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10 CFR 72.7

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ATTN: Document Control Desk
Director, Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277, 50-278, and 72-29

Subject: Exemption Request for Transnuclear TN-68 Casks Loaded with Fuel Bundles with Incorrect Cooling Times

In accordance with 10 CFR 72.7, "Specific exemptions," Exelon Generation Company, LLC (EGC) is requesting NRC approval of a one-time exemption for the Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3 Independent Spent Fuel Storage Installation (ISFSI) from the requirements of 10 CFR 72.212(b)(3) and (b)(11). Specifically, the exemption request addresses the non-compliance of four spent fuel assemblies with the terms and conditions of the Transnuclear, Inc. (TN) Certificate of Compliance (CoC) Number 1027, Amendment 0, at the time of loading.

The regulations require, in part, compliance to the terms and conditions of CoC 1027. Contrary to this requirement, in June and July 2001, four PBAPS Unit 3 fuel assemblies with cooling times less than the minimum cooling time specified in CoC 1027, Amendment 0, Appendix A, Technical Specification (TS) 2.1.1, Table 2.1.1-1, "Minimum Acceptable Cooling Time as a Function of Max. Burnup and Min. Initial Enrichment," were loaded into four TN-68 casks (i.e., one assembly per cask). Specifically, the four fuel assemblies had been cooled for 9.8 years instead of the required period of 10 years.

EGC identified this condition on January 24, 2013, during a review of ISFSI fuel characterization data. Upon discovery, EGC verified that the actual heat load of each fuel bundle, at the time of loading, was less than the limit specified in TS 2.1.1.E.ii. The decay heat of the assemblies has continued to decrease since their initial loading in June and July 2001. As of September 14, 2001, the four assemblies were in compliance with the TS 2.2.1, Table 2.1.1-1 Cooling Time requirement.

EGC also conducted an extent of condition review for all fuel assemblies currently stored within the PBAPS ISFSI. All other loaded fuel assemblies were in compliance with the TS Cooling Time requirement, at the time of loading.

The attachment to this letter describes the need and justification for the issuance of an exemption, as well as an environmental assessment of the proposed action.

There are no regulatory commitments in this submittal.

If you have any questions or require additional information, please contact Mr. John L. Schrage at (630) 657-2821.

Respectfully,

Patrick R. Simpson
Manager - Licensing

Attachment: 10 CFR 72.7 Exemption Request, Peach Bottom Atomic Power Station Independent Spent Fuel Storage Installation

cc: NRC Regional Administrator - Region I

Attachment
10 CFR 72.7 Exemption Request
Peach Bottom Atomic Power Station
Independent Spent Fuel Storage Installation

1. Background

The Transnuclear, Inc., (TN) TN-68 storage system is designed to store 68 spent fuel assemblies for independent spent fuel storage installation (ISFSI) deployment. The system is listed in 10 CFR 72.214 as Certificate of Compliance (CoC) Number 1027. This system is currently installed and in use at the Peach Bottom Atomic Power Station (PBAPS) under a 10 CFR Part 72 general license.

During a January 2013 internal review of historical ISFSI fuel characterization for PBAPS, Exelon Generation Company, LLC (EGC) identified that in June and July 2001, four PBAPS Unit 3 spent fuel assemblies with cooling times less than the minimum cooling time specified in CoC 1027, Amendment 0, Appendix A, Technical Specification (TS) 2.1.1, Table 2.1.1-1, "Minimum Acceptable Cooling Time as a Function of Max. Burnup and Min. Initial Enrichment," were loaded into four TN-68 casks (i.e., one assembly per cask).

Specifically, the four spent fuel assemblies had been cooled for approximately 9.8 years instead of the required 10 years that is specified in TS Table 2.1.1-1. Upon discovery of the TS non-compliance, EGC verified that the actual heat load of each fuel bundle, at the time of loading, was less than the limit specified in TS 2.1.1.E.ii. The decay heat of the assemblies has continued to decrease since their initial loading in June and July 2001. As of September 14, 2001, the four assemblies fully complied with the TS 2.2.1, Table 2.1.1-1 cooling time requirement.

EGC also conducted an extent of condition review for all fuel assemblies currently stored within the PBAPS ISFSI. All other loaded fuel assemblies were in compliance with the TS cooling time requirement, at the time of loading.

