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

October 1, 2018

Mr. Bryan C. Hanson
Senior Vice President
Exelon Generation Company, LLC
President and Chief Nuclear Officer (CNO)
Exelon Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: BRAIDWOOD, UNITS 1 AND 2 – SUPPLEMENTAL INFORMATION NEEDED FOR ACCEPTANCE OF REQUESTED LICENSING ACTION REGARDING UTILIZATION OF TVEL TVS-K LEAD TEST ASSEMBLIES (EPID L-2018-LLA-0208)

Dear Mr. Hanson:

By letter dated July 19, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18204A169), Exelon Generation Company, LLC (Exelon, the licensee) submitted a license amendment request for Braidwood Station, Units 1 and 2. The proposed amendment request would authorize the use of up to eight Joint Stock Company "TVEL" (Fuel Company of Rosatom) TVS-K lead test assemblies (LTAs) in non-limiting reactor core locations for operation and evaluation. The purpose of this letter is to provide the results of the U.S. Nuclear Regulatory Commission (NRC) staff's acceptance review of this amendment request. The acceptance review was performed to determine if there is sufficient technical information in scope and depth to allow the NRC staff to complete its detailed technical review. The acceptance review is also intended to identify whether the application has any readily apparent information insufficiencies in its characterization of the regulatory requirements or the licensing basis of the plant.

Consistent with Section 50.90 of Title 10 of the *Code of Federal Regulations* (10 CFR), an amendment to the license (including the technical specifications) must fully describe the changes requested, and following as far as applicable, the form prescribed for original applications. Section 50.34 of 10 CFR addresses the content of technical information required. This section stipulates that the submittal address the design and operating characteristics, unusual or novel design features, and principal safety considerations.

The NRC staff has reviewed your application and concluded that the information delineated in the enclosure to this letter is necessary to enable the staff to make an independent assessment regarding the acceptability of the proposed amendment request in terms of regulatory requirements and the protection of public health and safety and the environment.

Enclosure 2 contains Proprietary Information. When separated from Enclosure 2, this letter is DECONTROLLED.

In order to make the application complete, the NRC staff requests that Exelon supplement the application to address the information requested in the enclosure by October 19, 2018. This will enable the NRC staff to begin its detailed technical review. If the information responsive to the NRC staff's request is not received by the above date, the application will not be accepted for review pursuant to 10 CFR 2.101, and the NRC will cease its review activities associated with the application. If the application is subsequently accepted for review, you will be advised of any further information needed to support the staff's detailed technical review by separate correspondence.

The information requested and associated time frame in this letter were discussed with David Gullott of your staff on October 1, 2018.

If you have any questions, please contact the Braidwood Project Manager, Joel Wiebe, at (301) 415-6606 or Joel.Wiebe@nrc.gov.

Sincerely,

/RA/

Joel S. Wiebe, Senior Project Manager
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-456 and 50-457

Enclosures:
1. Information Request (Non-proprietary)
2. Information Request (Proprietary)

cc w/o Enclosure 2: Listserv

ENCLOSURE 1
(NON-PROPRIETARY)

SUPPLEMENTAL INFORMATION NEEDED

AMENDMENT REQUEST REGARDING UTILIZATION OF

TVEL TVS-K LEAD TEST ASSEMBLIES

EXELON GENERATION COMPANY, LLC

BRAIDWOOD STATION, UNITS 1 AND 2

DOCKET NOS. 50-456 AND 50-457

Proprietary information pursuant to Title 10 of the *Code of Federal Regulations* Section 2.390 has been redacted from this document.

Redacted information is identified by blank space enclosed within double brackets as shown here [[ ]].

SUPPLEMENTAL INFORMATION NEEDED

AMENDMENT REQUEST REGARDING UTILIZATION OF

TVEL TVS-K LEAD TEST ASSEMBLIES

EXELON GENERATION COMPANY, LLC

BRAIDWOOD STATION, UNITS 1 AND 2

DOCKET NOS. 50-456 AND 50-457

In order to ensure compliance with regulatory requirements contained in Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," as well as General Design Criterion (GDC) 10, "Reactor Design," which is contained in Appendix A to 10 CFR, Part 50, operating thermal design limits are established for all fuel loaded in the reactor core. Monitoring of the fuel to verify that the operating thermal design limits are not exceeded for normal operations will then verify that the assumptions of the analyses for postulated accidents and anticipated operational occurrences are not violated. By extension, the 10 CFR, Part 100, "Reactor Site Criteria," requirements as they relate to the exposure to an individual as a result of fission product releases for postulated accidents are also verified to be met by ensuring that the analyses remain bounding with respect to the number of fuel rod failures.

In its letter dated July 19, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18204A169), Exelon Generation Company, LLC (Exelon, the licensee) is proposing to show that the proposed lead test assemblies (LTAs) will remain bounded by the reload licensing analyses of record (AOR), by use of a separate thermal limit evaluation for the LTAs. The letter provides a thermal mechanical code, thermal hydraulic code, and critical heat flux (CHF) correlation that will be used in the thermal limit evaluation. The use of these codes and CHF correlation have not been previously approved by the U.S. Nuclear Regulatory Commission (NRC) for this specific application, so more information is needed to fully justify how the codes and CHF correlation will be used to evaluate the thermal limits for the LTAs.

