NUCLEAR REGULATORY COMMISSION

Docket No. 50-219

Exelon Generation Company, LLC

Oyster Creek Nuclear Generating Station

Exemption

I. Background.

Exelon Generation Company, LLC (Exelon or the licensee) is the holder of Renewed Facility Operating License No. DPR-16 for Oyster Creek Nuclear Generating Station (Oyster Creek). The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC) now or hereafter in effect. The facility is located in Ocean County, New Jersey.

By letter dated February 14, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18045A084), Exelon submitted a certification to the NRC that it would permanently cease power operations at Oyster Creek no later than October 31, 2018. On September 17, 2018, Exelon permanently ceased power operations at Oyster Creek. By letter dated September 25, 2018 (ADAMS Accession No. ML18268A258), Exelon certified the permanent removal of fuel from the Oyster Creek reactor vessel.

In accordance with Section 50.82(a)(2) of Title 10 of the *Code of Federal Regulations* (10 CFR), the license for a power reactor facility no longer authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel upon the docketing of the certifications for permanent cessation of operations and permanent removal of fuel from the reactor vessel. The facility is still authorized to possess and store irradiated (i.e., spent) nuclear fuel. Spent fuel is currently stored onsite in the Oyster Creek spent fuel pool (SFP) and a dry cask independent spent fuel storage installation (ISFSI) at the Oyster Creek facility.

Many of the accident scenarios postulated in the updated final safety analysis reports (UFSARs) for operating power reactors involve failures or malfunctions of systems, which could affect the fuel in the reactor core and, in the most severe postulated accidents, would involve the release of large quantities of fission products. With the permanent cessation of operations at Oyster Creek and the permanent removal of the fuel from the reactor vessel, such accidents are no longer possible. The reactor, reactor coolant system, and supporting systems are no longer in operation and have no function related to the storage of the spent fuel. Therefore, emergency planning (EP) provisions for postulated accidents involving failure or malfunction of the reactor, reactor coolant system, or supporting systems are no longer applicable.

The EP requirements of 10 CFR 50.47, “Emergency plans,” and Appendix E to 10 CFR Part 50, “Emergency Planning and Preparedness for Production and Utilization Facilities,” continue to apply to nuclear power reactors that have permanently ceased operation and have permanently removed all fuel from the reactor vessel. There are no explicit regulatory provisions distinguishing EP requirements for a power reactor that is permanently shutdown and defueled from those for a reactor that is authorized to operate. To reduce or eliminate EP requirements that are no longer necessary due to the decommissioning status of the facility, Exelon must obtain exemptions from those EP regulations.

On October 16, 2018, the NRC exempted Exelon from certain EP requirements for Oyster Creek (ADAMS Accession No. ML18220A980). These exemptions eliminated the requirements to maintain an offsite radiological emergency preparedness plan and reduce the scope of onsite EP activities at Oyster Creek, based on the reduced risks of accidents that could result in an offsite radiological release at a decommissioning nuclear power reactor. The October 16, 2018, exemptions were to become effective no earlier than 12 months (365 days) after permanent cessation of power operations at Oyster Creek.

II. Request/Action.

By letter dated November 6, 2018 (ADAMS Accession No. ML18310A306), as supplemented by letter dated February 13, 2019 (ADAMS Accession No. ML19044A643), Exelon requested to modify the effective date of the October 16, 2018, exemptions from 12 months (365 days) to 9.38 months (285 days) after permanent cessation of power operations. Oyster Creek permanently ceased power operations on September 17, 2018. Therefore, the revised effective date of the exemptions would be June 29, 2019. To provide a complete record of the NRC staff's review, the NRC is reissuing the October 16, 2018, exemptions to reflect the revised effective date. These reissued exemptions supersede the exemptions issued on October 16, 2018.

III. Discussion.

In accordance with 10 CFR 50.12, "Specific exemptions," the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when: (1) the exemptions are authorized by law, will not present an undue risk to public health and safety, and are consistent with the common defense and security; and (2) any of the special circumstances listed in 10 CFR 50.12(a)(2) are present. These special circumstances include, among other things, that the application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule.

