



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

November 3, 2022

Mr. David P. Rhoades
Senior Vice President
Constellation Energy Generation, LLC
President and Chief Nuclear Officer
Constellation Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3, LASALLE COUNTY STATION, UNITS 1 AND 2, AND QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2 – REGULATORY AUDIT REPORT TO SUPPORT THE REVIEW OF AMENDMENTS TO REVISE CRITICALITY SAFETY ANALYSIS METHODOLOGIES (EPIDS L-2022-LLA-0085, L-2021-LLA-0124, AND L-2021-LLA-0159)

Dear Mr. Rhoades:

By application dated June 8, 2022 (Agencywide Document Access and Management System (ADAMS) Accession No. ML22159A310) Constellation Energy Generation, LLC (Constellation) submitted a license amendment request (LAR) for Dresden Nuclear Power Station, Units 2 and 3 (Dresden). By application dated June 30, 2021 (ML21183A169), as supplement by letters dated November 4, 2021 (ML21312A457) and June 17, 2022 (ML22172A175) Exelon Generation Company, LLC, (Exelon) submitted LARs for LaSalle County Station, Units 1 and 2 (LaSalle). By application dated October 25, 2021 (ML21298A168), as supplemented by letter dated November 3, 2021 (ML22194A085), Exelon submitted LARs for Quad Cities Nuclear Power Station, Units 1 and 2 (Quad Cities). On February 1, 2022 (ML22032A333), Exelon was renamed Constellation. The amendments request the use of new criticality safety analysis (CSA) methodology for performing criticality safety evaluations for fuel in the spent fuel pool. The proposed changes to the CSA will use GESTAR II methodology for validating new fuel vault criticality safety. Due to the complex nature of this material, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an audit for understanding under the Office of Nuclear Reactor Regulation guidance LIC-111, "Regulatory Audits." The audit plan was provided on August 2, 2022, (ML22214A004).

The audit was conducted from August 4, 2022, through September 2, 2022. An Audit Exit Meeting was held with the licensees on September 1, 2022,

The audit was conducted virtually using an online portal and online discussions. The purpose of the audit was to gain understanding, to verify information, and to identify information that will require docketing to support the proposed licensing actions. The enclosure to this letter provides a report of the NRC staff's audit.

D. Rhodes

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If you have any questions, please contact me at (301) 415-3733 or at Robert.Kuntz@nrc.gov.

Sincerely,

/RA/

Robert F. Kuntz, Senior Project Manager
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-237, 50-249, 50-373,
50-374, 50-254, and 50-265

Enclosure:
Audit Report

cc: Listserv



UNITED STATES
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REGULATORY AUDIT REPORT
TO SUPPORT REVIEW OF CRITICALITY SAFETY ANALYSIS THAT SUPPORT
LICENSE AMENDMENT REQUESTS FOR
DRESDEN NUCLEAR POWER STATION, UNITS 2 AND 3,
LASALLE COUNTY STATION, UNITS 1 AND 2, AND
QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2
DOCKET NOS. 50-237, 50-249, 50 373, 50 374, 50-254, AND 50 265

1.0 BACKGROUND

By application dated June 8, 2022 (Agencywide Document Access and Management System (ADAMS) Accession No. ML22159A310) Constellation Energy Generation, LLC (Constellation) submitted a license amendment request (LAR) for Dresden Nuclear Power Station, Units 2 and 3 (Dresden). By application dated June 30, 2021 (ML21183A169), as supplement by letters dated November 4, 2021 (ML21312A457) and June 17, 2022 (ML22172A175) Exelon Generation Company, LLC, (Exelon) submitted LARs for LaSalle County Station, Units 1 and 2 (LaSalle). By application dated October 25, 2021 (ML21298A168), as supplemented by letter dated November 3, 2021 (ML22194A085), Exelon submitted LARs for Quad Cities Nuclear Power Station, Units 1 and 2 (Quad Cities). On February 1, 2022 (ML22032A333), Exelon was renamed Constellation. The amendments request the use of new criticality safety analysis (CSA) methodology for performing criticality safety evaluations for fuel in the spent fuel pool. The proposed changes to the CSA will use GESTAR II methodology for validating new fuel vault criticality safety. Due to the complex nature of this material, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an audit for understanding under the Office of Nuclear Reactor Regulation guidance LIC-111, "Regulatory Audits." The audit plan was provided on August 2, 2022, (ML22214A004).

The audit was conducted from August 4, 2022, through September 2, 2022. An audit Exit meeting was held with the licensees on September 1, 2022.

2.0 SCOPE AND PURPOSE

The subject LARs are proposing to update their new fuel vault (NFV) and spent fuel pool (SFP) storage to accommodate a fuel transition to the GNF3 fuel product. Each LAR included a standalone CSA for fuel storage in the respective SFPs to support the fuel transition. The CSAs for the SFPs were not the primary focus of this audit.

The NRC conducted a virtual audit for understanding of the method for validating new fuel vault criticality safety at Dresden, LaSalle, and Quad Cities. Title 10 of the *Code of Federal Regulations* (10 CFR) 50.68 has two paragraphs that apply to NFV storage of nuclear fuel: 10 CFR 50.68(b)(2) and 10 CFR 50.68(b)(3).

