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May 17, 2012

U.S. Nuclear Regulatory Commission
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Peach Bottom Atomic Power Station, Units 2 and 3
Renewed Facility Operating License Nos. DPR-44 and DPR-56
NRC Docket Nos. 50-277 and 50-278

Subject: Response to Request for Additional Information - License Amendment Request for Use of Neutron Absorbing Inserts in Units 2 and 3 Spent Fuel Pool Storage Racks

References:

1) Letter from M. D. Jesse (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "License Amendment Request – Use of Neutron Absorbing Inserts in Units 2 and 3 Spent Fuel Pool Storage Racks," dated November 3, 2011

2) Letter from J. D. Hughey (U.S. Nuclear Regulatory Commission) to M. J. Pacilio (Exelon Generation Company, LLC), "Peach Bottom Atomic Power Station, Units 2 and 3 – Supplemental Information Needed for Acceptance of Requested Licensing Action RE: Use of Neutron Absorbing Inserts in Units 2 and 3 Spent Fuel Pool Storage Racks (TAC NOS. ME7538 and ME7539)," dated December 14, 2011

3) Letter from M. D. Jesse (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "License Amendment Request – Use of Neutron Absorbing Inserts in Units 2 and 3 Spent Fuel Pool Storage Racks," dated December 22, 2011

4) Letter from J. D. Hughey (U.S. Nuclear Regulatory Commission) to M. J. Pacilio (Exelon Generation Company, LLC), "Peach Bottom Atomic Power Station, Units 2 and 3 – Request for Additional Information Regarding License Amendment Request for Use of Neutron Absorbing Inserts in Units 2 and 3 Spent Fuel Pool Storage Racks (TAC NOS. ME7538 and ME7539)," dated March 12, 2012

5) Letter from M. D. Jesse (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "Response to Request for Additional Information - License Amendment Request for Use of Neutron Absorbing Inserts in Units 2 and 3 Spent Fuel Pool Storage Racks," dated April 4, 2012

6) Letter from R. B. Ennis (U.S. Nuclear Regulatory Commission) to M. J. Pacilio (Exelon Generation Company, LLC), "Peach Bottom Atomic Power Station, Units 2 and 3 – Request for Additional Information Regarding License Amendment Request for Use of Neutron Absorbing Inserts in Spent Fuel Pool Storage Racks (TAC NOS. ME7538 and ME7539)," dated April 18, 2012

In the Reference 1 letter, Exelon Generation Company, LLC (Exelon) requested a proposed change to modify the Technical Specifications (TS) to include the use of neutron absorbing spent fuel pool rack inserts for the purpose of criticality control in the spent fuel pools at Peach Bottom Atomic Power Station (PBAPS), Units 2 and 3. In References 2 and 4, the U.S. Nuclear Regulatory Commission requested additional information. References 3 and 5 were our responses to those requests. In Reference 6, the U.S. Nuclear Regulatory Commission requested additional information. Attached is our response to Requests for Additional Information (RAI's) 14 through 18.

Exelon has reviewed the information supporting a finding of no significant hazards consideration and the environmental consideration provided to the U.S. Nuclear Regulatory Commission in Reference 1. The additional information provided in this submittal does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. In addition, the additional information provided in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed amendment.

There are no regulatory commitments contained in this submittal.

Should you have any questions concerning this letter, please contact Tom Loomis at (610) 765-5510.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 17th of May 2012.

Respectfully,

Michael D. Jesse
Director, Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Attachment: Response to Request for Additional Information

cc: USNRC Region I, Regional Administrator
USNRC Senior Resident Inspector, PBAPS
USNRC Senior Project Manager, PBAPS
R. R. Janati, Bureau of Radiation Protection
S. T. Gray, State of Maryland

ATTACHMENT

Response to Request for Additional Information

Question:

RAI-14: Section 3.1.3 of Attachment 1 to letter dated November 3, 2011, indicates that the functionality of the NETCO-SNAP-IN® neutron absorbing inserts at PBAPS relies on the establishment of an adequate amount of static friction between the insert wings and the walls of the PBAPS, Units 2 and 3 SFP racks. The response to Supplemental Request for Additional Information (RAI) 1, in Attachment 1 to the letter dated December 22, 2011, indicates that the minimum removal force criteria associated with the NETCO-SNAP-IN® neutron absorbing inserts is 200 pounds. State the basis for this value and how it applies to the establishment of an adequate frictional force capable of withstanding the design basis loads to which the insert may be subjected during a seismic event. Confirm that this value adequately accounts for the effects of stress relaxation which may occur in the insert, as discussed in Section 3.4.5 of the letter dated November 3, 2011.

Response:

50% stress relaxation over 20 years in pure 1100 series aluminum is used as a bounding estimate of the composite material performance (see Section 3.4.5 of the November 3, 2011, License Amendment Request). The acceptance criterion for the coupon surveillance program is, therefore, 50% stress relaxation in a coupon under strain that bounds that experienced by the installed inserts. As such, design basis load analyses are performed at 50% of the minimum removal force criteria, or 100 pounds of retention force. The results of these analyses show that there is a 2.45x factor of safety for retention force at that value during a seismic event. The establishment of the frictional force between the insert and the cell wall has been predicted analytically and verified experimentally. Pull tests (removal tests) have been performed which show that, after installation, it requires greater than 200 pounds of pull force to remove the insert from its installed location.

