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

SAFETY EVALUATION REPORT

DOCKET NOS. 72-1032, 72-78, 50-317 AND 50-318
EXEMPTION REQUEST FOR
EXELON GENERATION COMPANY, LLC
CALVERT CLIFFS NUCLEAR POWER PLANT
INDEPENDENT SPENT FUEL STORAGE INSTALLATION

SUMMARY

By application dated October 3, 2019 (Agencywide Documents Access and Management System (ADAMS) No. ML19276D398), Exelon Generation Company, LLC (EGC) requested an exemption under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste," to load and store spent fuel with a larger maximum pellet diameter than authorized in Amendment No. 1, Revision 1 of the Holtec International certificate of compliance (CoC) No. 1032 for the HI-STORM FW storage system. Specifically, EGC requested an exemption from the requirements of 10 CFR 72.212(b)(3), and the portion of 10 CFR 72.212(b)(11) that requires compliance with the terms and conditions set forth in the CoC for each spent fuel cask used by an independent spent fuel storage installation (ISFSI) general licensee. In evaluating the request, the NRC also considered, pursuant to authority in 10 CFR 72.7, exempting Exelon from similar requirements in 10 CFR 72.212(a)(2), 10 CFR 72.212(b)(5)(i); and 10 CFR 72.214, "List of approved spent fuel storage casks."

The licensee plans to use Holtec International's HI-STORM FW storage cask utilizing CoC No. 1032, Amendment No. 1, Revision 1 for dry storage of pressurized water reactor 14×14C fuel assemblies at the Calvert Cliffs Nuclear Power Plant (CCNPP) under the general license provisions of 10 CFR Part 72 in an upcoming loading campaign. The maximum pellet diameter in CoC No. 1032, Amendment No. 1, Revision 1 14×14C fuel assemblies is 0.3805 inches (0.9665 cm). However, the maximum pellet diameter for the fuel assemblies to be loaded at CCNPP is 0.3810 (0.9677 cm) inches.

This safety evaluation report (SER) documents the staff's review and evaluation of EGC's exemption request for CCNPP. The staff reviewed EGC's application to determine whether it meets the criteria for an exemption specified in 10 CFR 72.7. The requirements in 10 CFR 72.7 authorizes the Commission to grant exemptions from the requirements of 10 CFR Part 72 if the exemption is authorized by law and will not endanger life, property, or the common defense and security, and is otherwise in the public interest.

A. Authorized by Law

The Commission has the legal authority to issue exemptions from the requirements of 10 CFR Part 72 as provided in 10 CFR 72.7. Issuance of this exemption is consistent with the Atomic Energy Act of 1954, as amended, and not otherwise inconsistent with the U.S. Nuclear Regulatory Commission regulations or other applicable laws. Therefore, issuance of the exemption is authorized by law.

B. Will Not Endanger Life, Property or the Common Defense and Security

The staff reviewed EGC's exemption request for CCNPP and concludes, as discussed below, that the proposed exemption from certain requirements of 10 CFR Part 72 will not cause the HI-STORM FW storage cask to encounter conditions beyond those for which it has already been evaluated and demonstrated to meet the applicable safety requirements in 10 CFR Part 72. The staff followed the guidance in NUREG-1536 Revision 1, "Standard Review Plan for Spent Fuel Dry Cask Storage Systems at a General License Facility," July 2010, to complete its safety evaluation. The staff's safety evaluation includes only the criticality, shielding, and thermal safety areas of review since they are the only technical areas affected by this exemption.

Thermal
The applicant stated in Attachment 1 of its transmittal letter that (a) the small change in fuel pellet diameter, which is used in the effective fuel thermal conductivity calculations, has a second order impact on the effective fuel properties; (b) a larger fuel pellet diameter reduces the resistance to heat transfer by decreasing the helium gap between the fuel pellet and cladding; and (c) the 14x14C fuel assembly is bounded by the WE 17x17 fuel assembly adopted in the licensing basis analyses for the referenced MPC-37 canisters to be loaded at CCNPP. Therefore, the applicant concluded that loading the fuel pellet with slightly different diameters does not impact the thermal design functions of the loaded cask.

The staff reviewed the thermal section in Attachment 1 of the transmittal letter and finds the applicant's statements (a) and (b) for heat transfer in the radial direction reasonable based upon engineering judgement of thermal phenomena. In addition, the slight increase of 0.0005 inches (0.0013 cm) to the fuel pellet diameter over the limit of 0.3805 inches (0.9665 cm) represents an approximately 0.13% increase in the fuel pellet diameter and an approximately 0.26% increase in the fuel pellet cross-sectional area. Staff finds that this very small change in cross-sectional area only causes a very small increase in heat transfer in the axial direction of the fuel pellet. Staff also reviewed the HI-STORM FW storage system final safety analysis report (FSAR) and confirmed the applicant's statement (c) mentioned above.

Based on heat transfer in both radial and axial directions, staff concluded that the impact of loading a fuel pellet with a slightly increased diameter is negligible to the thermal design functions of the loaded cask because (a) the design heat load limit remains unchanged, (b) thermal properties of the fuel pellet remain unchanged, and (c) increase of 0.0005 inches (0.0013 cm) in the fuel pellet diameter only causes small changes in the effective thermal properties of the fuel; therefore, the change in the heat removal capability of the cask is negligible.

