energy
DSEIS	Draft Supplemental Environmental Impact Statement (NUREG-1437)
EPA	Environmental Protection Agency
ER	Environmental Report
Exelon	Exelon Generation Company, LLC
FP	Fire Protection
FSAR	Final Safety Analysis Report
FSS	Final Status Survey
FWS	Fish and Wildlife Service
GEIS	Generic Environmental Impact Statement (NUREG-0586)
GTCC	Greater than Class C
GW	Groundwater
HVAC	Heating Ventilating Air Conditioning
ISFSI	Independent Spent Fuel Storage Installation
LLRW	Low-Level Radioactive Waste
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MGD	Million Gallons per Day
MWt	Megawatt-thermal
NEI	Nuclear Energy Institute
NESP	National Environmental Studies Project
NJDEP	New Jersey Department of Environmental Protection

NJHPO	New Jersey Historic Preservation Office
NJPDES	New Jersey Pollutant Discharge Elimination System
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
PSDAR	Post-Shutdown Decommissioning Activities Report
OCNGS	Oyster Creek Nuclear Generating Station
ODCM	Offsite Dose Calculation Manual
REMP	Radiological Environmental Monitoring Program
SEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437), Supplement 28, "Regarding Oyster Creek Nuclear Generating Station"
SFP	Spent Fuel Pool
SSCs	Structures, Systems and Components
UFSAR	Updated Final Safety Analysis Report
USACE	U.S. Army Corps of Engineers

1.0 INTRODUCTION AND SUMMARY

1.1. INTRODUCTION

In accordance with the requirements of Title 10 of the Code of Federal Regulations (CFR) 50.82, "Termination of license," paragraph (a)(4)(i), this report constitutes the Post-Shutdown Decommissioning Activities Report (PSDAR) for the Oyster Creek Nuclear Generating Station (OCNGS). This PSDAR contains the following:

1. A description of the planned decommissioning activities along with a schedule for their accomplishment.
2. A discussion that provides the reasons for concluding that the environmental impacts associated with site-specific decommissioning activities will be bounded by appropriate previously issued environmental impact statements.
3. A site-specific decommissioning cost estimate (DCE), including the projected cost of managing irradiated fuel and the post-decommissioning site restoration cost.

The PSDAR has been developed consistent with Regulatory Guide 1.185, "Standard Format and Content for Post-Shutdown Decommissioning Activities Report," (Reference 1). This report is based on currently available information and the plans discussed herein may be modified as additional information becomes available or conditions change. As required by 10 CFR 50.82(a)(7), Exelon Generation Company, LLC (Exelon) will notify the Nuclear Regulatory Commission (NRC) in writing, with copies sent to the State of New Jersey, before performing any decommissioning activity inconsistent with, or making any significant schedule change from, those actions and schedules described in the PSDAR, including changes that significantly increase the decommissioning cost.

1.2. BACKGROUND

The Oyster Creek Nuclear Generating Station (OCNGS) is a single unit Boiling Water Reactor (BWR-2) with a Mark I type containment. It is located in Lacey Township, Ocean County, New Jersey, approximately two miles south of the community of Forked River. OCNGS is licensed to generate 1930 megawatts-thermal (MWt). The current facility operating license for OCNGS expires on April 9, 2029. The principal structures at OCNGS site include a reactor building that houses primary containment and the reactor, turbine building, office buildings, old and new radwaste buildings, offgas building, emergency diesel generators, intake and discharge structures, ventilation stack, storage tanks, warehouse, security structures, and dry fuel storage facility (ISFSI).

A brief history of the major milestones related to OCNGS construction and operational history is as follows:

- Construction Permit Issued: Dec 15, 1964
- Provision Operating License Issued: April 9, 1969
- Commercial Operation: December 23, 1969
- Major Plant Refurbishment: 1984
- Full Term Operating License Issued July 2, 1991
- Original License Expiration: April 9, 2009
- Renewed License Expiration: April 9, 2029

By letter dated January 7, 2011 (Reference 2), Exelon provided formal notification to the NRC that it intended to permanently cease power operations of OCNGS no later than December 31, 2019. A February 14, 2018, supplement to this letter certified that operations would cease no later than October 31, 2018 (Reference 3), in accordance with 10 CFR 50.82(a)(l)(i) and 10 CFR 50.4(b)(8). Upon docketing of the certifications required by CFR 50.82(a)(1)(i) and 10 CFR 50.82(a)(1)(ii), pursuant to 10 CFR 50.82(a)(2), the 10 CFR Part 50 license for OCNGS will no longer authorize operation of the reactor or emplacement or retention of fuel in the reactor vessel.

Pursuant to 10 CFR 50.51(b), "Continuation of license," the license for a facility that has permanently ceased operations continues in effect beyond the expiration date to authorize ownership and possession of the utilization facility until the Commission notifies the licensee in writing that the license has been terminated.

During the period that the license remains in effect, 10 CFR 50.51(b) requires that Exelon:

- Take actions necessary to decommission and decontaminate the facility and continue to maintain the facility including storage, control, and maintenance of the spent fuel in a safe condition.
- Conduct activities in accordance with all other restrictions applicable to the facility in accordance with NRC regulations and the 10 CFR 50 facility license.

10 CFR 50.82(a)(9) states that power reactor licensees must submit an application for termination of the license at least two years prior to the license termination date and that the application must be accompanied or preceded by a license termination plan to be submitted for NRC approval.

1.3. SUMMARY OF DECOMMISSIONING ALTERNATIVES

The NRC has evaluated the environmental impacts of three general methods for decommissioning power reactor facilities in NUREG-0586, "Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors," (GEIS) (Reference 4). The three general methods evaluated are summarized as follows:

- DECON: The equipment, structures and portions of the facility and site that contain radioactive contaminants are promptly removed or decontaminated to a level that permits termination of the license shortly after cessation of operations.
- SAFSTOR: After the plant is shut down and defueled, the facility is placed in a safe, stable condition and maintained in that state (safe storage). The facility is decontaminated and dismantled at the end of the storage period to levels that permit license termination. During SAFSTOR, a facility is left intact or may be partially dismantled, but the fuel is removed from the reactor vessel and radioactive liquids are drained from systems and components and then processed. Radioactive decay occurs during the SAFSTOR period, thereby lowering the level of contamination and radioactivity that must be disposed of during decontamination and dismantlement.

- ENTOMB: Radioactive structures, systems and components (SSCs) are encased in a structurally long-lived substance, such as concrete. The entombed structure is appropriately maintained, and continued surveillance is carried out until the radioactivity decays to a level that permits termination of the license.

The decommissioning approach that has been selected by Exelon for OCNGS is the SAFSTOR method. The primary objectives of the OCNGS decommissioning project are to remove the facility from service, reduce residual radioactivity to levels permitting unrestricted release, restore the site, perform this work safely, and complete the work in a cost-effective manner. The selection of a preferred decommissioning alternative is influenced by a number of factors at the time of plant shutdown. These factors include the cost of each decommissioning alternative, minimization of occupational radiation exposure, availability of a high-level waste (spent fuel) repository or a Department of Energy (DOE) interim storage facility, regulatory requirements, and public concerns. In addition, 10 CFR 50.82(a)(3) requires decommissioning to be completed within 60 years of permanent cessation of operations.

Under the SAFSTOR methodology, the facility is placed in a safe and stable condition and maintained in that state allowing levels of radioactivity to decrease through radioactive decay, followed by decontamination and dismantlement. After the safe storage period, the facility will be decontaminated and dismantled to levels that permit license termination. In accordance with 10 CFR 50.82(a)(9), a license termination plan will be developed and submitted for NRC approval at least two years prior to termination of the license.

The decommissioning approach for OCNGS is described in the following sections.

- Section 2.0 describes the planned decommissioning activities and the general timing of their implementation.
- Section 3.0 describes the overall decommissioning schedule, including the spent fuel management activities.
- Section 4.0 provides an analysis of expected decommissioning costs, including the costs associated with spent fuel management and site restoration.
- Section 5.0 describes the basis for concluding that the environmental impacts associated with decommissioning OCNGS are bounded by the NRC generic environmental impact statement related to decommissioning.
- Section 6.0 is a list of references.

2.0 DESCRIPTION OF PLANNED DECOMMISSIONING ACTIVITIES

Exelon is currently planning to decommission OCNGS using a SAFSTOR method. SAFSTOR is broadly defined in Section 1.3 of this report. Use of the SAFSTOR method will require the management of spent fuel because of the DOE's failure to perform its spent fuel removal obligations under its contract with Exelon. To explain the basis for projecting the cost of managing spent nuclear fuel, a discussion of spent fuel management activities for the site is included herein.

The initial decommissioning activities to be performed after plant shutdown will entail preparing the plant for a period of safe-storage (also referred to as dormancy). This will entail de-fueling the reactor and transferring the fuel into the spent fuel pool, draining of fluids and de-energizing systems, reconfiguring the electrical distribution, ventilation, heating, and fire protection systems, and minor deconstruction activities. Systems temporarily needed for continued operation of the spent fuel pool may be reconfigured for operational efficiency.

During dormancy, the OCNGS will be staffed with personnel that will monitor, maintain and provide security for the Independent Spent Fuel Storage Installation (ISFSI) and plant facilities. Staffing and configuration requirements are expected to change during the period of dormancy, principally dependent upon the status of the spent fuel being stored on-site. This can be characterized as one of three spent fuel conditions, as follows:

- Wet and dry storage of spent fuel
- On-site dry storage of all spent fuel
- No fuel on site

Spent fuel will remain in the spent fuel pool until it meets the criteria for transfer, and the spent fuel can be transferred in an efficient manner to the ISFSI. After all fuel has been transferred to the ISFSI, the pool and supporting systems will be drained and de-energized for the remainder of the dormancy period. The spent fuel will be stored in the ISFSI until transfer to the DOE.

Decontamination and dismantlement (D&D) activities will be scheduled to enable the license to be terminated within 60 years after permanent cessation of operations. Following completion of the D&D activities and termination of the NRC license, site restoration will be performed to a to-be-determined condition such that the site may be re-used for beneficial purposes.

For the purposes of a current decommissioning cost estimate, it is assumed that remaining structures are to be demolished to three-feet below grade and the excavations backfilled with suitable material and erosion controls emplaced.

Decommissioning activities will be performed in accordance with written, reviewed, and approved site procedures. There are no identified or anticipated decommissioning activities that are unique to the OCNGS site outside the bounds considered in the GEIS.

Radiological and environmental programs will be maintained throughout the decommissioning process to ensure occupational, public health and safety, and environmental compliance. Radiological programs will be conducted in accordance with the facility's revised Technical Specifications, Facility Operating License, Updated Final Safety Analysis Report (UFSAR), Radiological Environmental Monitoring Program (REMP), and the Offsite Dose Calculation

Manual (ODCM). Non-radiological Environmental Programs will be conducted in accordance with applicable requirements and permits.

Tables 2.1 and 2.2 below provide summaries of the schedule / plant status and costs for decommissioning OCNGS. The major decommissioning activities and the general sequence of activities are discussed in more detail in the sections that follow.