The NRC staff requests the following information in order to complete its detailed review:

1. In its letter dated July 19, 2018, the licensee states that the VIPRE-01 thermal hydraulic computer code will be used to evaluate departure from nucleate boiling and thermal hydraulic related design constraints. The NRC staff has reviewed and found this code to be acceptable for pressurized-water reactor (PWR) applications; however, the staff safety evaluation clearly states that this approval is conditional on appropriate justification for the input selection and modeling assumptions (Reference 1). The licensee does not provide sufficient detail for the NRC staff to determine if the input selection and modeling assumptions are appropriate for this intended purpose, nor does it provide an applicable precedent to inform the NRC staff's understanding of the proposed approach. Provide a description and justification of the input, modeling

assumptions, and methodology application that will be used in the GNF-A [Global Nuclear Fuels – America] VIPRE-01 analysis.

2. In its letter dated July 19, 2018, the licensee states that a CHF correlation developed based on testing of the LTA design will be used with the VIPRE-01 computer code. The July 19, 2018 letter does not provide any detail regarding the data used as a basis for the CHF correlation or why it is appropriate for this purpose. Provide a discussion on the CHF testing, explain how the data was used to develop a CHF correlation (including consideration of any uncertainties), describe how the correlation is used in VIPRE-01, and briefly summarize why it is appropriate for this application.

3. In its letter dated July 19, 2018, the licensee states that the PRIME thermal mechanical computer code will be used to evaluate thermal mechanical performance of the LTAs. The NRC has approved PRIME for use in evaluating thermal mechanical performance for BWR fuel (Reference 2), but while the validation data set included PWR fuel, the NRC did not explicitly approve PRIME for PWR applications. The licensee discusses some of the PWR specific considerations documented by the NRC contractor that performed the review, but insufficient information is provided to confirm that PRIME is appropriately validated for PWR applications. For example, **[[**

]] Provide a discussion, including relevant data, regarding the validation for PWR applications, such that the NRC staff can confirm the acceptability of PRIME results for PWR specific applications. Discuss the applicability of the validation data to the materials specific to the LTAs.

Compliance with 10 CFR 50.46 and GDC 10 requirements as well as GDC 2, "Design bases for protection against natural phenomena," is typically demonstrated by showing that postulated seismic and loss-of-coolant accident (LOCA) events will not result in deformation that challenges core coolability.

In its letter dated July 19, 2018, the licensee states that the current approved AOR methods will be used to evaluate the seismic and LOCA loads, with the LTAs explicitly modeled using test-based dynamic information. The current licensing basis for Braidwood Station is based on Westinghouse analytic methodologies, which include both testing and analytical methodologies. The licensee does not provide further information regarding the testing performed for the (non-Westinghouse) LTA design, and how they are compatible with the analytical methodologies used to analyze the seismic and LOCA loads.

The NRC staff requests the following information in order to complete its detailed review:

4. Provide a description of the testing performed to determine the relevant parameters used to model the LTAs in the AOR methods for seismic/LOCA events at Braidwood Station, and discuss why the testing is consistent with the analytical methodology.

In its letter dated July 19, 2018, the licensee states that a source term specific to the TVS-K LTAs will be used to evaluate changes to the current source term due to the higher uranium loading and lower power density of the TVS-K LTAs. 10 CFR 50.67 (b)(2) requires that the

licensee's accident source term analysis must demonstrate with reasonable assurance that the criteria in 10 CFR 50.67 (b)(2)(i), (ii), and (iii) are met. Regulatory Guide 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," dated July 2000 (ADAMS Accession No. ML003716792), Section 1.3.2, "Re-Analysis Guidance," states that the evaluation should consider the impact of modifications to compliance with the regulatory criteria. The information provided by the licensee does not demonstrate that the regulatory criteria will be met.

5. Provide source term specific to the TVS-K LTAs that would "be used to evaluate changes to the current source term due to the higher uranium loading and lower power density of the TVS-K LTAs." Regulatory Guide 1.183 states that a complete recalculation of all facility radiological analyses is not expected, but all impacts of the proposed changes should be evaluated.

References

1. Letter from A. C. Thadani (NRC) to Y. Y. Yung (WPPSS), "Acceptance for Referencing of the Modified Licensing Topical Report, EPRI NP-2511-CCM, Revision 3, 'VIPRE-01: A Thermal Hydraulic Analysis Code for Reactor Cores,' (TAC NO. M79498)", dated October 30, 1993, ADAMS Accession No. ML18033A074.

2. Letter from A. A. Lingenfelter (GNF-A) to USNRC Document Control Desk, "Accepted Versions of Global Nuclear Fuel - Americas Topical Reports NEDC-33256P, 'The PRIME Model for Analysis of Fuel Rod Thermal – Mechanical Performance Part 1 – Technical Bases,' NEDC-33257P, 'The PRIME Model for Analysis of Fuel Rod Thermal – Mechanical Performance Part 2 – Qualification,' and NEDC-33258P, 'The PRIME Model for Analysis of Fuel Rod Thermal-Mechanical Performance Part 3 – Application Methodology' (TAC # MD4114)," dated September 15, 2010, ADAMS Accession No. ML 102600259.

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