As required by TS 2.2.2, EGC notified the NRC Operations Center within 24 hours of discovery of the TS non-compliance (i.e., ENS notification 48698). Similarly, as required by TS 2.2.3, EGC provided a 30-day special report to the NRC on February 22, 2013. This special report described the cause of the TS non-compliance and the actions taken to restore compliance and prevent recurrence. EGC also indicated in the special report that a one-time exemption request would be submitted to obtain NRC approval for the period of time that the four spent fuel assemblies were non-compliant with the TS-required cooling time.

2. Request for Exemption

In accordance with 10 CFR 72.7, "Specific exemptions," EGC is requesting NRC approval of a one-time exemption for the PBAPS, Units 2 and 3 ISFSI from the following requirements of 10 CFR 72.212, due to a non-compliance with the terms and conditions of CoC 1027.

- 10 CFR 72.212(b)(3), which states the general licensee must "[e]nsure that each cask used by the general licensee conforms to the terms, conditions, and specifications of a CoC or an amended CoC listed in § 72.214"

- The portion of 10 CFR 72.212(b)(11) which states that " [t]he licensee shall comply with the terms, conditions, and specifications of the CoC...."

Specifically, four spent fuel assemblies were non-compliant, at the time of loading, with the cooling time requirement in CoC 1027 Amendment 0, Appendix A, TS 2.2.1 for durations ranging from 58 to 86 days. As of September 14, 2001, all four spent nuclear fuel assemblies were in compliance with the terms and conditions of CoC 1027.

These assemblies, the associated cask numbers, maximum burnup values, load dates, and CoC non-compliance durations are listed in the Table below. All four are GE6 8x8 type assemblies, with a uranium content of 0.182 MTU, a minimum initial bundle average enrichment of 2.99%, and a last at-power date of September 14, 1991.

Assembly No.	Cask No.	Maximum Burnup (GWd/MTU)	Load Date	CoC Non-compliance Duration
LJW874	TN-68-05	29.582	19-Jun-2001	86 days
LJW875	TN-68-06	29.577	26-Jun-2001	79 days
LJW882	TN-68-07	29.578	10-Jul-2001	65 days
LJW867	TN-68-08	29.580	17-Jul-2001	58 days

3. Basis for Approval of Exemption Request

In accordance with 10 CFR 72.7, the NRC may, upon application by any interested person or upon its own initiative, grant such exemptions from the requirements of the regulations in this part as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.

a. Authorized by Law

This exemption would allow EGC to continue to store four spent nuclear fuel assemblies at the PBAPS ISFSI which were, at the time of loading in June and July 2001, in non-compliance with the minimum cooling time requirement specified in CoC 1027, Amendment 0, Appendix A, TS 2.2.1, Table 2.1.1-1. All four spent nuclear fuel assemblies currently comply with all TS requirements.

The NRC issued 10 CFR 72.7 under the authority granted to it under Section 133 of the Nuclear Waste Policy Act of 1982, as amended, 42 U.S.C. § 10153. Section 72.7 allows the NRC to grant exemptions from the requirements of 10 CFR Part 72. Granting the proposed exemption provides adequate protection to public health and safety, and the environment. As described below, the proposed exemption will not endanger life or property, or the common defense and security, and is otherwise in the public interest. Therefore, the exemption is authorized by law.

b. Will not Endanger Life or Property or the Common Defense and Security

EGC has verified that loading of the four spent nuclear fuel assemblies with cooling times less than the minimum required time, for the applicable durations, did not impact the shielding, confinement, and thermal design functions of the loaded TN-68 casks, as described in the Technical Analysis section below.

In addition, by Safety Evaluation Report (SER) dated October 30, 2007, the NRC approved Amendment 1 to CoC 1027. This amendment, in part, increased the TS average assembly burn-up limit and decreased the TS minimum allowable cooling time for all fuel types, except GE 7x7 assemblies. The revised minimum cooling time for 8x8, 9x9, and 10x10 assemblies is seven years, which is specified in a new fuel selection flowchart that was added to TS 2.1.1 (i.e., Figure 2.1.1-2, "Flowchart for Selection of 8x8, 9x9, and 10x10 Fuel"). This figure also includes a mathematical function for determination of decay heat as a function of fuel burnup, cooling times, and initial fuel enrichment. In April 2013, EGC updated the four applicable TN-68 casks to the requirements of CoC 1027, Amendment 1, in accordance with the requirements of 10 CFR 72.