Table 2.1:
Decommissioning Schedule [a] and Plant Status Summary

Plant Status / Decommissioning Activities	Start	End	Approximate Duration *(years)*
Pre-Shutdown			
Pre-Shutdown Planning	17 Sep 2014	16 Sep 2018	
Preparations for Dormancy			
Plant Shutdown / Defueling Outage	17 Sep 2018 [b]	30 Sep 2018	0.04
Preparations for Dormancy	30 Sep 2018	19 Mar 2020	1.46
Dormancy			
Dormancy w/ Wet Fuel Storage	19 Mar 2020	18 Mar 2024	4.0
Dormancy w/ Dry Fuel Storage	18 Mar 2024	17 Sep 2034	10.5
Dormancy w/ No Fuel	17 Sep 2034	8 Dec 2073	39.2
Decommissioning Preparations	8 Dec 2073	6 Jun 2075	1.5
Decommissioning Operations			
Large Component Removal	6 Jun 2075	23 Jun 2076	1.0
Plant Systems Removal and Building Decontamination	23 Jun 2076	24 Dec 2077	1.5
License Termination	24 Dec 2077	17 Sep 2078	0.8
Site Restoration			
Site Restoration	17 Sep 2078	7 Apr 2080	1.6
Total from Shutdown to Completion of License Termination			60

a The schedule presented here represents a 15.5-month shift in the schedule in Reference 5. Reference 5 assumed a December 31, 2019 permanent shutdown of OCNGS.

b OCNGS is scheduled to permanently cease operation on September 17, 2018. In accordance with Reference 3, OCNGS will permanently cease operation no later than October 31, 2018.

Table 2.2:
Decommissioning Cost Summary
(December 31, 2017, dollars - thousands)

Decommissioning Periods	Radiological Decommissioning	Spent Fuel Management	Site Restoration
Pre-Shutdown			
Pre-Shutdown Planning [a]	3,268	4,700	
Preparations for Dormancy			
Planning and Preparations	153,632	35,962	
Dormancy			
Dormancy w/ Wet Fuel Storage	31,166	179,497	
Dormancy w/ Dry Fuel Storage	77,572	69,958	
Dormancy w/ No Fuel	288,353		
Decommissioning Preparations			
Site Reactivation	56,770		627
Preparations for D & D	42,314		495
Decommissioning Operations			
Large Component Removal	199,189		179
Plant Systems Removal and Building Decontamination	222,656		2,313
License Termination	34,412		
Site Restoration			
Site Restoration	247		56,588
Total[b]	1,109,576	290,116	60,202

a Costs represent projected spend in 2018 only.

b Columns may not add due to rounding

2.1. DISCUSSION OF DECOMMISSIONING ACTIVITIES

The following narrative describes the basic activities associated with decommissioning the OCNGS. The site specific DCE (Reference 5) is divided into phases or periods based upon major milestones within the project or significant changes in the annual projected expenditures. The following sub-sections correspond to the five major decommissioning periods within the estimate.

2.1.1. Preparations for Dormancy

The NRC defines SAFSTOR as, "A method of decommissioning in which a nuclear facility is placed and maintained in a condition that allows the facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use." The facility is left intact (during the dormancy period), with most structures maintained in a stable condition; some outbuildings not related to power production will be removed. Systems that are not required to support the spent fuel, HVAC, Emergency Plan or site security are drained, de-energized, and secured. Some cleaning / removal of loose contamination and or fixation and sealing of remaining contamination is performed. Access to contaminated areas is maintained secure to provide controlled access for inspection and maintenance.

The process of placing the plant in safe-storage will include, but is not limited to, the following activities:

- Creation of an organizational structure to support the decommissioning plan and evolving emergency planning and site security requirements.
- Revision of technical specifications, plans and operating procedures appropriate to the operating conditions and requirements.
- Characterization of the facility and major components as may be necessary to plan and prepare for the dormancy phase.
- Management of the spent fuel pool and reconfiguring fuel pool support systems so that draining and de-energizing may commence in other areas of the plant.
- Deactivation (de-energizing and or draining) of systems that are no longer required during the dormancy period.
- Processing and disposal of water and water filter and treatment media (resins) not required to support dormancy operation.
- Removal of select non-power production structures to improve monitoring efficiencies for ISFSI and prior power production structures.
- Disposition of incidental waste that may be present and is ready to ship prior to the start of the dormancy period, such as excess tools and equipment and waste produced while deactivating systems and preparing the facility for dormancy.
- Reconfiguration of power, lighting, heating, ventilation, fire protection, and any other services needed to support long-term storage and periodic plant surveillance and maintenance.
- Stabilization by fixing or removing loose incidental surface contamination to facilitate future building access and plant maintenance. Decontamination of high-dose areas is not anticipated.

- Performance of interim radiation surveys of the plant, posting caution signs and establishing access requirements, where appropriate.
- Maintenance of appropriate barriers for contaminated and radiation areas.
- Reconfiguration of security boundaries and surveillance systems, as needed to support efficiency during the dormancy period.

The following is a general discussion of the planned reconfiguration expected after plant shutdown.

2.1.1.1. *Electrical Systems*

The electrical systems will undergo a series of reconfigurations between shutdown and the time all spent fuel has been transferred to dry storage. The reconfigurations will be performed to reduce operating and maintenance expenses, while maintaining adequate power for station loads, and backup power for spent fuel pool-related systems and critical security equipment.

2.1.1.2. *Mechanical Systems*

Following shutdown, as applicable, fluid filled systems will be drained and abandoned, and resins removed based on an evaluation of system category, functionality, and plant configuration. The plant configuration and functionality of each system within the plant configuration as it evolves will determine when a system can be drained and abandoned.

2.1.1.3. *Ventilation and Heating Systems*

Ventilation will be reconfigured to support remaining systems and habitability. Fluid filled systems will either be drained or freeze protection installed, and the heating steam secured. The ventilation system will be reconfigured to maintain building temperature to support habitability and the functioning of Fuel Pool Cooling systems, Fire Protection systems, Security systems, and Dry Fuel Storage systems as needed.

2.1.1.4. *Fire Protection Systems*

Fire Protection (FP) systems will be reconfigured based on a fire hazards analysis. The fire hazards analysis provides a comprehensive evaluation of the facility's fire hazards, the fire protection capability relative to the identified hazards, and the ability to protect spent fuel and other radioactive materials from potential fire induced releases. The fire hazards analysis will be reevaluated and revised as necessary to reflect the unique or different fire protection issues and strategies associated with decommissioning. It is expected that as the plant's systems are drained and the combustible loading footprint shrinks, the FP requirements will be reduced.

2.1.1.5. *Maintenance of Systems Critical to Decommissioning*

There are no mechanical systems that will be critical to the final decommissioning process. As such, mechanical systems will be abandoned after all spent fuel has been transferred to Dry Fuel Storage, with the exception of systems required to maintain habitability during dormancy. The site power distribution system will be abandoned with the possible exception of motor control centers that are required to support ventilation and lighting.

The organization responsible for the final dismantlement will be expected to establish temporary services, including electrical and cranes.

2.1.2. Dormancy

Activities required during the early dormancy period while spent fuel is stored in the fuel pool will be substantially different than those activities required during dry fuel storage.

Early activities include operating and maintaining the spent fuel pool and its associated systems, and transferring spent fuel from the pool to the ISFSI. Spent fuel transfer is expected to be complete in 2024. After the fuel transfer is completed, the spent fuel pool and systems will be drained and de-energized for long-term storage.

Dormancy activities will include a 24-hour security force, preventive and corrective maintenance on security systems, area lighting, general maintenance of buildings, freeze protection heating, ventilation of buildings for periodic habitability, routine radiological inspections of contaminated structures, maintenance of structural integrity, and a site environmental and radiation monitoring program.

Security during the dormancy period will be conducted primarily to safeguard the spent fuel on site and prevent unauthorized entry. Security barriers, sensors, alarms, and other surveillance equipment will be maintained as required to provide security.

An environmental surveillance program will be carried out during the dormancy period to monitor for radioactive material in the environment. Appropriate procedures will be established and initiated for potential releases that exceed prescribed limits. The environmental surveillance program will consist of a version of the program in effect during normal plant operations that will be modified to reflect the plant's conditions and risks at the time.

During the dormancy period, additional activities will include transferring the spent fuel from the ISFSI to the DOE. For planning purposes, Exelon's Spent Fuel Management Plan as submitted in Reference 6 reflects the dates described in Table 2.1. It is acknowledged that the plant owner will seek the most expeditious means of removing fuel from the site when DOE commences performance. The ISFSI pad and associated facilities will be decommissioned along with the power block structures during the deferred decontamination and dismantlement phases.

2.1.3. Decommissioning Preparations

Prior to the commencement of decommissioning operations, preparations will be undertaken to reactivate site services and prepare for decommissioning. Preparations include engineering and planning, a site characterization, and the assembly of a decommissioning management organization. This would likely include the development of work plans, specifications and procedures.

2.1.4. Decommissioning Operations (Decontamination and Dismantlement)

Following the preparations for decommissioning, physical decommissioning activities will take place. This includes the removal and disposal of contaminated and activated components and structures, leading to the termination of the 10 CFR 50 operating license. Although much of the

radioactivity will decrease during the dormancy period due to decay of ^{60}Co and other short-lived radionuclides, the internal components of the reactor vessel will still exhibit radiation dose rates that will likely require remote sectioning under water due to the presence of long-lived radionuclides such as ^{94}Nb and ^{59}Ni. Portions of the biological shield wall may also be radioactive due to the presence of activated trace elements with longer half-lives (such as ^{152}Eu and ^{l54}Eu). It is assumed that radioactive contamination on SSC surfaces will not have decayed to levels that will permit unrestricted release. These surfaces will be surveyed and items dispositioned in accordance with the license termination release criteria.

Significant decommissioning activities in this phase include:

- Reconfiguration and modification of site structures and facilities, as needed, to support decommissioning operations. Modifications may also be required to the reactor or other buildings to facilitate movement of equipment and materials, support the segmentation of the reactor vessel and reactor vessel internals, and for large component removal.
- Design and fabrication of temporary and longer-term shielding to support removal and transportation activities, construction of contamination control envelopes, and the procurement of specialty tooling.
- Procurement or leasing of shipping cask, cask liners, and industrial packages for the disposition of low-level radioactive waste.
- Decontamination of components and piping systems, as required, to control (minimize) worker exposure.
- Removal of piping and components no longer essential to support decommissioning operations.
- Removal of reactor head and segmentation as necessary.
- Removal and segmentation of the dryer, separator, and top guide. Segmentation will maximize the loading of the shielded transport casks, i.e., by weight and activity. The operations are conducted under water using remotely operated tooling and contamination controls.
- Disassembly and segmentation of the remaining reactor internals, including the core materials left above the core support guide, core shroud, fuel support castings, core support guide, and control rod drive guide tubes. Some material is expected to exceed Class C disposal requirements. As such, the segments will be packaged in modified fuel storage canisters for future geologic disposal.
- Segmentation of the reactor vessel as necessary. A shielded platform is installed for segmentation as cutting operations are performed using remotely operated equipment within a contamination control envelope. The water level is maintained to minimize the working area dose rates. Segments are transferred to containers that are stored under water, for example, in an isolated area of the refueling canal.
- Removal of the steel liners from the drywell, torus, refueling pool and spent fuel pool, disposing of the activated and / or contaminated sections as radioactive waste.
- Removal of the activated portions of the concrete biological shield and accessible contaminated concrete surfaces.

- Removal of the recirculation piping and pumps for material recovery and controlled disposal.
- Surface soil, sub-surface media and groundwater will meet the unrestricted use criteria in 10 CFR 20.1402.
- Underground piping (or similar items) and associated soil will be removed as necessary to meet license termination criteria.