As noted previously, the EP regulations contained in 10 CFR 50.47(b) and Appendix E to 10 CFR Part 50 apply to both operating and shutdown power reactors. The NRC has consistently acknowledged that the risk of an offsite radiological release at a power reactor that has permanently ceased operations and permanently removed fuel from the reactor vessel is

significantly lower, and the types of possible accidents are significantly fewer, than at an operating power reactor. However, the EP regulations do not recognize that once a power reactor permanently ceases operation, the risk of a large radiological release from credible emergency accident scenarios is significantly reduced. The reduced risk for any significant offsite radiological release is based on two factors. One factor is the elimination of accidents applicable only to an operating power reactor, resulting in fewer credible accident scenarios. The second factor is the reduced short-lived radionuclide inventory and decay heat production due to radioactive decay. Due to the permanently defueled status of the reactor, no new spent fuel will be added to the SFP and the radionuclides in the current spent fuel will continue to decay as the spent fuel ages. The irradiated fuel will produce less heat due to radioactive decay, increasing the available time to mitigate a loss of water inventory from the SFP. The NRC's NUREG/CR-6451, "A Safety and Regulatory Assessment of Generic BWR [Boiling Water Reactor] and PWR [Pressurized Water Reactor] Permanently Shutdown Nuclear Power Plants," dated August 1997 (ADAMS Accession No. ML082260098), and the NRC's NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," dated February 2001 (ADAMS Accession No. ML010430066), confirmed that for permanently shutdown and defueled power reactors that are bounded by the assumptions and conditions in the reports, the risk of offsite radiological release is significantly less than for an operating power reactor.

The EP exemptions previously approved for Oyster Creek were based on the licensee's demonstration that: (1) the radiological consequences of design-basis accidents would not exceed the limits of the U.S. Environmental Protection Agency's (EPA) early phase Protective Action Guides (PAGs) of one roentgen equivalent man (rem) at the exclusion area boundary; and (2) in the highly unlikely event of a beyond-design-basis accident resulting in a loss of all modes of heat transfer from the fuel stored in the SFP, there is sufficient time to initiate appropriate mitigating actions, and if needed, for offsite authorities to implement offsite

protective actions using a Comprehensive Emergency Management Program, or “all-hazards,” approach to protect the health and safety of the public.

With respect to design-basis accidents at Oyster Creek, the licensee demonstrated that, as of 33 days after the permanent cessation of operations, the radiological consequences of the only remaining design-basis accident with potential for offsite radiological release (the fuel handling accident (FHA) in the Auxiliary Building, where the SFP is located) will not exceed the limits of the EPA early phase PAGs to the public beyond the exclusion area boundary. Exelon stated that this analysis remains unchanged. Because the requested effective date of the exemptions is 285 days following permanent cessation of power operations, the 33-day decay period necessary for the FHA dose to decrease within the EPA PAGs remains bounded.

With respect to beyond-design-basis accidents at Oyster Creek, the licensee analyzed a drain down of the SFP water that would effectively impede any decay heat removal. The analysis demonstrates that at 285 days after permanent cessation of power operations, there would be 10 hours after the assemblies have been uncovered with all cooling lost until the limiting fuel assembly (for decay heat and adiabatic heatup analysis) reaches 900 degrees Celsius (°C), the temperature used to assess the potential onset of fission product release. The analysis conservatively assumes that the heat up time starts when the SFP has been completely drained with all cooling lost, although it is likely that site personnel will start to respond to an incident when drain down starts. The analysis also does not consider the period of time from the initiating event causing loss of SFP water inventory until cooling is lost.

The NRC reviewed the licensee’s justification for the exemptions, including the modified effective date, against the criteria in 10 CFR 50.12(a) and determined, as described below, that the criteria in 10 CFR 50.12(a) will be met, and that the exemptions should be granted 285 days after the permanent cessation of power operations. As discussed above, in October 2018, the NRC staff previously granted Exelon exemptions from the relevant EP requirements, with an effective date of these exemptions being 365 days after the permanent cessation of operations.

Subsequently, in November 2018, Exelon requested to change the effective date of these exemptions from 365 days to 285 days. Consequently, the NRC is reissuing the October 2018 exemptions with a revised effective date of 285 days after Oyster Creek has permanently ceased operations.