Question:

RAI-15: The response to Supplemental RAI 4 in Attachment 1 to the letter dated December 22, 2011, details the clean pool testing which was performed to verify design criteria specific to the performance of the NETCO-SNAP-IN® inserts proposed for use at PBAPS, including insertion forces, drag forces and withdrawal forces. With respect to the testing performed for the withdrawal forces, summarize the testing performed and the results of this testing to demonstrate that the established withdrawal force acceptance criterion was satisfied. Additionally, provide a technical justification which demonstrates that the clean pool withdrawal force testing provides a sufficient means to capture the effects of stress relaxation which may influence the measured withdrawal force over long durations.

Response:

As mentioned in the response to Supplemental RAI-04, testing was performed using full size NETCO-SNAP-IN® inserts, made from the same Alcan W1100N series material that is used in the PBAPS spent fuel pools. These were installed into test cells that were fabricated using PBAPS spent fuel rack design specifications and manufactured to the largest and smallest manufacturing tolerances to bound the environment in the fuel pool. Specifically, with regard to the withdrawal force testing, inserts that had been previously installed into a test cell were engaged with a removal tool that pulled vertically on the insert. A calibrated dynamometer was placed between the hoist and the removal tool to record the hanging load during removal of the insert. The net load on the dynamometer, after accounting for the weight of the removal tool and insert, was recorded for each withdrawal test to determine the force required to remove the insert. The withdrawal tests were performed with a range of insert bend angles in both the minimum sized and maximum sized test cells. In initial tests, the peak load while the insert was moving and under the effects of kinetic friction was recorded to conservatively bound the static friction based retention force.

Subsequent testing (in the initial testing a calibrated dynamometer was used; however, the instantaneous load (break-free force) could not be recorded) showed that the static friction based retention was, at a minimum, 1.4x greater than the kinetic based value. Testing has shown static friction-based retention forces between 443 pounds (165 pounds kinetic) and 976 pounds (700 pounds kinetic). This yields 50% relaxed values of 222 pounds and 488 pounds, respectively. This is in excess of the required 100 pound (static) required retention force discussed in the response to RAI-09.1.

Question:

RAI-16: The response to Supplemental RAI 1, in Attachment 1 to the letter dated December 22, 2011, indicates that the internal stresses developed in the NETCO-SNAP-IN® neutron absorbing inserts proposed for use at PBAPS were based, in part, on experimental data. Discuss the approach used to determine the stress distribution throughout the inserts under design basis loading combinations and state the applicability of the aforementioned experimental data to the stress analysis of the inserts. Additionally, state the basis for using the material ultimate stress as the acceptance criterion for the inserts when the inserts are subjected to the aforementioned design basis loads.

Response:

An analytical model for bending stresses within the insert based upon bent beam stress equations and curved member stress equations has been developed to predict insert behavior under design basis loading conditions. Additionally, finite element models have been developed as a confirmatory analysis of the analytical model assumptions. These models predict that, during installation, the inserts undergo elastic and sometimes plastic deformation in the "wing" and central bend sections of the insert. Whether deformation is in the elastic or plastic regime largely depends upon the size of the installation cell with respect to its nominal dimension. The inserts are designed to provide greater than 200 pounds retention force in the largest cell and still require less than 800 pounds to install in the smallest cell. As a consequence, the geometry of the smallest cell may push the insert past the elastic limit during installation. In either case, however, the ultimate strength of the material is not exceeded.

The predictions of these models have been validated through laboratory bend tests and demonstration tests of the inserts (discussed above). The test results show that the predicted retention and installation forces are accurate to within the uncertainty of the friction coefficient as this is the only other factor in predicting the retention force. After plastic deformation, sufficient elastic margin remains to provide adequate retention force as demonstrated by the test results discussed in RAI-15.

Question:

RAI-17: Section 10.3.4.1 of the PBAPS Updated Final Safety Analysis Report (UFSAR) indicates that the PBAPS SFP racks are designed in accordance with Subsection NF of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (Code), Section III, as stipulated by the NRC Office of Technology (OT) Position Paper, "OT Position For Review and Acceptance of Spent Fuel Storage and Handling Applications," dated April 14, 1978, amended by an NRC letter dated January 18, 1979 (NRC Generic Letters 78-11 and 79-04, respectively). The response to Supplemental RAI 1, in Attachment 1 to the letter dated December 22, 2011, indicates that the 1986 Westinghouse SFP calculation (WNEP 8542), performed to support high density SFP rack installation at PBAPS, was performed using loads which bound those which will be present following installation of the NETCO-SNAP-IN® neutron absorbing inserts. Specifically, it is noted in the letter dated December 22, 2011, that calculation WNEP 8542 utilized fuel assembly weights greater than those in use at PBAPS and those used in the NETCO analysis. Confirm that all applicable design basis requirements applicable to the existing PBAPS SFP racks, as stipulated by the provisions of Subsection NF of the ASME Code, will remain satisfied following installation of the neutron absorbing inserts. Specifically, confirm that normal and abnormal operating condition loads, including deadweight, thermal and seismic loads, are bounded by those used in the existing analysis of record such that the resulting margins of safety are positive and will continue to satisfy the requirements of the ASME Code. Additionally, confirm that the fuel-handling accident analyses discussed in Section 10.3.4.1 of the PBAPS UFSAR and required by Section IV of the OT Position Paper remain acceptable.