At least two years prior to the anticipated date of license termination, a License Termination Plan (LTP) will be submitted to the NRC. That plan will include: a site characterization, description of the remaining dismantling / removal activities, plans for remediation of remaining radioactive materials, developed site-specific Derived Concentration Guideline Levels, methodology and criteria for the final status (radiation) survey (FSS), designation of the end use of the site, an updated cost estimate to complete the decommissioning, and associated environmental concerns.

The FSS plan will identify the radiological surveys to be performed once the decontamination activities are completed and will be developed using the guidance provided in the "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)." The MARSSIM "provides information on planning, conducting, evaluating, and documenting building and surface soil final status radiological surveys for demonstrating compliance with dose or risk-based regulations or standards." The MARSSIM uses the Data Quality Objective / Analysis processes tool for data collection activities and provides a basis for balancing decision uncertainty with available resources. This document incorporates statistical approaches to survey design and data evaluation. It also identifies commercially available instrumentation and procedures for conducting radiological surveys. Use of this guidance ensures that the surveys are conducted in a manner that provides a high degree of confidence that applicable NRC criteria are satisfied. Once the FSS is complete, the results will be submitted to the NRC, along with a request for termination of the NRC license.

Exelon may release unaffected portions of the site on a partial site release basis, as they become available, before all site decommissioning work has been completed.

2.1.5. Site Restoration

After the NRC terminates the license, site restoration activities will be performed, at the licensee's discretion. Exelon currently assumes that remaining structures will be removed to a nominal depth of three feet below the surrounding grade level. Affected area(s) would then be backfilled with suitable fill materials, graded, and appropriate erosion controls established.

Non-contaminated concrete remaining after the demolition activities may be used for backfilling subsurface voids or may be transported to an offsite area for appropriate disposal as construction debris.

2.2. GENERAL DECOMMISSIONING CONSIDERATIONS

2.2.1. Major Decommissioning Activities

As defined in 10 CFR 50.2, "definitions," a "major decommissioning activity" is "any activity that results in permanent removal of major radioactive components, permanently modifies the structure of the containment, or results in dismantling components for shipment containing greater than class C waste in accordance with § 61.55 of this chapter." The following discussion provides a summary of the major decommissioning activities currently planned for decommissioning of the OCNGS. These activities are envisioned to occur in the Dismantling and Decontamination Period. The schedule may be modified as conditions dictate.

Prior to starting a major decommissioning activity, the affected components will be surveyed and decontaminated, as required, in order to minimize worker exposure, and a plan will be developed for the activity. Shipping casks and other equipment necessary to conduct major decommissioning activities will be procured.

The initial major decommissioning activity inside the containment building will be the removal, packaging, and disposal of systems and components attached to the reactor, to provide access and allow it to be removed.

The reactor vessel internals will be removed from the reactor vessel and segmented, if necessary, for packaging, transport and disposal, or to separate greater than Class C (GTCC) waste. Internals classified as GTCC waste will be segmented and packaged into containers similar to spent fuel canisters for transfer to the DOE. Removal of the reactor vessel follows the removal of the reactor internals. Industry experience indicates that there may be several options available for the removal and disposal of the reactor vessel (i.e., segmentation or disposal as an intact package). The viability of these options will be analyzed as a part of future planning and preparation activities. If segmented, it is likely that the work would be performed remotely in-air, using a contamination control envelope.

Other major decommissioning activities that would be conducted include the removal and disposal of the turbine, condenser, main steam piping, feed water piping, pumps and heaters, spent fuel pool support equipment, and neutron activated / contaminated concrete or metals.

Other Decommissioning Activities

In addition to the reactor and large components discussed above, all other plant components will be removed from the Reactor, Turbine, and associated support buildings, radiologically surveyed and dispositioned appropriately.

2.2.2. Decontamination and Dismantlement Activities

The overall objective of D&D is to ensure that radioactively contaminated or activated materials will be removed from the site to allow the site to be released for unrestricted use. This is achieved in part by radioactive decay during the SAFSTOR period which will significantly reduce the quantity of contamination and radioactivity that must be disposed of during decontamination and dismantlement. The disposition of remaining radioactive materials will be accomplished by the decontamination and / or dismantlement of contaminated structures. This may be accomplished

by decontamination in place, off-site processing of the materials, or direct disposal of the materials as radioactive waste. A combination of these methods may be utilized. The methods chosen will be those deemed most appropriate for the particular circumstances.

Low-level radioactive waste (LLRW) will be managed in accordance with approved procedures and commercial disposal facility requirements. This includes characterizing contaminated materials, packaging, transporting and disposal at a licensed LLRW disposal facility.

2.2.3. Radioactive Waste Management

A major component of the decommissioning work scope for the OCNGS is the packaging, transportation and disposing of primarily contaminated / activated equipment, piping, concrete, and in some cases soil. A waste management plan will be developed to incorporate the most cost-effective disposal strategy, consistent with regulatory requirements and disposal / processing options for each waste type at the time of the D&D activities. Decommissioning wastes from OCNGS may be disposed of at the Barnwell Facility, South Carolina, and / or EnergySolutions site in Clive, Utah. If other licensed disposal facilities become available in the future, Exelon may elect to use them. Radioactive wastes from OCNGS will be transported by licensed transporters. The waste management plan will be based on the evaluation of available methods and strategies for processing, packaging, and transporting radioactive waste in conjunction with the available disposal facility options and associated waste acceptance criteria.

2.2.4. Removal of Mixed Wastes

If mixed wastes are generated they will be managed in accordance with applicable Federal and State regulations.

If generated, mixed wastes will be transported by authorized and licensed transporters and shipped to authorized and licensed facilities. If technology, resources, and approved processes are available, the processes will be evaluated to render the mixed waste non-hazardous.

2.2.5. Site Characterization

During the decommissioning process, site characterization will be performed in which radiological, regulated, and hazardous wastes will be identified, categorized, and quantified. Surveys will be conducted to establish the contamination and radiation levels throughout the site. This information will be used in developing procedures, surveys and sampling plans to ensure that hazardous, regulated, and radiologically contaminated areas are remediated and to ensure that worker exposure is controlled. As decontamination and dismantlement work proceeds, surveys will be conducted to maintain a current site characterization and to ensure that decommissioning activities are adjusted accordingly.

As part of the site characterization process, a neutron activation analysis calculation study of the reactor internals and the reactor vessel will be performed. Using the results of this analysis (along with benchmarking surveys), neutron irradiated components will be classified (projected for the future D&D time-frame) in accordance with 10 CFR 61, "Licensing requirements for land disposal of radioactive waste." The results of the analysis form the basis of the plans for removal, segmentation, packaging and disposal.

2.2.6. Groundwater Protection and Radiological Decommissioning Records Program

A groundwater (GW) protection program currently exists at OCNGS in accordance with the Nuclear Energy Institute (NEI) Technical Report 07-07, "Industry Groundwater Protection Initiative - Final Guidance Document" (Reference 18). This program is directed by procedures and will continue during decommissioning.

Exelon will also continue to maintain the existing radiological decommissioning records program required by 10 CFR 50.75(g). The program is directed by procedures.

Neither the monitoring results of the groundwater protection program nor events noted in 10 CFR 50.75(g) indicate the presence of long-lived radionuclides in sufficient concentrations following remediation as needed to preclude unrestricted release under 10 CFR 20.1402, "Radiological criteria for unrestricted use."

2.2.7. Changes to Management and Staffing

Throughout the decommissioning process, plant management and staffing levels will be adjusted to reflect the ongoing transition of the site organization. Staffing levels and qualifications of personnel used to monitor and maintain the plant during the various periods after plant shutdown will be subject to appropriate Technical Specification and Emergency Plan requirements. These staffing levels do not include contractor staffing which may be used to carry out the future fuel movements, plant modifications in preparation for SAFSTOR, and the D&D / license termination / site restoration work. Contractors may also be used to provide general services, staff augmentation or replace permanent staff. The monitoring and maintenance staff will be comprised of radiation protection, radiological environmental monitoring program, plant engineering and craft workers as appropriate for the anticipated work activities.

3.0 SCHEDULE OF PLANNED DECOMMISSIONING ACTIVITIES

Exelon intends to pursue the decommissioning of OCNGS utilizing a SAFSTOR methodology and will make appropriate filings with the NRC to obtain authority prior to beginning radiological decommissioning. The SAFSTOR method involves removal of radioactively contaminated or activated material from the site following an extended period of dormancy. Work activities associated with the planning and preparation period began before the plant was permanently shut down and will continue into 2018. The schedule of spent fuel management and major decommissioning activities is provided in Table 2.1. Additional detail is provided in the site-specific DCE (Reference 5). Dates in site-specific DCE are based on December 31, 2019, shutdown date and have been adjusted as reflected in Table 2.1. The schedule accounts for spent fuel being stored in the ISFSI until the assumed date of transfer to the DOE.

4.0 ESTIMATE OF EXPECTED DECOMMISSIONING AND SPENT FUEL MANAGEMENT COSTS

10 CFR 50.82(a)(4)(i) requires the submission of a PSDAR prior to or within two years following permanent cessation of operations that contains a site-specific DCE, including the projected cost of managing irradiated fuel.

TLG Services, Inc. has prepared a DCE for OCNGS, which provides the site-specific projected costs of radiological decommissioning, managing spent fuel, and site restoration; each category accounted for separately. This DCE was submitted to the NRC on March 30, 2016 (Reference 5). The SAFSTOR scenario as presented in the DCE submitted in Reference 5 constitutes the OCNGS site-specific DCE and fulfills the requirements of 10 CFR 50.82(a)(4)(i) and 10 CFR 50.82(a)(8)(iii) for a site-specific DCE for OCNGS. Section 4.1 describes the adjustments made to the projected expenditures in the DCE to produce Table 2.2.

The methodology used by TLG Services, Inc. to develop the site-specific DCE follows the basic approach originally advanced by the Atomic Industrial Forum (AIF) in its program to develop a standardized model for DCEs. The results of this program were published as AIF/NESP-036, "A Guideline for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," (Reference 7). The AIF document presents a unit cost factor method for estimating direct activity costs, simplifying the estimating process. The unit cost factors used in the study reflect the latest available data, at the time of the study, concerning worker productivity during decommissioning.

Under NRC regulations (10 CFR 50.82(a)(8)), a licensee must provide reasonable assurance that funds will be available (or "financial assurance") for decommissioning (i.e., license termination) costs. The regulations also describe the acceptable methods a licensee can use to demonstrate financial assurance. Most licensees do this by funding a nuclear decommissioning trust fund (DTF).

Exelon maintains two separate trusts for this purpose, a tax qualified fund (Qualified Trust) and a non-tax qualified fund (Non-Qualified Trust). The trustee for both funds is Northern Trust Bank. As of December 31, 2017, the Non-Qualified Trust had a balance of $68,193,000 and the Qualified Trust had a balance of $913,902,000. The adequacy of these funds to cover all costs shown in Table 2.2 is demonstrated in Reference 8.

The 10 CFR 50.75(c) minimum formula amount for OCNGS as of December 31, 2017 is $584,847,000 (Reference 9). As indicated in Table 2.2, the estimated cost of radiological decommissioning at OCNGS is $1,109,576,000. In accordance with Regulatory Guide 1.185 (Reference 1), the site-specific DCE (Reference 5) exceeds the minimum formula amount.

10 CFR 50.82(a)(6)(iii) states that, "Licensees shall not perform any decommissioning activities," as defined in 10 CFR 50.2 that, "Result in there no longer being reasonable assurance that adequate funds will be available for decommissioning." Exelon does not intend to perform any decommissioning activities that would jeopardize the availability of adequate funds for the completion of decommissioning.