An assessment of the Exelon EP exemptions originally issued on October 16, 2018, is described in SECY-18-0062, "Request by the Exelon Generation Company, LLC for Exemptions from Certain Emergency Planning Requirements for the Oyster Creek Nuclear Generating Station," dated May 31, 2018 (ADAMS Accession No. ML18030B340). The Commission approved the NRC staff's recommendation to grant the exemptions in the staff requirements memorandum to SECY-18-0062, dated July 17, 2018 (ADAMS Accession No. ML18198A449). The NRC staff's detailed review and technical basis for the approval of the specific EP exemptions are provided in the NRC staff's safety evaluation associated with the October 16, 2018 exemptions (ADAMS Accession No. ML18220A980). That safety evaluation remains valid as to all aspects of the exemptions other than the revised effective date. The NRC staff's detailed review and technical basis for the modification of the effective date of the exemptions is provided in a separate safety evaluation dated June, 11, 2019 (ADAMS Accession No. ML19095A873).

In sum, the NRC reviewed the licensee's justification for the requested exemptions, including the modified effective date, against the criteria in 10 CFR 50.12(a) and determined, as described below, that the criteria in 10 CFR 50.12(a) will be met, and that the exemptions should be granted 285 days after the permanent cessation of power operations. To provide a complete record of the NRC staff's analysis, the NRC is reissuing the specific EP exemptions with the revised effective date of 285 days after the permanent cessation of power operations.

A. The Exemptions are Authorized by Law.

The licensee has proposed exemptions from certain EP requirements in 10 CFR 50.47(b), 10 CFR 50.47(c)(2), and 10 CFR 50, Appendix E, Section IV, that would allow Exelon to revise the Oyster Creek Emergency Plan to reflect the permanently shutdown and defueled condition of the facility. The licensee has also requested to modify the effective date for the implementation of the previously approved exemptions from 12 months to 9.38 months (285 days) after permanent cessation of power operations. As stated above, in accordance with 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50. The NRC staff has determined that reissuing the licensee's proposed exemptions, with the modified effective date, will not result in a violation of the Atomic Energy Act of 1954, as amended, or the NRC's regulations. Therefore, the exemptions are authorized by law.

B. The Exemption Presents No Undue Risk to Public Health and Safety.

As stated previously, Exelon provided an analysis showing that the radiological consequences of design-basis accidents will not exceed the limits of the EPA early phase PAGs at the exclusion area boundary. Therefore, based on the reduced risk of radiological consequences from design-basis accidents still possible at Oyster Creek 285 days after the plant has permanently ceased power operations, formal offsite radiological emergency preparedness plans required under 10 CFR Part 50 will no longer be needed for protection of the public beyond the exclusion area boundary.

Exelon provided an analysis showing that, as of 33 days after permanent cessation of power operations, the radiological consequences of the only remaining design-basis accident with potential for offsite radiological release (FHA in the Auxiliary Building) will not exceed the limits of the EPA early phase PAGs to the public beyond the exclusion area boundary. Because the requested effective date of the exemption is 285 days following permanent cessation of

power operations, the 33-day decay necessary for the FHA dose to decrease within the EPA PAGs remains bounded. Oyster Creek permanently ceased power operations on September 17, 2018.

In addition, the licensee analyzed beyond-design-basis accidents at Oyster Creek, which would result in a drain down of the SFP water that would effectively impede any decay heat removal. The analysis demonstrates that at 285 days after permanent cessation of power operations, there would be 10 hours after the assemblies have been uncovered until the limiting fuel assembly (for decay heat and adiabatic heatup analysis) reaches 900 °C, the temperature used to assess the potential onset of fission product release.

Exelon has demonstrated that sufficient time continues to exist to implement prompt SFP mitigative action, and if warranted, for offsite governmental officials to implement measures to protect the public using a CEMP, or “all-hazards,” approach. As such, the determination that formal offsite radiological emergency preparedness plans required under 10 CFR Part 50 will no longer be needed for protection of the public beyond the exclusion area boundary remains valid.

Further, NUREG-1738 confirms that the risk of beyond-design-basis accidents is greatly reduced at permanently shutdown and defueled reactors. The NRC staff’s analyses in NUREG-1738 conclude that the event sequences important to risk at permanently shutdown and defueled power reactors are limited to large earthquakes and cask drop events. For EP assessments, this is an important difference relative to operating power reactors, where typically a large number of different sequences make significant contributions to risk. As described in NUREG-1738, relaxation of offsite EP requirements in 10 CFR Part 50 beyond a few months after shutdown resulted in only a small change in risk. The report further concludes that the change in risk due to relaxation of offsite EP requirements is small because the overall risk is low and because even under current EP requirements for operating power reactors, EP was judged to have marginal impact on evacuation effectiveness for the severe earthquakes that dominate SFP risk. All other sequences including cask drops (for which offsite radiological

emergency preparedness plans are expected to be more effective) are too low in likelihood to have a significant impact on risk.