Given that: 1) The loading of the four non-compliant spent nuclear fuel assemblies in 2001 did not impact the shielding, confinement, and thermal design functions of the loaded TN-68 casks; 2) The non-compliant condition was resolved within 86 days after loading; and 3) The TS-minimum-required cooling time has been subsequently reduced, by TS amendment, to less than the actual cooling times of the four assemblies, at time of loading, the proposed exemption does not compromise the ability of the four as-loaded TN-68 casks to safely store the four fuel assemblies. Therefore, the proposed exemption does not endanger life or property or the common defense and security.

c. Otherwise in the Public Interest

The proposed exemption is based on guidance provided in CoC 1027 Amendment 0, TS Bases 2.2.1. This states that non-compliant fuel assemblies may remain in the associated cask if this is determined to be a safe condition.

In addition to the proposed exemption request, EGC has considered the alternative action to correct the historical condition, as established in TS 2.2, "Functional and Operational Limits Violations." Specifically, if a Functional and Operational Limit is violated, TS 2.2.1 requires the licensee to remove the affected fuel assemblies and place in a safe condition. In this case, the applicable fuel assemblies would be removed from their respective casks and either reloaded into a TN-68 cask, or unloaded into the PBAPS Unit 3 spent fuel pool.

This action would require EGC to:

- Transport each individual cask from the ISFSI pad to the PBAPS Reactor Building trackway
- Lift each cask with the Reactor Building crane to the PBAPS Unit 3 spent fuel pool
- Remove the casks' lids and applicable fuel assemblies

- Relocate and/or reload the assemblies
- Reinstall the lid
- Remove the TN-68 casks from the spent fuel pool
- Process the reloaded casks to ensure cask integrity
- Lower the loaded casks to the Reactor Building trackway
- Transport each cask back to the ISFSI pad.

Based on historical loading performance, EGC has determined that the implementation of this process would result in approximately 300 mrem of personnel radiation exposure per cask (i.e., 1.2 person-rem total) and a financial cost of approximately $409,000 per cask (i.e., $1.63 million total), as well as the generation of low-level radioactive waste (LLRW) (i.e., in the form of radiologically contaminated consumables and anti-contamination clothing used during the unloading and reloading process). In addition, the process would result in additional opportunities for the occurrence of both off-normal events and design basis accidents, such as a fuel handling or cask drop event.

Since the four assemblies are currently in a safe condition in the four individual casks, and in full compliance with the CoC cooling time requirement, the integrity of the casks and fuel will not be impacted by the short period of non-compliance in 2001. Therefore, the additional personnel radiation exposure, generation of LLRW, and financial cost would not be in the public interest.

4. Technical Analysis

The TN-68 system provides criticality control, passive heat removal, confinement, and shielding, independent of any other facility structures or components. The structural design of the cask also maintains the integrity of the fuel during storage.

The cask design requires certain limits on spent fuel parameters, including fuel type, assembly weight, initial enrichment, maximum burnup, minimum cooling time, and physical condition to safely store the spent fuel. These limitations are included in the thermal, structural, radiological, and criticality evaluations for the cask.

The TN-68 is designed to store 68 boiling water reactor (BWR) type spent fuel assemblies. CoC 1027 Amendment 0 establishes a maximum allowable initial lattice-average enrichment of 3.7 wt% U-235, a maximum bundle average burnup of 40 GWd/MTU, a maximum decay heat load of 0.312 kW/assembly, and a minimum cooling time of ten years, for all BWR fuel types.

The allowable combinations of burnup, enrichment, and cooling time ensure that the thermal, shielding, and confinement design functions for a loaded fuel assembly are bounded by those evaluated in the Independent Fuel Storage Safety Analysis Report (IFSSAR) for the design fuel assembly. With respect to cooling time, the specified value of ten years ensures that the maximum decay heat load per assembly shall not exceed the TS 2.1.1.E.ii value of 0.312 kW (i.e., the bounding design value).