10 CFR 50.82(a)(8)(iv) states that, "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." Section 4.2 details how Exelon will meet this requirement.

4.1. COST ESTIMATE ADJUSTMENTS

Table 2.2 reflects the projected expenditures required for decommissioning OCNGS based on the SAFSTOR scenario from the DCE (Reference 5), updated to reflect the current situation at OCNGS. The updated projected costs for radiological decommissioning (license termination costs), spent fuel management, and site restoration (non-radiological decommissioning) efforts are separately reflected in Table 2.2. The costs from Reference 5 have been updated to reflect the current situation at OCNGS as follows:

(1) The DCE (Reference 5) is in 2016 dollars. The costs reflected in Table 2.2 have been escalated to December 31, 2017, dollars in two steps. The first step increased the cost estimate to June 30, 2017, dollars and the second step increased the cost estimate to December 31, 2017, dollars.

The first step was performed by the vendor that prepared the OCNGS DCE using actual escalation indices applied to the five component parts of Total Cost (Labor, Equipment and Material, Energy, Low-Level Radioactive Waste Disposal, and Other Costs). The component parts were then summed to determine the Total Cost in June 30, 2017, dollars.

- Labor cost escalation was based on the Employment cost index, Total Private Compensation.
- Equipment and Material cost escalation was based on the Producer Price Index, Machinery, and Equipment.
- Energy cost escalation was based on the Producer Price Index, Fuels and Related Products and Power.
- Low Level Radioactive Waste Disposal cost escalation was based upon published Barnwell, South Carolina disposal rates.
- Other cost escalation was based on the Consumer Price Index, Services.

The second step was performed by Exelon using a forecasted average annual escalation rate of 2.6848% (based on the most recent data at the time of this submittal). This rate was calculated by the vendor that prepared the OCNGS DCE using forecasted indices from a subcontractor with expertise in economic forecasting. The subcontractor does not forecast low level radioactive waste disposal rates. The Consumer Price Index for Services, plus 1%, was used for this component in the calculation of the forecasted average annual escalation rate based on vendor experience with historical rates.

(2) Projected radiological decommissioning planning costs and spent fuel management planning costs for 2018 are included in Table 2.2 under "Pre-Shutdown Planning." Planning costs for prior years are not reflected in Table 2.2.

The site-specific DCE (Reference 5) includes costs associated with radiological decommissioning planning performed by a dedicated site organization prior to permanent shutdown (costs occur in 2016 through 2019, the Pre-Shutdown Early Planning period, in

the estimate). In 2018, the site decommissioning planning organization will continue to function. Therefore, the estimated cost for this organization has been included in Table 2.2 under Radiological Decommissioning Costs "Pre-Shutdown Planning."

Spent fuel management planning costs are included in the site-specific DCE (Reference 5) starting after permanent shutdown; however, Exelon began spent fuel management planning at OCNGS in 2017. These planning activities will continue in 2018. The 2018 projected costs have been included in Table 2.2 under Spent Fuel Management "Pre-Shutdown Planning." No adjustment to the costs associated with other periods have been made to account for the earlier start to spent fuel management planning. Consequently, Table 2.2 double counts these costs.

4.2. MEANS OF ADJUSTING COST ESTIMATES AND ASSOCIATED FUNDING LEVELS

During the SAFSTOR period, the site-specific DCE will be periodically updated in compliance with Exelon procedures and applicable regulatory requirements.

In accordance with 10 CFR 50.82(a)(8)(v), decommissioning funding assurance will be reviewed and reported to the NRC annually during the SAFSTOR period. The latest site specific DCE adjusted for inflation, in accordance with applicable regulatory requirements, will be used to demonstrate funding assurance. In addition, actual radiological and spent fuel management expenses will be included in the annual report in accordance with the applicable regulatory requirements.

If the funding assurance demonstration shows the DTF is not sufficient, then an alternate funding mechanism allowed by 10 CFR 50.75(e) and the guidance provided in Regulatory Guide 1.159 (Reference 10) (applicable revision at the time) will be put in place.

5.0 ENVIRONMENTAL IMPACTS

To support the PSDAR environmental impacts review, the environmental effects of decommissioning activities planned for OCNGS, as currently understood, were evaluated to determine if potential environmental impacts are bounded by previously issued environmental impact statements (Reference 11). 10 CFR 50.82(a)(4)(i) requires that the PSDAR include, "... a discussion that provides the reasons for concluding that the environmental impacts associated with site-specific decommissioning activities will be bounded by appropriate previously issued environmental impact statements." To determine if the estimated potential environmental impacts associated with OCNGS decommissioning activities are bounded, the potential environmental impacts were compared to those in:

- NUREG-0586, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors (Reference 4) (Referred to as the GEIS).
- NUREG-1496, Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities (Reference 12).
- Atomic Energy Commission, Final Environmental Statement related to the Operation of Oyster Creek Nuclear Generating Station Unit 1 (Reference 13).
- NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 28, Regarding Oyster Creek Nuclear Generating Station (Reference 14) (Referred to as the SEIS).
- NUREG-1437, Revision 1, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, (Reference 15).

As required, site-specific assessments were conducted for threatened and endangered species and environmental justice. Site-specific assessments were also performed for offsite land use and impacts to aquatic ecology, terrestrial ecology, and cultural and historic resources for decommissioning activities beyond the operational area. For the purpose of assessing decommissioning environmental impacts, the operational area at OCNGS consists of the approximately 150 acres west of U.S. Highway 9 that are bounded by the intake and discharge canals. Some decommissioning activities to support barge shipment of large components would take place outside of the operational area. Operational area is defined in the GEIS. The levels of significance assigned to site-specific environmental impacts are classified as small, moderate, or large, as defined by NRC in the Decommissioning GEIS (Reference 4, pgs. 4-1 and 4-2).

Exelon has concluded that the environmental impacts associated with planned OCNGS decommissioning activities are bounded by the impacts addressed by previously issued environmental impact statements. OCNGS's decommissioning plans are consistent with the methods assumed by NRC in the GEIS. No unique site-specific features or unique aspects of the planned decommissioning have been identified.

5.1. ENVIRONMENTAL IMPACTS OF OCNGS DECOMMISSIONING

The following is a summary of the reasons for reaching the conclusion that the environmental impacts of decommissioning OCNGS are bounded by the GEIS, or are site-specific and small. Each environmental resource evaluated in the GEIS is listed along with an explanation as to why Exelon concludes that either the GEIS analysis bounds the impacts of OCNGS decommissioning on that resource, or the impacts are site-specific and small. As a general matter, OCNGS is smaller than the reference boiling water reactor used in the GEIS to generically evaluate the environmental impacts of decommissioning, and its decommissioning impacts are therefore bounded by those assessments. Further, no unique site-specific features or unique aspects of the planned decommissioning have been identified.

5.1.1. Onsite / Offsite Land Use

In the GEIS, the NRC generically determined onsite land use impacts to be small for facilities having land-use changes only within the operational area. For decommissioning that involves land use changes outside the operational area, the GEIS concluded that impacts could not be predicted generically and must be evaluated on a site-specific basis.

5.1.1.1. *Onsite Land Use*

The previously disturbed area surrounding the power block offers substantial space to support decommissioning activities. Site restoration activities include backfill of excavations. The fill needed will be sourced from clean fill resulting from onsite demolition or, if additional fill is needed, clean fill will be sourced from offsite borrow areas that are approved for that land use.

Exelon has determined that onsite land to be used to support decommissioning at OCNGS has been previously disturbed and decommissioning activities at OCNGS would not result in changes in onsite land use patterns. After the site is released for unrestricted use, the land could continue as industrial use or be available for other nonindustrial uses. Exelon concludes that anticipated onsite land use impacts are bounded by Section 4.3.1 in the GEIS.

5.1.1.2. *Offsite Land Use*

For OCNGS, Exelon proposes to ship large plant components by barge using the north bank of Oyster Creek immediately east of U.S. Highway 9 as the barge landing. This offsite shoreline was used during plant construction for delivery of the reactor pressure vessel and has continued to be used during operations for large component delivery. The barge landing is located on Exelon-owned property but is outside the operational area. The barge landing would be reached by traversing the short distance from the OCNGS operational area boundary across Barnegat Branch Trail and U.S. Highway 9. There is no permanently installed equipment / infrastructure at the barge landing site or for the movement of large components to / from the plant and none is anticipated to support decommissioning. This offsite land use would be for a short duration and would not involve construction of structures. Exelon anticipates that dredging between the barge landing and Barnegat Bay could be required to provide enough depth for the barge shipment. If dredging is necessary, it would be conducted under U.S. Army Corps of Engineers (USACE) and appropriate New Jersey Department of Environmental Protection (NJDEP) Division of Land Use Regulation permits. Exelon has reserved space for dredge spoils in an existing State of New Jersey dredge spoils basin on property adjacent to Oyster Creek.

Because decommissioning activities at OCNGS would utilize an existing barge landing and dredge spoils basin, there would be no changes to offsite land use patterns outside the operational area. Furthermore, the transfer of large plant components to the barge landing would cause only temporary and short duration disturbance outside the operational area to land that has been previously disturbed for similar purposes, and dredging, if required for barge passage, would be conducted under appropriate federal and state permits. Hence, Exelon concludes that site-specific impacts to offsite land from OCNGS decommissioning use would be small, and additional mitigation is not warranted.

5.1.2. Water Use

The GEIS observes that quantities of water required during decommissioning are trivial compared to those used when a plant is operating. The GEIS mentions construction dust abatement and decontamination (flushing systems or pressure-washing components) as typical decommissioning water uses. NRC asserted in Section 4.3.2 in the GEIS that potential impacts of decommissioning on water use at all plants are neither detectable nor destabilizing and made the generic conclusion that impacts in all cases are small.

The OCNGS obtains surface water from the South Branch of Forked River for circulating water and service water cooling and dilution water. Also, existing onsite wells provide potable and nonpotable groundwater for a variety of uses. Exelon expects to reduce circulating water intake withdrawals to 250,000 gpm (360 million gallons per day (MGD)) during the first 60 days following plant shutdown. Then, within 9 months after plant shutdown, water intake withdrawals will be reduced to 12,000 gpm (17.3 MGD), which is needed to provide secondary cooling for the spent fuel pool and will be achieved by service water pumps. The spent fuel pool will be used until all the spent fuel is moved into dry storage, approximately 5.5 years after the plant is shut down. Upon shutdown of the circulating water system, the discharge of waste heat to Barnegat Bay via the discharge canal and Oyster Creek will end, which will eliminate most evaporative surface water losses resulting from station operation. Dilution water intake flows will cease with plant shutdown. Regarding groundwater use, Exelon assumes that the existing onsite wells will continue providing potable and nonpotable groundwater for drinking and other uses during OCNGS decommissioning. Even so, based purely on staffing projections, the demand for potable / domestic water at the plant will be substantially lower during decommissioning years than during operational years. Accordingly, although the amounts of surface water or groundwater that may be used for dust abatement or decontamination during OCNGS decommissioning are unknown, Exelon expects total decommissioning water use to be much lower than operational water use.

Because Exelon expects water use during OCNGS decommissioning to be much lower than water use during operational years, which is consistent with the statements made in the GEIS, and because there is nothing about OCNGS's design, location, configuration, operating history, or decommissioning plans that would alter or contradict this generic conclusion, Exelon concludes that decommissioning water use impacts for OCNGS are bounded by the analysis in the GEIS.