Therefore, reissuing the previously approved exemptions with a modified effective date of 9.28 months (285 days) after permanent cessation of power operations will not present an undue risk to the public health and safety.

C. The Exemptions are Consistent with the Common Defense and Security.

The reissued exemptions involve EP requirements under 10 CFR Part 50 and will allow Exelon to revise the Oyster Creek Emergency Plan to reflect the permanently shutdown and defueled condition of the facility. Physical security measures at Oyster Creek are not affected by the reissued EP exemptions with the revised effective date. The discontinuation of formal offsite radiological emergency preparedness plans and the reduction in scope of the onsite EP activities at Oyster Creek will not adversely affect Exelon's ability to physically secure the site or protect special nuclear material. Therefore, the reissued exemptions are consistent with common defense and security.

D. Special Circumstances.

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(ii), are present whenever application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. The underlying purpose of 10 CFR 50.47(b), 10 CFR 50.47(c)(2), and 10 CFR Part 50, Appendix E, Section IV, is to provide reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency, to establish plume exposure and ingestion pathway emergency planning zones for nuclear power plants, and to ensure that licensees maintain effective offsite and onsite radiological emergency preparedness plans. The standards and requirements in these regulations were developed by considering the risks associated with operation of a power

reactor at its licensed full-power level. These risks include the potential for a reactor accident with offsite radiological dose consequences.

As previously discussed, because Oyster Creek is permanently shut down and defueled, there is no longer a risk of a significant offsite radiological release from a design-basis accident exceeding EPA early phase PAGs at the exclusion area boundary and the risk of a significant offsite radiological release from a beyond-design-basis accident is greatly reduced when compared to an operating power reactor. The NRC staff has confirmed the reduced risks at Oyster Creek by comparing the generic risk assumptions in the analyses in NUREG-1738 to site-specific conditions at Oyster Creek and determined that the risk values in NUREG-1738 bound the risks presented at Oyster Creek. As indicated by the results of the research conducted for NUREG-1738, and more recently for NUREG-2161, "Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor," dated September 2014 (ADAMS Accession No. ML14255A365), while other consequences can be extensive, accidents from SFPs with significant decay time have little potential to cause offsite early fatalities, even if the formal offsite radiological EP requirements were relaxed. The licensee's analysis of a beyond-design-basis accident involving a complete loss of SFP water inventory, based on an adiabatic heatup analysis of the limiting fuel assembly for decay heat, shows that within 285 days after permanent cessation of power operations, the time for the limiting fuel assembly to reach 900 °C is at least 10 hours after the assemblies have been uncovered assuming a loss of all cooling means.

The only analyzed beyond-design-basis accident scenario that progresses to a condition where a significant offsite release might occur involves the highly unlikely event where the SFP drains in such a way that all modes of cooling or heat transfer are assumed to be unavailable, which is referred to as an adiabatic heatup of the spent fuel. The licensee's analysis of this beyond-design-basis accident shows that within 285 days after permanent cessation of power operations, at least 10 hours would be available between the time that all cooling means are lost

to the fuel (at which time adiabatic heatup is conservatively assumed to begin), until the fuel cladding reaches a temperature of 900 °C, which is the temperature associated with rapid cladding oxidation and the potential for a significant radiological release. This analysis conservatively does not include the period of time from the initiating event causing a loss of SFP water inventory until all cooling means are lost.

The NRC staff has verified Exelon's analyses and its calculations. The analyses provide reasonable assurance that in reissuing the requested exemptions to Exelon, there is no design-basis accident that will result in an offsite radiological release exceeding the EPA early phase PAGs at the exclusion area boundary. In the highly unlikely event of a beyond-design-basis accident affecting the SFP that results in a complete loss of heat removal via all modes of heat transfer, there will be over 10 hours available before an offsite release might occur and, therefore, at least 10 hours to initiate appropriate mitigating actions to restore a means of heat removal to the spent fuel. If a radiological release were projected to occur under this highly unlikely scenario, a minimum of 10 hours is considered sufficient time for offsite authorities to implement protective actions using a CEMP, or "all-hazards," approach to protect the health and safety of the public.