Reactivity parameters for the four loaded fuel assemblies and associated casks were not affected by the non-compliance period. The reactivity parameters of the fuel at the time of loading complied with Technical Specification requirements.

a. Thermal Design Function

Upon discovery of the non-compliance for the four spent nuclear fuel assemblies, EGC calculated the as-loaded decay heat load value for each fuel assembly, using the actual assembly burnup, enrichment, and cooling times. This calculation was performed using the analytical method in Regulatory Guide (RG) 3.54, "Spent Fuel Heat Generation in an Independent Spent Fuel Storage Installation," as well as the analytical method provided in CoC 1027 Amendment 1, TS 2.1.1, Figure 2.1.1-2. The actual decay heat value for each of the four assemblies was 0.201 kW using the RG 3.54 method and 0.194 kW using the CoC Amendment 1 method. Both values are bounded by the IFSSAR and TS design limit of 0.312 kW. Therefore, the short period of time in 2001 when the cooling time for each of the four assemblies was less than the minimum required did not impact the thermal design function of the casks.

b. Radiation Shielding Design Function

Shielding for the TN-68 cask is provided mainly by the cask body. For the neutron shielding, a borated polyester resin compound surrounds the cask body and a polypropylene disk covers the lid. Additional shielding is provided by the steel shell surrounding the resin layer and by the steel and aluminum structure of the fuel basket. Geometric attenuation, enhanced by air and ground attenuation, provides additional dose reduction for distant locations at the restricted area and site boundaries.

As part of the initial IFSSAR for CoC 1027, Amendment 0, a shielding evaluation was performed utilizing the source terms from a GE 7x7 fuel assembly with an initial bundle-average enrichment of 3.3 wt% and a total maximum bundle average burnup of 40 GWd/MTU. Given the design basis burnup and enrichment, this fuel assembly type is the most conservative based on the initial uranium loading. The shielding evaluation resulted in projected radiation levels that formed the basis for the dose rate limits in TS 5.2.3, "Cask Surface Dose Rate Evaluation Program."

The total gamma and neutron sources of the four non-compliant fuel assemblies were approximately 27% and 70% lower, respectively, than the design basis fuel sources. Similarly, actual contact dose rates on the TN-68 cask, following loading of the four non-compliant fuel assemblies in 2001, were significantly lower than the TS 5.2.3 limits. Therefore, the shielding design function will continue to limit external dose to levels bounded by the TN-68 IFSSAR.

c. Confinement Design Function

The confinement of radioactivity during the storage of spent fuel in the TN-68 cask system is ensured by the use of multiple confinement barriers and systems. These barriers are the fuel pellet matrix, the fuel cladding, and the cask.

The long-term integrity of the stored fuel is dependent on storage in a dry, inert environment and maintenance of adequate heat transfer mechanisms. This environment is established by removing water from the cask cavity and backfilling the cavity with helium (i.e., an inert gas). Helium assists in heat removal and provides a non-reactive environment to protect fuel assemblies against fuel cladding degradation which might otherwise lead to gross rupture.

The thermal design function analyses for storage operations assume that the cask is filled with helium. As described above, the decay heat load for each of the four non-compliant fuel assemblies are bounded by the thermal analysis in the IFSSAR for a design fuel assembly. Therefore, the short period of time in 2001 when the cooling time for each of the four assemblies was less than the minimum required, did not impact the confinement design function of the casks.

In addition, TS 3.1.1, "Cask Cavity Vacuum Drying," and TS 3.1.2, "Cask Helium Back Pressure," specify Limiting Conditions for Operation (LCOs) and Surveillance Requirements (SRs) to ensure that the required helium environment within a TN-68 cask is correctly established during loading operations. TS 3.1.3, "Cask Helium Leak Rate" and TS 3.1.5, "Cask Interseal Pressure," establish LCOs and SRs to ensure that this environment is maintained during storage operations. When loaded in 2001, the four applicable TN-68 casks were in compliance with TS 3.1.1 and TS 3.1.2. Ongoing monitoring of the four casks, as required by TS 3.1.3 and TS 3.1.5, has confirmed continued compliance with TS requirements. This compliance ensures that the confinement design function was satisfied when initially loaded, and continues to be satisfied during storage operations.