5.1.3. Water Quality

Decommissioning activities with potential for impacting surface water quality include fuel removal, stabilization, large component removal, decontamination and dismantlement, and structure dismantlement. Stormwater runoff and accidental releases (spills) are the most likely sources of pollutants entering surface waters during decommissioning. The GEIS asserts that regulatory

programs applicable to permitted substance releases plus the application of Best Management Practices (BMPs) for controlling stormwater runoff and erosion will render any change in surface water quality from decommissioning activities nondetectable and nondestabilizing. With respect to groundwater, the GEIS noted that demolishing concrete structures and storing rubble on site could result in changes (higher alkalinity) in local water chemistry, but the nonradiological effects of such changes on water quality would be non-detectable offsite at all nuclear power plants. Furthermore, Subtitle D of the Resource Conservation and Recovery Act would apply to concentrated subsurface placement of demolition debris, which would limit water quality effects from using rubble and soil as fill material.

During OCNGS decommissioning, Exelon will continue to comply with applicable regulations, which require reporting of hazardous material spills. All reasonable precautions will be taken to prevent or mitigate spills of hazardous materials. New Jersey's Site Remediation Program oversees ongoing remediation and monitoring systems at OCNGS. Remedial activities needed to meet Industrial Sites Recovery Act requirements will be completed in a timely manner in consultation with NJDEP. Reductions in groundwater use during decommissioning are not expected to alter groundwater flow paths or otherwise affect ongoing remedial activities.

While a final decision has not been made, both the OCNGS circulating water intake structure and dilution water intake structure may be removed. Demolition of OCNGS structures and buildings and related earth-moving work (digging, grading, filling) has at least a limited potential to result in erosion and sedimentation that could affect water quality, but these kinds of construction activities routinely take place around operating nuclear power plants and are subject to the provisions of state-issued permits. If the OCNGS intake structures are removed, a cofferdam with dewatering system would be used to isolate the southern end of the intake canal and facilitate removal of the two reinforced concrete structures. Also, BMPs would be employed to limit erosion while these structures were being demolished / removed.

Barging large plant components from OCNGS to Barnegat Bay and beyond may require dredging in portions of Oyster Creek between the barge landing and Barnegat Bay to an unknown depth. It may also be necessary to dredge in Barnegat Bay to allow passage of loaded barges between the mouth of Oyster Creek and Barnegat Inlet. Dredging at nuclear plants to remove sediments in the vicinity of intake and discharge structures and to "maintain barge shipping" has not created surface water quality problems at operating nuclear power plants. In the GEIS for License Renewal of Nuclear Power Plants (Reference 15), NRC characterized the impact of dredging on water quality as small for all nuclear plants. In the past, Exelon has obtained dredging permits from the USACE and NJDEP (Division of Land Use Regulation), both of which include an environmental review, and as required, will do so in the future.

In Section 4.3.3 in the GEIS, NRC concluded generically that for all facilities, decommissioning impacts to surface and groundwater quality would be small. Because there is nothing about OCNGS's design, location, configuration, operating history, or decommissioning plans that would alter or contradict this generic conclusion and Exelon would comply with regulatory and permit requirements to protect surface water and groundwater resources, Exelon has determined that impacts of decommissioning on water quality would be small and bounded by the analysis in the GEIS.

5.1.4. Air Quality

The GEIS identified decommissioning activities that may have an effect on air quality as including worker transportation to and from the site, dismantling of systems and removal of equipment, movement and open storage of material onsite, demolition of buildings and structures, shipment of material and debris to offsite locations, and operation of concrete batch plants. NRC considered the potential for adverse impacts from these activities, the greatest of which would be fugitive dust, for the range of decommissioning plants and generically determined air quality impacts to be small.

During OCNGS decommissioning, reasonable and appropriate control measures such as wetting of soil piles, covering loads and staging areas, and seeding of bare areas would be implemented to minimize fugitive dust. Permits governing air emissions from the decommissioning activities and equipment would be obtained as required, and as needed. Exelon will maintain existing air permits for equipment that will continue to be used during OCNGS decommissioning. The exhaust from commuting and shipping vehicles could affect air quality somewhat, but it is unlikely that air quality would be degraded sufficiently to be noticeable beyond the immediate vicinity of U.S. Highway 9 and other local roadways. Hence, because (1) the air quality impacts from decommissioning activities at OCNGS are expected to be temporary, localized, and small in magnitude, (2) reasonable and appropriate control measures would be employed, (3) the appropriate air permits would be obtained, and (4) there is nothing about OCNGS's design, location, configuration, operating history, or decommissioning plans that would alter or contradict the generic conclusion in Section 4.3.4 in the GEIS, Exelon concludes that air quality impacts from OCNGS decommissioning activities are bounded by the analysis in the GEIS.

5.1.5. Aquatic Ecology

Aquatic resources may be directly or indirectly impacted by decommissioning activities. Direct impacts to aquatic communities may result from shoreline or in-water construction or from dredging. Indirect impacts may result from construction-related erosion and stormwater runoff. These impacts are typically undetectable (or barely discernible) and do not destabilize any important attributes of the resources. The GEIS concluded generically that such decommissioning activities within the operational areas of nuclear power plants, including removal of shoreline or in-water structures, would have only minor impacts on aquatic communities, provided all appropriate BMPs are employed. Therefore, Section 4.3.5 in the GEIS concluded that aquatic impacts from decommissioning activities would be small. The GEIS further states, however, that if decommissioning activities outside of the operational area are anticipated, impacts to aquatic resources cannot be predicted and must be determined through site-specific analysis.

The aquatic resource of chief concern for decommissioning impacts at OCNGS is Barnegat Bay. Aquatic resources (estuarine / marine resources at OCNGS) may be directly or indirectly impacted by decommissioning activities. Removal of OCNGS structures and buildings and related earth-moving work (digging, grading, filling) in early phases of decommissioning has at least a limited potential to affect water quality, thus aquatic communities, but construction activities like these routinely take place and are subject to the provisions of state and local permits, including employment of BMPs. Accordingly, Exelon concludes that impacts from these types of activities during OCNGS decommissioning would be small.

The degree to which impingement and entrainment at the OCNGS circulating water intake (and entrainment at the dilution water intake, which has no travelling screens) has affected Barnegat Bay fish populations has been debated since the station came on line in 1969. Although OCNGS's cooling system almost certainly affects the distribution and abundance of fish and shellfish in the immediate vicinity of the station's intake and discharge, there is no evidence that this influence extends outside of a fairly small area in Barnegat Bay. Based on an NRC review of impingement and entrainment in support of OCNGS license renewal, it appears that discontinuing station operation will have a beneficial effect on fish and shellfish in near-field locations, including Forked River, Oyster Creek, and western portion of Barnegat Bay, but the Bay-wide impact on important fish and shellfish species would depend on the status of individual species populations (Reference 14). Reducing cooling water withdrawals is expected to result in commensurate reductions in entrainment and impingement losses, which indicates that impacts from withdrawals of water for non-power-related uses, such as the spent fuel pool, will have minimal impact on fish and shellfish populations. Exelon will continue to comply with applicable NJPDES regulations, including Clean Water Act (CWA) Section 316(b)-related regulations, and permit conditions for water withdrawals and wastewater discharges during the OCNGS decommissioning process. Hence, Exelon concludes that impingement and entrainment impacts on aquatic resources in Barnegat Bay during OCNGS decommissioning would be small.

Moving large plant components from the OCNGS powerblock area to the barge landing, which is outside of the operational area, will likely involve heavy equipment, but any ground disturbance would be minor and of relatively brief duration. Any impact on benthic organisms and fish from soil disturbance would be correspondingly minor. As discussed previously, BMPs would be employed, as necessary, to limit erosion and sedimentation. Barging large plant components to Barnegat Bay and beyond may require dredging portions of Oyster Creek and Barnegat Bay to an unknown depth. Impacts from dredging, whether in Oyster Creek or Barnegat Bay, are expected to be small, because (1) NRC's detailed review of dredging impacts at U.S. nuclear power plants in the GEIS for License Renewal of Nuclear Power Plants (Reference 15) indicates that dredging is a fairly benign activity with impacts to biota that are small at all nuclear plants, (2) both Oyster Creek and Barnegat Bay are regularly dredged to facilitate movement of commercial and recreational vessels, thus are not pristine waterbodies, and (3) any dredging that is carried out will be subject to USACE and NJDEP environmental permitting reviews and any other-than-minor impacts predicted would likely have to be mitigated.

In conclusion, Exelon has determined that impacts of OCNGS decommissioning on aquatic resources, including those outside of the operational area, are small. Hence, Exelon concludes that such impacts are bounded by the analysis in the GEIS. Also, Exelon will obtain prior approvals, as needed, for dredging and ground disturbance associated with decommissioning and will continue to comply with applicable NJPDES regulations, including CWA Section 316(b)-related regulations, and permit conditions for water withdrawals and wastewater discharges during the OCNGS decommissioning process.

5.1.6. Terrestrial Ecology

Section 4.3.6 of the GEIS maintains that "[f]or facilities where habitat disturbance is limited to operational areas, the impacts on terrestrial ecology (i.e., plant and animal communities) are not detectable or destabilizing," primarily because most vegetation and wildlife habitat in the operational area was removed during plant construction. NRC staff concluded that, "for such

facilities…potential impacts to terrestrial ecology are small" and no further mitigation measures are warranted. Site-specific analysis is only required of licensees when decommissioning activities are likely to occur outside of the operational area.

Terrestrial habitats in the vicinity of the OCNGS site are described in the site-specific environmental assessments listed in Section 5.0 and the application Exelon submitted to the Wildlife Habitat Council when it sought to have the site recertified under the Wildlife at Work program. Prior to station construction, the operational area consisted primarily of pitch pine-scrub oak woodlands and freshwater wetlands. Most of the native vegetation was removed during construction, and most of the site's wetlands were drained and filled. Only scattered patches of low-quality wildlife habitat remained onsite after the station was built. Over time, the areas north and south of the power block area recovered (some as a result of active restoration / revegetation efforts, some as a result of natural successional changes), and they now support habitats including open grassland / meadow, cedar / conifer forest, pitch pine-scrub oak forest, and freshwater wetland. Although these habitats support a variety of disturbance-tolerant wildlife species, their value as wildlife habitat is reduced by the fact that they are ringed by industrial canals, bordered to the east by a busy highway, and exposed to human activity and noise from the station. Accordingly, Exelon concludes that impacts of decommissioning activities within the OCNGS operational area would be small.

Exelon intends to use the barge landing on the north bank of Oyster Creek to transfer large plant components to barges during decommissioning. The barge landing, which is located outside the operational area, was first used during transport of the reactor pressure vessel to the site more than 50 years ago, and since then, it has been used as needed during removal and delivery of other large plant components, Any transfer of a large plant component during decommissioning would be of short duration and would have minimal impact on terrestrial resources because the components will be transported across (1) a heavy-industrial area, (2) a highway, and (3) a previously-disturbed area that contains no unusual, rare, or sensitive plants or animals, and no important / sensitive habitats. Because no high-value terrestrial habitats (such as native prairie, open-canopy savannah, bog, pocosin, white cedar swamp, or mature forest) will be disturbed, impacts are expected to be small and should not require mitigation, beyond routine construction BMPs. Therefore, Exelon concludes that impacts of OCNGS decommissioning on terrestrial resources located outside of the operational area, are small.

In conclusion, Exelon has determined that impacts of OCNGS decommissioning on terrestrial resources, including those outside of the operational area, are small. Hence, Exelon concludes that such impacts are bounded by the analysis in the GEIS.