Response:

The maximum dry weight of the consolidated fuel bundle used in the Westinghouse Spent Fuel Rack analysis is 1377 pounds (in RAI-02, the submerged weight was reported as 1315 pounds). The maximum dry weight of the Peach Bottom fuel bundles currently stored in the pool is assumed to be 800 lbs.

Using 800 pounds as the weight of a fuel bundle, the difference in the weight for the fuel bundle used in the Westinghouse analysis versus that for the heaviest PBAPS bundles (1377 - 800 = 577 pounds) is much greater than the 18.15 pounds weight of the NETCO rack insert. The 800 pounds includes the weight of the heaviest fuel bundle in the spent fuel pool plus an additional allowance for future heavier bundles. Therefore, the Westinghouse analysis remains bounding for the condition with the NETCO rack inserts installed.

Therefore, the provisions of Subsection NF of the ASME Code for normal and abnormal operating condition loads, including deadweight, thermal and seismic loads for the existing PBAPS SFP racks remain satisfied with positive margins of safety as determined per the existing Westinghouse calculation of record following installation of the neutron absorbing inserts.

The effects of fuel handing accidents on the storage of spent fuel are summarized in PBAPS UFSAR Subsection 10.3.4.1.3. The following accident events were considered for spent fuel pool structural integrity and criticality control to address the guidance in the NRC OT Position Paper, Section IV(1)(b):

- Fuel bundle dropped from an elevation of 24 inches above the top of the fuel pool racks;
- Fuel bundle dropped through an empty storage cavity; and
- Uplift on the racks caused by the refueling crane attempting to lift a stuck fuel bundle

The structural effects of the above accident events remain acceptable because the rack structure and design basis fuel assembly are not changed by the use of NETCO-SNAP-IN® neutron absorbing inserts proposed in this license amendment request (LAR). No credit is taken for the NETCO-SNAP-IN® inserts in the structural analysis of the racks. Damage to the racks from a fuel bundle dropped on top of the racks is unaffected by use of the NETCO-SNAP-IN® neutron absorbing inserts. Since the top of the NETCO-SNAP-IN® neutron absorbing inserts is even with the top of the racks, any damage to the insert will not occur in the active fuel region of the fuel bundle. The structural impact of a fuel bundle dropped through an empty storage location and uplift due to a stuck fuel assembly remains the same as described in the PBAPS UFSAR because the rack structure credited in the structural analysis is not modified by the proposed change to use NETCO-SNAP-IN® inserts in the racks.

The criticality effects of a drop of a fuel bundle onto the storage racks and into an empty storage cavity have been analyzed for their criticality effect as discussed in Section 3.8.1 of the LAR and the supporting criticality analysis for the LAR. The reactivity of the system as a result of these events remains less than 0.95 and is, therefore, acceptable. The effect on the criticality analysis of the inadvertent removal of an insert due to a stuck bundle is bounded by the criticality analysis for a missing insert.

Question:

RAI-18: Discuss the effect of the proposed installation of the NETCO-SNAP-IN® neutron absorbing inserts on the design basis loads (deadweight, thermal, seismic) applicable to the SFP structure, including the SFP walls, slab and the stainless steel liner. State whether the aforementioned Westinghouse SFP calculation (WNEP 8542) evaluated the PBAPS, Units 2 and 3 SFPs using loads which bound those loads which will be present following installation of the neutron absorbing inserts at PBAPS. If the design basis loads established in the Westinghouse calculation do not bound the loads which will be present following installation of the inserts, quantify the effects of the installation of the inserts and demonstrate that the design basis acceptance criteria applicable to the SFP walls, slab and liner will remain satisfied following installation.

Response:

As stated per the response to RAI-17 above, the Westinghouse spent fuel rack analysis used a dry fuel bundle weight of 1377 pounds whereas the maximum dry weight of the Peach Bottom fuel bundles currently stored in the pool is assumed to be 800 lbs. The dry weight of the NETCO rack insert is 18.15 pounds as determined per ECR 11-00077.

Using 800 pounds as the weight of a fuel bundle including the channel, the difference in the weight for the fuel bundle used in the Westinghouse analysis vs. that for the heaviest PBAPS bundles (1377 – 800 = 577 pounds) is much greater than the 18.15 pounds weight of the NETCO rack insert. Therefore, the Westinghouse analysis of record remains bounding for the condition with the NETCO rack inserts installed.