Based on a review of the statements and evaluations in the exemption request, staff concludes that the slight fuel pellet diameter increase from 0.3805 inches (0.9665 cm) to 0.3810 inches (0.9677 cm) does not result in a need for revision to the thermal evaluation and the previous finding from CoC No. 1032 remains in force. The HI-STORM FW storage system continues to meet the thermal requirements of 10 CFR Part 72.

Shielding
The licensee submitted an exemption request from a requirement in CoC No. 1032, Amendment 1, Revision 1, Appendix B, Table 2.1-2 of the HI-STORM FW storage system that specifies the fuel pellet diameter is a maximum of 0.3805 inches (0.9665 cm). The licensee stated that CCNPP has fuel meeting all requirements of class 14×14C fuel except for a fuel pellet diameter

that is 0.3810 inches (0.9677 cm). The licensee evaluated the impact of increasing the pellet diameter from 0.3805 inches (0.9665 cm) to 0.3810 inches (0.9677 cm) to be placed in the HI-STORM FW storage system. The licensee determined that the small increase in heavy metal from 438 kg to 439.15 kg caused by increasing the pellet diameter is conservatively bounded by the uranium weight for the design basis fuel assembly in Table 5.2.1 of the HI-STORM FW FSAR of 469 kg. Since the uranium weight of the design basis fuel assembly bounds the increased weight of the fuel (with a pellet diameter of 0.3810 inches), the system shielding analyses in the FSAR also bound the expected increase in radiation from the slightly larger fuel pellets.

The staff determined that the proposed change to the pellet diameter will not significantly change the system shielding analyses in the HI-STORM FW FSAR and that the WE17×17 design basis fuel assembly in the HI-STORM FW FSAR with 469 kg of heavy metal bounds the CCNPP 14×14C fuel assemblies with 439.15 kg of heavy metal. The staff finds that this proposed exemption has no effect on the ability of the HI-STORM FW storage system to meet the safety requirements of 10 CFR Part 72.

Criticality
The licensee submitted an exemption request to deviate from the maximum pellet diameter for assembly class 14×14C, stored in the Holtec HI-STORM FW storage system. The licensee stated that Holtec evaluated a maximum pellet diameter of 0.3805 inches (0.9665 cm) in the HI-STORM FW FSAR (ADAMS Accession No. ML17179A443). EGC provided an additional criticality safety analysis of the HI-STORM FW storage system containing assembly class 14×14C fuel with a maximum pellet diameter of 0.3810 inches (0.9677 cm), 0.0005 in. (0.0013 cm) larger than the previously evaluated maximum diameter. The results of the criticality analysis showed a maximum k_{eff} of 0.9220 at a maximum allowable enrichment of 4.0 weight percent ^{235}U (wt%), and 0.9276 at a maximum allowable enrichment of 5.0 wt%. These results are statistically equivalent to the maximum k_{eff} previously calculated by Holtec for the smaller maximum pellet diameter, 0.9211 and 0.9277 for fuel at 4.0 and 5.0 wt%, respectively. Therefore, EGC stated that its proposed exemption has no effect on the criticality safety of the HI-STORM FW storage system.

The staff reviewed the FSAR and finds that the proposed change to the pellet diameter will not result in statistically significant changes to the storage cask system k_{eff}. The staff also finds that this proposed exemption does not affect the ability of the HI-STORM FW storage system to meet the criticality safety requirements in 10 CFR Part 72.

Security
EGC's exemption request is not related to any aspect of the physical security or defense of the CCNPP ISFSI. In addition, modification of the pellet diameter does not affect the CCNPP ISFSI security plans. Therefore, granting the exemption would not result in any potential impacts to common defense and security.

Based on this evaluation, the staff concludes that granting this exemption is consistent with the requirements of 10 CFR Part 72 and will not endanger life, property or the common defense and security.

C. Otherwise in the Public Interest

In determining whether granting the exemption is in the public interest, the staff considered the no-action alternative of denying EGC's exemption request. Denial of the exemption request would cause EGC to postpone loading CCNPP spent fuel that contains the larger pellet

diameter until it is approved in an amendment for CoC No. 1032 or until alternative loading arrangements are implemented. The licensee stated that the proposed exemption is in the public interest because it would allow EGC to store CCNPP fuel assemblies in an inherently safe, passive system, and the exemption would relieve EGC from the unnecessary burden and impact of requesting a license amendment, which, based on the NRC's timeline of review, would not be a viable approach given that the fuel loading campaign is scheduled for early summer 2021. The staff reviewed the information provided by EGC, and based upon the above stated information, concludes that granting the requested exemption continues to provide adequate protection of public health and safety and is otherwise in the public interest.

CONCLUSION

Based on the statements and representations provided by EGC in its exemption request, the staff concludes that the proposed action (i.e., loading the larger pellet diameter using Amendment No. 1, Revision 1 to CoC No. 1032) is authorized by law and will not endanger life, property, or the common defense and security, and is otherwise in the public interest, and therefore meets the exemption requirements in 10 CFR 72.7.