5.1.7. Threatened and Endangered Species

The GEIS lists stabilization, large component removal, decontamination and dismantlement (removal of contaminated soil), and structure dismantlement as activities with potential to impact threatened and endangered species. Section 4.3.7 in the GEIS did not make a generic determination on the impact of decommissioning on threatened and endangered species, noting that impacts to these species are expected to be minor and non-detectable when activities are confined to the site operational area. Impacts are to be determined on a site-specific basis, paying particular attention to activities outside of the developed operational area. Noise and dust generation from construction activity and increased truck traffic, rather than direct impacts such as habitat destruction, are the primary concerns.

Table 5.1 identifies state and federally listed species potentially occurring in the vicinity of OCNGS based on site-specific assessments conducted in support of license renewal (2005-2007), information Exelon submitted to the Wildlife Habitat Council in 2015, the Ocean County rare plant list (dated March 2014) that is posted on the New Jersey Natural Heritage Program website, and the profiles of federally listed species on the website of the New Jersey Field Office of the U.S. Fish and Wildlife Service (FWS) (updated September 2017).

Table 5.1:
State and Federally Listed Species Potentially Occurring in the Vicinity of OCNGS

Scientific Name	Common Name	Federal Status[a]	State Status[b]
Vascular Plant			
Amaranthus pumilus	Seabeach Amaranth	LT	E
Arnoglossum atriplicifolium	Pale Indian Plantain		E
Aster radula	Low Rough Aster		E
Cardamine longii	Long's Bittercress		E
Cirsium virginianum	Virginia Thistle		E
Clitoria mariana	Butterfly-pea		E
Corema conradii	Broom Crowberry		E
Cyperus pseudovegetus	Marsh Flat Sedge		E
Desmodium pauciflorum	Few-flower Tick-trefoil		E
Diodia virginiana var. virginiana	Larger Buttonweed		E
Eleocharis tortilis	Twisted Spike-rush		E
Eriophorum tenellum	Rough Cotton-grass		E
Eupatorium resinosum	Pine Barren Boneset		E
Fraxinus profunda	Pumpkin Ash		E
Galactia volubilis	Downy Milk-pea		E
Gnaphalium helleri var. micradenium	Small Everlasting		E
Helonias bullata	Swamp-pink	LT	E
Honckenya peploides var. robusta	Seabeach Sandwort		E
Hottonia inflata	Featherfoil		E
Jeffersonia diphylla	Twinleaf		E
Juncus caesariensis	New Jersey Rush		E
Juncus torreyi	Torrey's Rush		E
Kyllinga pumila	Low Spike Sedge		E
Limosella australis	Awl-leaf Mudwort		E

Scientific Name	Common Name	Federal Status[a]	State Status[b]
Linum intercursum	Sandplain Flax		E
Luzula acuminata var. acuminata	Hairy Wood-rush		E
Malaxis unifolia	Green Adder's-mouth		E
Melanthium virginicum	Virginia Bunchflower		E
Myriophyllum tenellum	Slender Water-milfoil		E
Myriophyllum verticillatum	Whorled Water-milfoil		E
Narthecium americanum	Bog Asphodel		E
Nuphar lutea ssp. pumila	Small Yellow Pond-lily		E
Onosmodium virginianum	Virginia False-gromwell		E
Plantago pusilla	Dwarf Plantain		E
Polygonum glaucum	Sea-beach Knotweed		E
Ranunculus cymbalaria	Seaside Buttercup		E
Rhynchospora knieskernii	Knieskern's Beaked-rush	LT	E
Rhynchospora microcephala	Small-head Beaked-rush		E
Rhynchospora recognita	Coarse Grass-like Beaked-rush		E
Rumex hastatulus	Engelmann's Sorrel		E
Sagittaria teres	Slender Arrowhead		E
Schoenoplectus maritimus	Saltmarsh Bulrush		E
Schwalbea americana	Chaffseed	LE	E
Scirpus longii	Long's Woolgrass		E
Spiranthes laciniata	Lace-lip Ladies'-tresses		E
Stylisma pickeringii var. pickeringii	Pickering's Morning-glory		E
Tridens flavus var. chapmanii	Chapman's Redtop		E
Triglochin maritima	Seaside Arrow-grass		E
Utricularia biflora	Two-flower Bladderwort		E
Utricularia minor	Lesser Bladderwort		E
Utricularia resupinata	Reversed Bladderwort		E
Uvularia puberula var. nitida	Pine Barren Bellwort		E
Valerianella radiata	Beaked Cornsalad		E
Verbena simplex	Narrow-leaf Vervain		E
Xyris fimbriata	Fringed Yellow-eyed-grass		E
Zigadenus leimanthoides	Death-camus		E

Scientific Name	Common Name	Federal Status[a]	State Status[b]
Invertebrates			
Cincindela d. dorsalis	Beetle, Northeastern beach tiger	LT	E
Nicrophorus americanus	Beetle, American burying	LE*	E
Fish			
Acipenser oxyrinchus oxyrinchus	Sturgeon, Atlantic	LE**	E
Acipenser brevirostrum	Sturgeon, shortnose	LE	E
Amphibians			
Ambystoma tigrinum	Salamander, Eastern tiger		E
Hyla andersonii	Treefrog, Pine Barrens		T
Hyla chrysocelis	Treefrog, Southern gray		E
Reptiles			
Caretta caretta	Loggerhead, Atlantic		E
Chelonia mydas	Turtle, green	LT	T
Clemmys muhlenbergii	Turtle, bog	LE	E
Crotalus h. horridus	Rattlesnake, timber		E
Dermochelys coriacea	Leatherback, Atlantic	LE	E
Elaphe g. guttata	Snake, corn		E
Eretmochelys imbricata	Hawksbill, Atlantic	LE	E
Glyptemys insculpta	Turtle, wood		T
Lepidochelys kempii	Ridley, Kemp's	LE	E
Pituophis m. melanoleucus	Snake, Northern pine		T
Birds			
Ammodramus henslowii	Sparrow, Henslow's		E
Ammodramus savannarum BR	Sparrow, grasshopper BR		T
Asio flammeus BR	Owl, short-eared BR		E
Batramia longicauda	Sandpiper, upland		E
Botaurus lentiginosos BR	Bittern, American BR		E
Buteo lineatus BR	Hawk, red-shouldered BR		E
Calidris canutus	Knot, red	LT	E
Charadrius melodus	Plover, piping	LT	E
Circus cyaneus BR	Harrier, Northern BR		E
Cistothorus platensis	Wren, sedge		E

Scientific Name	Common Name	Federal Status[a]	State Status[b]
Falco peregrinus BR	Falcon, peregrine BR		E
Falco sparverius	Kestrel, American		T
Haliaeetus leucocephalus BR	Eagle, bald BR		E
Haliaeetus leucocephalus NB	Eagle, bald NB		T
Laterallus jamaicensis BR	Rail, black BR		E
Laterallus jamaicensis NB	Rail, black NB		T
Melanerpes erythrocephalus	Woodpecker, red-headed		T
Nyctanassa violacea	Night-heron, yellow-crowned		T
Nycticorax nycticorax BR	Night-heron, black-crowned BR		T
Pandion haliaetus BR	Osprey BR		T
Passerculus sandwichensis	Sparrow, savannah		T
Podilymbus podiceps BR	Grebe, pied-billed BR		E
Pooecetes gramineus BR	Sparrow, vesper BR		E
Rynchops niger	Skimmer, black		E
Sterna dougallii	Tern, roseate	LE	E
Sternula antillarum	Tern, least		E
Strix varia	Owl, barred		T
Mammals			
Lynx rufus	Bobcat		E
Myotis septentrionalis	Bat, Northern long-eared	LT	

[a] LT = federally threatened; LE = federally endangered
[b] T = state threatened; E = state endangered
BR = breeding population
NB = nonbreeding population
*Believed to have been extirpated in New Jersey
**New York Bight and Chesapeake Bay populations

5.1.7.1. *Protected Terrestrial Species*

Decommissioning activities at OCNGS with greatest potential for directly and indirectly affecting sensitive terrestrial species are those scheduled for late phases, when large plant components would be moved to the barge landing, and major reactor and support structures would be razed. There appears to be sufficient space within the operational area for all decommissioning activities (save movement of large plant components to the barge landing) and temporary storage of materials and equipment. Because there is ample open space in the operational area to support OCNGS decommissioning operations, there would be no reason to disturb any undeveloped land outside of the site operational area that provides high-quality habitat, unless movement of large components to the barge landing would have such an effect.

Moving large plant components from the powerblock area to the barge landing will likely involve heavy equipment and could produce some minor soil disturbance. These activities will be of short duration and take place in previously disturbed areas on Exelon-owned land that has very little value as wildlife habitat. No protected terrestrial species will be affected by this activity.

5.1.7.2. *Protected Aquatic Species*

No protected fish species were found in pre-operational surveys of freshwater reaches of Oyster Creek and the South Branch of the Forked River or in Barnegat Bay. Atlantic sturgeon and shortnose sturgeon are found in the Delaware River in New Jersey, but none of the resource agencies contacted by the NRC in 2006 when OCNGS was seeking to renew its operating license evidenced concern about these species. Furthermore, neither has been collected by biologists conducting ecological studies at OCNGS.

Sea turtles were first observed in the vicinity of OCNGS in 1992, when one Kemp's Ridley and two loggerhead sea turtles (one loggerhead was captured twice) were impinged on the station's circulating water intake trash rack. Since 1992, the number of sea turtles impinged annually at the OCNGS intakes has ranged from zero (1995 and 1996) to 12 (in 2015). Most (85; 72.0 percent) of the sea turtles impinged have been Kemp's ridley turtles. Smaller numbers of loggerhead sea turtles (17; 14.4 percent) and green sea turtles (16; 13.6 percent) have also been impinged. In most years, relatively few turtles are found dead at the intakes, and some of these appear to have floated into the intakes after being struck by boats (or propellers) or succumbing to disease. Of 36 sea turtles collected over the 2013-2017 timeframe, 29 (80.6 percent) were recovered alive and 7 (19.4 percent) were recovered dead. When the plant's circulating water and dilution water systems are shut down, impingement at the two intakes should be completely eliminated, and a source of potential harm to sea turtles will also be eliminated.

Barging large plant components from Oyster Creek to Barnegat Bay and beyond may require dredging portions of Oyster Creek between the barge landing and Barnegat Bay to an unknown depth to allow barge passage. In the past, Exelon has obtained dredging permits from the USACE and NJDEP (Division of Land Use Regulation), both of which include an environmental review. If dredging could affect threatened or endangered species or critical habitat, as established under the Endangered Species Act, the USACE must consult with FWS or the National Marine Fisheries Service (NMFS). The USACE would probably require mitigation measures if dredging is likely to result in a "taking" of a federally listed sea turtle. Exelon therefore concludes that adverse impacts to threatened and endangered aquatic species from dredging activities are not likely to occur.

5.1.7.3. *Conclusion*

Exelon has determined that none of the planned decommissioning activities at OCNGS would encroach on the habitat of any state or federally-listed terrestrial species. Any indirect (disturbance-related) impacts from construction noise and human activity would be localized, of short duration, and ecologically insignificant.