5. Environmental Consideration

EGC has evaluated the environmental impacts of the proposed exemption request and has determined that the proposed action will not have an adverse impact to the environment. Therefore, the proposed action does not require any Federal permits, licenses, approvals, or other entitlements.

a. Environmental Impacts of the Proposed Action

The PBAPS ISFSI is a radiologically controlled, Protected Area with limited access, and is located inside the EGC Owner Controlled Area. The area considered for potential environmental impact as a result of this exemption request is the area in and surrounding the ISFSI.

The interaction of a loaded TN-68 with the environment is through the thermal, shielding, and confinement design functions for the cask system.

Upon discovery of the CoC 1027 Amendment 0 non-compliance for the four spent nuclear fuel assemblies, EGC calculated the as-loaded decay heat load value for each fuel assembly, using the actual assembly burnup, enrichment, and cooling times. The

actual decay heat value for each of the four assemblies was bounded by the IFSSAR and TS design limit of 0.312 kW, with significant margin.

Based on the actual radioactive source terms for the four non-compliant assemblies, relative to the design source term, as well as the initial radiation levels on the four applicable TN-68 casks, relative to design limits, the shielding design function will continue to limit external dose to levels bounded by the TN-68 IFSSAR.

Finally, since the decay heat load of the four assemblies are bounded by the IFSSAR design thermal analysis, the confinement design functions of the fuel cladding and the TN-68 structure were not adversely impacted by the as-loaded configurations.

In that compliance with TS 2.1.1, Table 2.1.1-1 for all four non-compliant assemblies was achieved on September 14, 2001, EGC has concluded that all TN-68 design functions impacting the environment are, and will continue to be bounded by the IFSSAR evaluations.

EGC has also determined that there are no gaseous, liquid or solid effluents (radiological or non-radiological), radiological exposures (worker or member of the public) or land disturbances associated with the proposed action. Therefore, approval of the requested exemption to allow the fuel assemblies to remain as loaded has no impact on the environment.

b. Adverse Environmental Effects Which Cannot be Avoided Should the Exemption be Approved

As noted previously, there are no environmental impacts associated with approval of this exemption. Therefore, there are no adverse environmental effects which cannot be avoided should the exemption request be approved.

c. Alternative to the Proposed Action

In addition to the proposed exemption request, EGC has considered the alternative action to correct the historical condition, as established in TS 2.2, "Functional and Operational Limits Violations." Specifically, if a Functional and Operational Limit is violated, TS 2.2.1 requires the licensee to remove the affected fuel assemblies and place in a safe condition. In this case, the applicable fuel assemblies would be removed from their respective casks and either reloaded into a TN-68 cask, or unloaded into a PBAPS spent fuel pool. This would involve the following steps:

- Retrieve each affected TN-68 from the ISFSI Pad and transport to the PBAPS Unit 3 Reactor Building trackway
- Lift each cask with the Reactor Building crane to the PBAPS Unit 3 spent fuel pool
- Remove the casks' lids and applicable fuel assemblies
- Relocate and/or reload the assemblies
- Reinstall the lid
- Remove the TN-68 casks from the spent fuel pool
- Process the reloaded casks to ensure cask integrity

- Lower the loaded casks to the Reactor Building trackway
- Transport each cask back to the ISFSI pad.

This alternative would restore the affected as-loaded TN-68 casks to compliance with CoC 1027.

d. Environmental Effects of the Alternatives to the Proposed Action

The environmental impacts of the alternative to the proposed action would result in both real and potential radiological impacts. Based on historical loading performance, EGC has determined that the implementation of this process would result in approximately 300 mrem of personnel radiation exposure per cask (i.e., 1.2 person-rem total) and a financial cost of approximately $409,000 per cask (i.e., $1.63 million total), as well as the generation of low-level radioactive waste (LLRW) (i.e., in the form of radiologically contaminated consumables and anti-contamination clothing used during the unloading and reloading process). In addition, the process would result in additional opportunities for the occurrence of both off-normal events and design basis accidents, such as a fuel handling or cask drop event.

e. Conclusion and Status of Compliance

As a result of the environmental assessment, EGC concludes that the proposed action, which will allow EGC to maintain the four fuel assemblies in their current storage configuration, is in the public interest in that it avoids the adverse environmental, radiological, and financial effects associated with the alternative to the proposed action.