Exemptions from the offsite EP requirements in 10 CFR Part 50 have previously been approved by the NRC when the site-specific analyses show that at least 10 hours is available following a loss of SFP coolant inventory accident with no air cooling (or other methods of removing decay heat) until cladding of the hottest fuel assembly reaches the rapid oxidation temperature. The NRC staff concluded in its previously granted exemptions, as it does with Exelon's requested EP exemptions, that if a minimum of 10 hours is available to initiate mitigative actions consistent with plant conditions or, if needed, for offsite authorities to implement protective actions using a CEMP approach, then formal offsite radiological emergency preparedness plans, required under 10 CFR Part 50, are not necessary at permanently shutdown and defueled facilities.

Additionally, Oyster Creek committed to maintaining SFP makeup strategies in its letters to the NRC dated March 8 and 19, 2018 (ADAMS Accession Nos. ML18067A087 and ML18078A146, respectively). The multiple strategies for providing makeup to the SFP include: using existing plant systems for inventory makeup; an internal strategy that relies on the fire protection system with redundant pumps (one diesel-driven and one electric motor-driven); and onsite diesel fire truck that can take suction from the Barnegat Bay. These strategies will continue to be required as condition 2.C.(8), "Mitigation Strategy License Condition," of renewed facility operating license DPR-16 for Oyster Creek. Considering the very low probability of beyond-design-basis accidents affecting the SFP, these diverse strategies provide multiple methods to obtain additional makeup or spray to the SFP before the onset of any postulated offsite radiological release.

For all of the reasons stated above, the NRC staff finds that the licensee's requested exemptions, including the modified effective date, meet the underlying purpose of all of the standards in 10 CFR 50.47(b), and requirements in 10 CFR 50.47(c)(2) and 10 CFR Part 50, Appendix E, and satisfy the special circumstances provision in 10 CFR 50.12(a)(2)(ii) in view of the greatly reduced risk of offsite radiological consequences associated with the permanently shutdown and defueled state of the Oyster Creek facility 285 days after permanent cessation of power operations.

The NRC staff has concluded that the exemptions being granted by this action will maintain an acceptable level of emergency preparedness at Oyster Creek and, if needed, that there is reasonable assurance that adequate offsite protective measures can and will be taken by State and local government agencies using a CEMP, or "all-hazards," approach in the unlikely event of a radiological emergency at Oyster Creek. Because the underlying purposes of the rules, as exempted, would continue to be achieved, even with the elimination of the requirements under 10 CFR Part 50 to maintain formal offsite radiological emergency

preparedness plans and the reduction in the scope of the onsite emergency planning activities at Oyster Creek, the special circumstances required by 10 CFR 50.12(a)(2)(ii) exist.

E. Environmental Considerations.

In accordance with 10 CFR 51.31(a), the Commission has determined that the reissuing the EP exemptions with a revised effective date will not have a significant effect on the quality of the human environment. The NRC staff previously analyzed the October 16, 2018, EP exemptions in a Finding of No Significant Impact and associated Environmental Assessment published in the *Federal Register* on August 13, 2018 (83 FR 40092). That evaluation remains valid as to all aspects of the EP exemptions other than the revised effective date. The NRC staff analyzed the environmental impacts of the revised effective date in a separate Finding of No Significant Impact and associated Environmental Assessment published in the *Federal Register* on May 1, 2019 (84 FR 18586).

IV. Conclusions.

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12, reissuing the specific EP exemptions originally granted on October 16, 2018, with the revised effective date of 285 days after permanent cessation of operations will not present an undue risk to the public health and safety and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby reissues Exelon's exemption from certain EP requirements in 10 CFR 50.47(b), 10 CFR 50.47(c)(2), and 10 CFR Part 50, Appendix E, as discussed and evaluated in detail in the NRC staff's safety evaluation associated with these exemptions. Oyster Creek permanently ceased power operations on

September 17, 2018. Therefore, the revised effective date of the reissued exemptions is June 29, 2019.

Dated at Rockville, Maryland, this 11th day of June, 2019.

For the Nuclear Regulatory Commission.

/RA/

John R. Tappert, Director,
Division of Decommissioning, Uranium Recovery
and Waste Processing,
Office of Nuclear Material Safety and Safeguards.