From:	Kuntz, Robert
Sent:	Monday, July 11, 2022 1:26 PM
To:	Steinman, Rebecca L:(Constellation Nuclear)
Subject:	RAI RE: Quad Cities License Amendment to expand the use of PRIME methods (EPID L-2022-LLA-0014)
Attachments:	QCNPS Legacy Fuel PRIME LAR Request for Additional Information.docx

By letter dated January 20, 2022, Exelon Generation Company, LLC, proposed to revise the Technical Specifications (TSs) for Quad Cities Nuclear Power Station, Units 1 and 2 (Quad Cities 1 and 2) as necessary to add a reference to Report 006N8642-P, Revision 1, "Justification of PRIME Methodologies for Evaluating TOP [Thermal Overpower] and MOP [Mechanical Overpower] for non-GNF [Global Nuclear Fuels] Fuels," to TS 5.6.5.b, the Core Operating Limits Report (COLR) references (Agencywide Document Access and Management System (ADAMS) Package Accession No. ML22020A398). Subsequently, the Quad Cities 1 and 2 facility operating licenses were transferred to Constellation Energy Generation, LLC (Constellation, the licensee). The letter above was supplemented by letter dated March 16, 2022 (ML22075A212). The Nuclear Regulatory Commission (NRC) staff has determined that additional information is required to complete its review. The NRC staff's request for additional information (RAI) is included. During a clarification discussion held on July 11, 2022, a 30 day response to the attached RAI was agreed upon. Therefore a response to the RAI is expected on or before August 11, 2022.

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Hearing Identifier: NRR_DRMA
Email Number: 1704

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Subject: RAI RE: Quad Cities License Amendment to expand the use of PRIME methods (EPID L-2022-LLA-0014)
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From: Kuntz, Robert

Created By: Robert.Kuntz@nrc.gov

Recipients:
"Steinman, Rebecca L:(Constellation Nuclear)" <Rebecca.Steinman@constellation.com>
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Options
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Reply Requested: No
Sensitivity: Normal
Expiration Date:

REQUEST FOR ADDITIONAL INFORMATION

CONSTELLATION ENERGY GENERATION

QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2

REQUEST TO EXPAND APPLICABILITY OF

GLOBAL NUCLEAR FUELS FUEL THERMAL-MECHCANICAL ANALYSIS METHODS

TO FRAMATOME FUEL

DOCKET NOS. 50-254 AND 50-265

L-2022-LLA-0014

Background

By letter dated January 20, 2022, Exelon Generation Company, LLC, proposed to revise the Technical Specifications (TSs) for Quad Cities Nuclear Power Station, Units 1 and 2 (Quad Cities 1 and 2) as necessary to add a reference to Report 006N8642-P, Revision 1, "Justification of PRIME Methodologies for Evaluating TOP [Thermal Overpower] and MOP [Mechanical Overpower] for non-GNF [Global Nuclear Fuels] Fuels," (006N8642-P) to TS 5.6.5.b, the Core Operating Limits Report (COLR) references (Agencywide Document Access and Management System (ADAMS) Package Accession No. ML22020A398). Subsequently, the Quad Cities 1 and 2 facility operating licenses were transferred to Constellation Energy Generation, LLC (Constellation, the licensee). The letter above was supplemented by letter dated March 16, 2022 (ML22075A212).

Requirements

The regulatory requirements applicable to the fuel thermal-mechanical limits are based on General Design Criterion (GDC) 10, "Thermal Hydraulic System Design," contained in Appendix A, "General Design Criteria for Nuclear Power Plants," to part 50, "Domestic Licensing of Production and Utilization Facilities," of Title 10, "Energy" of the Code of Federal Regulations (10 CFR 50 Appendix A). However, Quad Cities Units 1 and 2 were licensed prior to the promulgation of these criteria and hence meet the intent of the draft Principal Design Criteria published in 1967 by the Atomic Energy Commission, as discussed in Chapter 3 of the Quad Cities Updated Final Safety Analysis Report (UFSAR). Therefore, the review.is based on the criteria contained Section 3.1.2 of the Quad Cities UFSAR. Specifically, the NRC staff considered Criterion 6, "Reactor Core Design," which states:

> The reactor core shall be designed to function throughout its design lifetime, without exceeding acceptable fuel damage limits which have been stipulated and justified. The core design, together with reliable process and decay heat removal systems, shall provide for this capability under all expected conditions of normal operation with appropriate margins for uncertainties and for transient situations which can be anticipated, including the effects of the loss of power to recirculation pumps, tripping out of a turbine generator set, isolation of the reactor from its primary heat sink, and loss of all offsite power.

Issue

Adequate fuel performance modeling helps to establish the above-mentioned acceptable fuel damage limits. In the present request, Constellation proposes to apply new correlations within the Global Nuclear Fuels (GNF) PRIME fuel analysis methodology to account for the properties and behavior of the Framatome fuel.[1] While PRIME has been approved for use by the NRC staff, it is not explicitly approved to analyze Framatome fuel. Thus, the new correlations have not been reviewed and approved by the NRC staff.

Request

1. Demonstrate that the properties of the Framatome fuel are adequately represented by Equation 4-1 of 006N8642-P. Explain which data sets illustrated in Figure 4-2 are most representative of the Framatome fuel. In terms of the application of Equation 4-1 within the PRIME methodology, demonstrate that the modeling for Framatome, cold-worked, stress-relieved (CWSR) fuel cladding is consistent with the existing models and methods used for GNF (i.e., recrystallized, annealed) fuel cladding, insofar as the treatment of uncertainties and amount of conservatism are concerned.

2. The modified model described in Section 4.2 of 006N8642-P appears to have been adjusted to reflect a somewhat qualitative assessment of differences between CWSR and RXA zircaloy claddings published in Reference 20[2] of 006N8642-P. By comparison, the PRIME methodology includes a rather extensive assessment of the adequacy of the model as applied to RXA zircaloy. Justify that the treatment adopted within Section 4.2 of 006N8642-P is suitably adequate for the requested application.

[1] Global Nuclear Fuels, "The PRIME Model for Analysis of Fuel Rod Thermal – Mechanical Performance: Part 1 – Technical Bases, NEDC-33256P-A, Part 2 – Qualification, NEDC-33257P-A, and Part 3, Application Methodology, NEDC-33258P-A," September 2010, ML102600259.
[2] F. Garzarolli, R. Adamson and P. Rudling, *Optimization of BWR Fuel Rod Cladding Condition for High Burnups.* Proceedings of 2010 Light Water Reactor Fuel Performance/TopFuel/WRFPM, September 2010. [Obtained from NRC Technical Library via inter-library loan].