Three federally-listed sea turtles have historically strayed into Barnegat Bay and could, in theory, be disturbed by dredging in the Bay, should dredging be necessary. However, if dredging is necessary, permits would be obtained from the USACE and NJDEP. Both agencies would conduct environmental reviews, including an assessment of potential impacts to threatened and endangered species, and could impose mitigation measures to protect affected species during

the dredging activities. In addition, because federally listed sea turtle species that have been impinged at the circulating water intake and dilution water intake during OCNGS operation will no longer be at risk after intake flows cease, decommissioning could have positive effects on those species.

Based on the site-specific findings summarized above, Exelon concludes that OCNGS decommissioning activities are unlikely to adversely affect any threatened or endangered species and will have no effect on any designated critical habitat. Therefore, additional mitigation is not warranted. However, as decommissioning plans mature, if changes in threatened and endangered species listings or critical habitat designations occur that affect this conclusion, Exelon will update the PSDAR in accordance with applicable NRC regulations.

5.1.8. Radiological

The GEIS considered radiological doses to workers and members of the public when evaluating the potential consequences of decommissioning activities and concludes that radiological impacts of decommissioning activities are small.

5.1.8.1. *Occupational Dose*

One conclusion of the GEIS is that, based on decommissioning experience, occupational dose during decommissioning is comparable to that observed during routine operations at the same or similar facilities. Therefore, Exelon evaluated OCNGS operational dose data and compared it to that of other BWRs and established that OCNGS operating collective dose is typical of U.S. BWRs. Furthermore, Exelon calculated occupational collective dose expected during the decommissioning period using methodology from NUREG/CR-6174, "Revised Analysis of Decommissioning for the Reference Boiling Water Reactor Power Station," (Reference 16). The calculated decommissioning collective dose was lower than that reported in NUREG/CR-6174 for the reference BWR. Thus, OCNGS decommissioning occupational dose is expected to be within the range of doses presented in the GEIS. There are no unique characteristics at OCNGS that would invalidate this conclusion.

Exelon selected a deferred decommissioning strategy, ensuring that most exposure scenarios will result in lower occupational doses than those during operations due to the fact that the plant has been defueled and a period of radioactive decay has reduced the radiological inventory. The OCNGS As Low as Reasonability Achievable (or ALARA) program and regulatory limits on dose will remain in effect during decommissioning.

5.1.8.2. *Public Dose*

Section 4.3.8 in the GEIS states that radionuclide emissions in gaseous and liquid effluents are reduced in facilities undergoing decommissioning. Given that OCNGS public doses during operations were well within the NRC-established public dose limits, it is reasonable to expect that public doses during decommissioning would also be well within such limits. Annual reports of environmental monitoring at OCNGS for the years from 2012 through 2016 demonstrate that radioactivity levels in the offsite environment are not measurably increasing, and controls on potential radiological releases will continue to be applied during decommissioning.

5.1.8.3. *Conclusion*

Exelon concludes that radiological impacts of OCNGS decommissioning are small for the following reasons:

- The GEIS generic evaluation of radiological impacts applies to a typical BWR. Both occupational dose and public dose from normal OCNGS operations are like those of other BWR plants, indicating that OCNGS doses are typical.
- The OCNGS collective worker dose estimate for the decommissioning periods is lower than that predicted by NUREG/CR-6174.
- Deferred or delayed decommissioning allows for radionuclides to decay over time, resulting in less dose at the time of decommissioning.
- Public doses during OCNGS operations have been well within the NRC-established public dose limits and are reasonably expected to decrease during decommissioning.

Therefore, Exelon further concludes that the radiological impacts of OCNGS decommissioning are bounded by the analysis in the GEIS.

5.1.9. Radiological Accidents

Section 4.3.9 in the GEIS examined a range of radiological accidents hypothetically possible during the decommissioning period. These included anticipated operational occurrences, non-nuclear fuel-related accidents, and nuclear fuel-related accidents. NRC determined that many of these accidents had been previously analyzed in environmental reviews for the operation of the plant. The GEIS concludes that impacts of radiological accidents of all types applicable to decommissioning activities are small.

The anticipated operational occurrences such as those identified in the GEIS were considered in the Final Environmental Statement (Reference 13) for operation of OCNGS. Given their potential to result in offsite doses, the GEIS considered spent fuel accidents of most concern for decommissioning. Once in dry cask storage, however, spent fuel management is no longer within the scope of decommissioning environmental review because NRC evaluated the environmental impacts of continued spent fuel storage for all nuclear power plants in NUREG-2157, "Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel," (Reference 17). Consequently, the only accidents of importance to offsite doses during decommissioning are those involving spent nuclear fuel in the spent fuel pool. Spent fuel pool accidents would no longer be applicable after the spent fuel is moved to dry cask storage.

The most significant of the spent fuel accidents, in terms of consequences and probability, involves spent fuel pool drainage leading to a zirconium fire. However, the NRC, in both NUREG-2157 and the GEIS, determined that the risk of a zirconium fire is very low (but, should it occur, the consequences could be high).

Exelon has determined that a zirconium fire accident is potentially possible (but very improbable) during a portion of the time that OCNGS spent fuel would be stored in the spent fuel pool. Permanently Defueled Technical Specifications have been proposed for OCNGS which mitigate this possibility. Also, Exelon knows of no unique features or conditions at OCNGS that would lead

to a conclusion concerning radiological accidents different than that reached in the GEIS. Therefore, Exelon concludes that radiological accident impacts of decommissioning activities at OCNGS would be small, and are thus bounded by the analysis in the GEIS.

5.1.10. Occupational Issues

Section 4.3.10 in the GEIS concluded that impacts due to occupational issues would be small for all plants based on strict adherence to NRC and Occupational Safety and Health Administration (OSHA) safety standards, practices, and procedures.

OCNGS decommissioning will be conducted under a comprehensive nonradiological safety and health program meeting OSHA, NRC, and plant procedural requirements. Exelon facilities have lower rates of injuries and illness than the national average for electrical utilities, and historically, the nuclear power industry has lower rates of injuries and illnesses than other industries. The OCNGS site-specific decommissioning plan poses no unique hazards from what was evaluated in the GEIS. Accordingly, Exelon concludes that anticipated impacts resulting from nonradiological occupational issues during OCNGS decommissioning are small and thus bounded by the analysis in the GEIS.

5.1.11. Cost

A site-specific decommissioning cost estimate is provided in Section 4.0. Section 4.3.11 of the GEIS recognizes that an evaluation of decommissioning cost is not a National Environmental Policy Act requirement. Therefore, a bounding analysis is not applicable.

5.1.12. Socioeconomics

Section 4.3.12 in the GEIS evaluated changes in workforce and population, changes in local tax revenues, and changes in public services for decommissioning. NRC considered the decreases in workforce and tax payments related to the cessation of operations outside the scope of decommissioning. The GEIS concluded that socioeconomic impacts are neither detectable nor destabilizing and that mitigation measures are not warranted.

As OCNGS ceases operation and transitions through the phases of decommissioning, an overall decrease in plant workforce and tax payments will occur. The changes during decommissioning would primarily impact Ocean County where the majority (>83 percent) of the plant workforce resides and Lacey Township which receives the preponderance of OCNGS property tax payments. The largest station workforce reduction (during decommissioning) would decrease the Ocean County population by 0.2 percent. OCNGS is not a significant source of tax revenue for state and local government. Plant property tax payments during operation have been approximately 4 percent of Lacey Township revenue. Compared with the existing property tax base, the anticipated decrease in OCNGS property taxes as a result of decommissioning is likely to be small.

Based on the findings summarized above, Exelon concludes that impacts to socioeconomic resources from OCNGS decommissioning would be small and thus bounded by the analysis in the GEIS.

5.1.13. Environmental Justice

Section 4.3.13 in the GEIS determined environmental justice to be an environmental impact area for which no generic conclusion could be determined due to its site-specific nature. Therefore, the GEIS indicates that site-specific assessments for each decommissioning nuclear power plant must be prepared.

Exelon prepared a site-specific assessment of environmental justice as it relates to the effects of OCNGS decommissioning. Exelon examined the geographic distribution of minority and low-income populations within a 50-mile radius of the OCNGS site using the 2012-2016 American Community Survey 5-year estimates. Census block groups containing minority populations were identified and were concentrated in the larger metropolitan areas, such as Philadelphia, Trenton, and Atlantic City. The nearest minority population is located about 8 miles north of OCNGS, near Toms River. Census block groups containing low-income populations were concentrated in the cities of Philadelphia and Trenton. The nearest low-income population is located near Toms River approximately 9 miles north of OCNGS.

Exelon determined that decommissioning impacts to all resource areas would be small, indicating that the effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. Because no member of the public will be substantially affected, there can be no disproportionately high and adverse impact or effects on minority and low-income populations resulting from the decommissioning of OCNGS. Based on these site-specific findings, Exelon concludes that the impacts of decommissioning OCNGS on minority and low-income populations are small.

5.1.14. Cultural, Historical, and Archaeological Resources

Section 4.3.14 in the GEIS determined that potential effects of decommissioning on cultural, historical and archaeological resources would be small for all plants when the decommissioning activities are confined to the operational area. However, impacts outside the operational area "must be determined through site-specific analysis."

Exelon anticipates that decommissioning activities will take place within the OCNGS operational area, except for the use of the existing barge landing on the north bank of Oyster Creek and the possible use of offsite fill to backfill the foundations of buildings and structures after demolition.

Exelon conducted a review of available information including data on locations of inventoried resources from the New Jersey Historic Preservation Office (NJHPO) about cultural, historical, and archaeological resources for the OCNGS site and an approximately 6-mile radius. Currently, no historic properties, including prehistoric and historic archaeological sites, above-ground historic structures or traditional cultural properties eligible for listing or listed on the National Register of Historic Places are present within the OCNGS operational area. As part of the OCNGS license renewal process, the NJHPO concurred that continued operation of OCNGS would not adversely affect cultural or historic resources at the plant or its immediate environs because no expansion or structural modifications were planned and maintenance activities would be limited to previously disturbed areas. Decommissioning activities within the previously disturbed operational area would not impact cultural resources.

The barge landing and the access from OCNGS to the landing are areas of prior ground disturbance and any improvements to the landing or access are expected to be limited to areas of previous ground disturbance. If dredging in Oyster Creek or portions of Barnegat Bay is necessary for barge passage, dredging would be performed under a USACE permit, whose permitting requirements include review of potential impacts to cultural resources. Also, it is anticipated that dredging would follow the channel established during construction and there would be little likelihood that any marine archaeological resources would be disturbed by dredging. Exelon therefore concludes that use of the existing barge landing on the north bank of Oyster Creek would not impact cultural and historical resources.

Clean backfill for demolished building and structure foundations will be sourced from onsite demolition activities, offsite, previously disturbed land, or other areas already cleared of cultural resources. Exelon therefore concludes that the possible use of offsite fill to backfill the foundations of buildings and structures after demolition will not impact cultural and historical resources.

Should an unanticipated discovery of a cultural resource be made during decommissioning of OCNGS, plant procedures would be implemented to address the discovery.

Based on the findings discussed above, Exelon concludes that impacts of OCNGS decommissioning to cultural, historical, and archaeological resources, including those outside of the operational area, are small and thus bounded by the analysis in the GEIS.

5.1.15. Aesthetic Issues

Section 4.3.15 in the GEIS singles out structure dismantlement and entombment as the only activities that may have impacts on aesthetic resources. The aesthetic impacts of decommissioning fall into two categories: (a) impacts, such as noise, associated with decommissioning activities that are temporary and cease when decommissioning is complete and (b) the changed appearance of the site when decommissioning is complete. NRC drew the generic conclusion that for all plants, the potential impacts from decommissioning on aesthetics are small and that the removal of structures is generally considered beneficial to the aesthetics of the site.

Some plant structures at OCNGS (e.g., ventilation stack, turbine and reactor buildings) can be readily seen from most directions. The ventilation stack's blinking marker lights can be seen as far as the Atlantic Ocean and as such serve as an unofficial navigational aid.

During OCNGS decommissioning, the impact of noise and dust would be temporary and controlled to minimize impacts. The appearance of OCNGS will be altered as the buildings and structures are dismantled. The visual intrusion during dismantlement would be temporary and would serve to reduce the aesthetic impact of the site. Exelon assumes that negotiations with the State of New Jersey will allow the intake and discharge canals created for the plant's cooling system to remain and over time return to a more natural appearance. Therefore, Exelon concludes that the impacts of OCNGS decommissioning on aesthetics are small and generally considered beneficial. Thus, such impacts are bounded by the analysis in the GEIS.

5.1.16. Noise

Section 4.3.16 in the GEIS generically examined noise during decommissioning, concluding that noise impacts would be small. NRC considered noise impacts for operation of OCNGS in the SEIS for license renewal (Reference 14) and concluded the noise impact of plant operation would be small. The noise levels associated with the decommissioning activities are not expected to be any more severe than during refueling outages and are not expected to present an audible intrusion on the surrounding community and environment. Decommissioning activities will be primarily limited to previously disturbed land surrounding the power block and isolated from both wildlife and members of the public. Therefore, because OCNGS decommissioning activities are of the type previously considered by NRC and OCNGS has no site-specific conditions that would alter the NRC's prior findings, Exelon concludes that the noise impacts from decommissioning activities would be small and thus bounded by the analysis in the GEIS.

5.1.17. Transportation

Section 4.4.17 in the GEIS, NRC states that its "regulations are adequate to protect the public against unreasonable risk from the transportation of radioactive materials." Therefore, the effects of transportation of radioactive waste on public health and safety are considered to be neither detectable nor destabilizing. Exelon will comply with NRC and Department of Transportation regulations for shipments of radioactive waste from OCNGS decommissioning.

The GEIS analyzes radiological shipments of waste from decommissioning and calculates incident-free doses and latent cancer fatalities to crew, the public along the route, and onlookers. The GEIS also calculates the collective dose for radiological accidents during transportation. The calculated impacts are closely related to the distance shipped, volumes shipped, and activity levels. The estimated volumes of radioactive waste associated with OCNGS decommissioning are summarized in Table 5.2.

Table 5.2:
Estimated Radioactive Waste Associated with OCNGS Decommissioning

Waste Type	**Volume (ft^3)**
High-activity waste	
Class B and C	1,770
Class A	23,518
Low-activity waste (Class A)	17,014
Very low-activity waste (Class A)	523,153

Considering radiological impacts alone, the conclusions in the GEIS would bound those of OCNGS decommissioning. Exelon considered a scenario that bounds the potential distance the OCNGS shipments would travel. In this scenario, Class A wastes are shipped to the EnergySolutions disposal site in Utah and Class B and C wastes are shipped to the Barnwell Atlantic Low-Level Waste Compact facility in South Carolina. The transportation impacts would be reduced if Class A waste generated at OCNGS was disposed at the Barnwell facility.

The OCNGS waste shipments would travel shorter distances than were analyzed in the GEIS. For OCNGS, the volumes would be lower for both high-activity and low-activity waste than the waste volumes NRC considered in the GEIS analysis. In the GEIS evaluation, the low-activity waste shipments were assumed to exhibit lower external dose rates (i.e., one-tenth of regulatory limits) and for very low-activity waste are sufficiently small that the activity may be neglected in evaluating the radiological impacts of transportation. Very low-activity waste is expected to comprise 92.5 percent of the overall OCNGS waste volume and would have negligible radiological impacts. The radioactive shipments, combined with nonradioactive shipments and other transportation, will occur over an extended period of time and will not result in significant changes to public safety or the transportation infrastructure.

The GEIS concludes that both nonradiological and radiological impacts of decommissioning transportation are small. No unique features or site-specific conditions are present at OCNGS that would alter these NRC prior findings. Therefore, Exelon concludes that transportation impacts of OCNGS decommissioning are small and thus bounded by the analysis in the GEIS.

5.1.18. Irreversible and Irretrievable Commitment of Resources

Section 4.3.18 in the GEIS generically concluded that the impacts of decommissioning on irreversible and irretrievable commitments of resources are small. Given that OCNGS would be decommissioned to radiological standards for unrestricted release, the land will be available for other uses. Furthermore, the materials and fuel consumed during OCNGS decommissioning would be minor. The decommissioning of OCNGS would generate radioactive waste and nonradiological waste requiring land disposal. Land devoted to radioactive waste disposal sites or industrial landfills was not within the scope of the GEIS because such commitments are addressed in the licensing documents for the disposal sites. Therefore, Exelon concludes that the impacts of OCNGS decommissioning on irreversible and irretrievable commitments of resources would be small and thus bounded by the analysis in the GEIS.

5.2. ENVIRONMENTAL IMPACTS OF LICENSE TERMINATION – NUREG-1496

According to the schedule provided in Section 3 of this report, a LTP for OCNGS will be developed and submitted to NRC approximately two years prior to the anticipated license termination date. The LTP will include a supplement to the OCNGS PSDAR Environmental Report (ER) describing any new information or significant environmental change associated with the proposed termination activities. Although the LTP, including a supplement to the ER, need not be prepared and submitted until a minimum of two years prior to the anticipated license termination date, as required by 10 CFR 50.82(a)(9), the absence of any unique site-specific factors, significant groundwater contamination, unusual demographics, or impediments to achieving unrestricted release indicate that impacts resulting from OCNGS license termination will be similar to those evaluated in NUREG-1496 (Reference 12).

5.3. DISCUSSION OF DECOMMISSIONING IN THE SEIS

As part of the OCNGS license renewal, decommissioning was addressed in Section 7 of the SEIS for license renewal (Reference 14). The NRC did not identify any new and significant information during their review and, therefore, NRC concluded that there would be no impacts beyond those discussed in the 1996 version of the GEIS for License Renewal of Nuclear Plants, NUREG-1437. For all of the Category 1 issues applicable to decommissioning, NRC concluded that the impacts

would be small, and that additional plant-specific mitigation measures would not likely be sufficiently beneficial to be warranted. There are no newly contemplated decommissioning activities for OCNGS that would alter that conclusion.

5.4. ADDITIONAL CONSIDERATIONS

The following considerations are relevant to concluding that OCNGS decommissioning activities prior to license termination will not result in significant environmental impacts not previously reviewed:

- Continued compliance with radiological release and dose regulatory limits and adherence to plant procedures for monitoring.
- Continued site access control to minimize or eliminate radiation release pathways to the public.
- Transport of radioactive waste in accordance with plant procedures, applicable Federal regulations, and the requirements of the receiving facility.
- Continued adherence to ALARA principles during decommissioning and compliance with occupational dose limits.
- Continued compliance with applicable regulations and permit conditions for water withdrawals and wastewater discharges.
- Continued storage of spent fuel in accordance with license and plant procedures.

Additionally, NUREG-2157, "Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel," found that the generic environmental impacts of ongoing spent fuel storage are small (Reference 17).

5.5. CONCLUSIONS

Exelon evaluated the site-specific impacts anticipated from decommissioning of OCNGS for each environmental resource area in the same manner and context as used by NRC in its GEIS. This evaluation indicates that OCNGS decommissioning activities fall within the range of decommissioning activities considered by NRC in the GEIS. There are no unique aspects of the plant or the expected decommissioning techniques that would invalidate the applicability to OCNGS of the GEIS conclusions. The evaluation indicates that the impacts of OCNGS decommissioning are bounded by the GEIS's assessment for those environmental issues for which NRC made generic determinations. For the areas where a site-specific assessment was required, the anticipated impacts from OCNGS decommissioning were determined to be small. NRC regulation 10 CFR 50.82(a)(6)(ii) prohibits a licensee from performing decommissioning activities that result in significant environmental impacts not previously reviewed. No such impacts have been identified.

6.0 REFERENCES

1. Regulatory Guide 1.185, "Standard Format and Content for Post-Shutdown Decommissioning Activities Report," Revision 1, dated June 2013 (ADAMS Accession No. ML13100A840)

2. Letter from Keith R. Jury, (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission - "Permanent Cessation of Operations at Oyster Creek Nuclear Generating Station," dated January 7, 2011, RA-11-007 (ADAMS Accession No. ML110070507)

3. Letter from Michael P. Gallagher, (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission - "Certification of Permanent Cessation of Power Operations for Oyster Creek Nuclear Power Station," dated February 14, 2018 (ADAMS Accession No. ML18045A084)

4. U.S. Nuclear Regulatory Commission, NUREG-0586, Supplement 1, "Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities," November 2002 (ADAMS Accession No. ML023470304 (Vol 1) and ML023470323 (Vol 2))

5. Letter from James Barstow, (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission - "Submittal of Updated Decommissioning Cost Analysis for Oyster Creek Nuclear Generation Station," dated March 30, 2016 (ADAMS Accession No. ML16090A067)

6. Letter from Michael P. Gallagher, (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission - "Update to Spent Fuel Management Plan for Oyster Creek Nuclear Generating Station," dated May 21, 2018 (ADAMS Accession No. ML18141A486)

7. Atomic Industrial Forum, AIF/NESP-036, "A Guideline for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," May 1986

8. Letter from Michael P. Gallagher, Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission - "Request for Exemption from 10 CFR 50.82(a)(8)(i)(A) and 10 CFR 50.75(h)(1)(iv)," dated March 22. 2018 (ADAMS Accession No. ML18081A201)

9. Letter from Patrick Simpson, (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission - "Report on Status of Decommissioning Funding for Shutdown Reactors, Reactors within 5 Years of Shutdown, and Reactor Involved in an Acquisition," dated March 28, 2018

10. U.S. Nuclear Regulatory Commission, Regulatory Guide 1.159, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors," Revision 2, dated October 2011

11. Environmental Report, Post-Shutdown Decommissioning Activities Report, Oyster Creek Nuclear Generating Station, dated April 18, 2018

12. U.S. Nuclear Regulatory Commission, NUREG-1496, "Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of

NRC-Licensed Nuclear Facilities," dated July 1997 (ADAMS Accession No. ML042310492)

13. Atomic Energy Commission. 1974. Final Environmental Statement related to the Operation of Oyster Creek Nuclear Generating Station Unit 1. December (ADAMS Accession No. ML072200150)

14. U.S. Nuclear Regulatory Commission, NUREG-1437, Supplement 28, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 28, Regarding Oyster Creek Nuclear Generating Station," dated January 2007 (ADAMS Accession No. ML070100234 (Vol 1) and ML070100258 (Vol 2))

15. U.S. Nuclear Regulatory Commission, NUREG-1437, Revision 1, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," dated June 2013.

16. U.S. Nuclear Regulatory Commission, NUREG/CR-6174, PNL-9975, "Revised Analysis of Decommissioning for the Reference Boiling Water Reactor Power Station," dated July 1996 (ADAMS Accession No. ML14008A186)

17. U.S. Nuclear Regulatory Commission, NUREG-2157. Vol. 1, "Final Report. Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel," dated September 2014 (ADAMS Accession No. ML14196A105)

18. Nuclear Energy Institute (NEI) Technical Report 07-07, "Industry Groundwater Protection Initiative - Final Guidance Document," August 2007