Regulation 10 CFR 50.68(b)(2) states, "The estimated ratio of neutron production to neutron absorption and leakage (k-effective) of the fresh fuel in the fresh fuel storage racks shall be calculated assuming the racks are loaded with fuel of the maximum fuel assembly reactivity and flooded with unborated water and must not exceed 0.95, at a 95 percent probability, 95 percent confidence level. This evaluation need not be performed if administrative controls and/or design features prevent such flooding or if fresh fuel storage racks are not used."

With respect to 10 CFR 50.68(b)(2) the licensee is proposing to change the methodology for demonstrating compliance and safety to GESTAR II at each site.

Regulation 10 CFR 50.68(b)(3) states, "If optimum moderation of fresh fuel in the fresh fuel storage racks occurs when the racks are assumed to be loaded with fuel of the maximum fuel assembly reactivity and filled with low-density hydrogenous fluid, the k-effective corresponding to this optimum moderation must not exceed 0.98, at a 95 percent probability, 95 percent confidence level. This evaluation need not be performed if administrative controls and/or design features prevent such moderation or if fresh fuel storage racks are not used."

With respect to 10 CFR 50.68(b)(3) the licensee made similar claims that this requirement did not apply because they have administrative controls to prevent optimum moderation.

3.0 AUDIT TEAM

The following NRC staff members participated in the audit:

- Robert Kuntz, Project Manager
- Surinder Arora, Project Manager
- Blake Purnell, Project Manager
- Kent Wood, Technical Reviewer

4.0 AUDIT SUMMARY

The audit focused on two topics, the licensee's compliance with 10 CFR 50.68(b)(2) and 10 CFR 50.68(b)(3).

With respect to 10 CFR 50.68(b)(2), the licensee proposed transferring the NFV CSA methodology to GESTAR II. The NRC staff audited documents 1, 3, 4, and 8, listed in section 5.0 of this report. Based on those documents the NRC staff made the following observations:

- Technical Design Procedure (TDP)-0140, Revision 5, “New and Spent Fuel Storage Rack Criticality Calculations,” is the [General, Nuclear Fuel] GNF procedure for performing NFV and SFP CSA. TDP-0140, Revision 5, explicitly states GESTAR II does not have an NRC approved methodology for performing criticality safety analysis for NFV and SFP.
- 003N7421, Revision 1, “Generic Criticality Safety Storage Analysis of GE New Fuel Storage Racks for GNF3 Fuel,” dated February 2018, is a CSA for GNF3 fuel in GE supplied NFV storage facilities.

With respect to 10 CFR 50.68(b)(3), each licensee made similar claims that this requirement did not apply because they have administrative controls to prevent optimum moderation. The NRC staff audited documents 2, 5.a through 5.g, 6, and 7, listed in section 5.0 of this report. Based on those documents the NRC staff made the following observations:

- Even if a licensee has “...administrative controls and/or design features [to] prevent such moderation...” 10 CFR 50.68(b)(3) will still apply. However, the method of compliance changes from an analysis and operation in accordance with that analysis that demonstrates sufficient sub-critical margin to maintenance of the “administrative controls and/or design features” and operation within those.
- All three LARs state that “administrative controls and/or design features” are in place that preclude an optimum moderation condition.
- All three LARs tie the “administrative controls and/or design features” back to service information letter (SIL)-152. “SIL-152” is a March 31, 1976, General Electric Service Information Letter titled Criticality Margins Storage of New Fuel. SIL-152 can be found in ADAMS as an attachment included in a public comment on proposed 10 CFR 50.68 rulemaking (ML20198C524).
- During the audit, the NRC staff identified an explicit link between SIL-152 and Quad Cities licensing basis. That link is provided by the Quad Cities 10 CFR 70.24 exemption request approval (ML20217H309). That exemption approval was limited to fuel with a maximum 5.0 weight percent enriched Uranium-235. The NRC staff was unable to identify a similar link for LaSalle and Dresden.
- The NRC staff inquired whether the SIL-152 recommendations were still applicable to these plants today, but 10 CFR 50.68(b)(3) was determined to be out of scope for the subject license amendments so no further review was performed on the relevant topics.

5.0 DOCUMENTS REVIEWED

The following documents were reviewed by the NRC staff during the audit:

1. 003N7421, Revision 1, "Generic Criticality Safety Storage Analysis of GE New Fuel Storage Racks for GNF3 Fuel," dated February 2018
2. CEG [Constellation Energy Generation] white paper "DRE SIL 152 Roadmap"
3. DRE [Dresden] USFAR 9.1, "Fuel Storage and Handling"
4. LAS [Lasalle] USFAR 9.1, "Fuel Storage and Handling"
5. CEG white paper "LaSalle SIL 152 Roadmap" and the following support documents that were referenced from the roadmap
 - a. Safety Evaluation Report for LaSalle, dated September 25, 1978 (7811240150)
 - b. Letter from NRC to Commonwealth Edison, dated October 5, 1981 (8110230445)
 - c. L-003145, Revision 0, FANP Criticality Safety Analysis for ATRIUM 10 Fuel - LaSalle Units 1 and 2 New Fuel Storage Vault, dated June 2001.
 - d. LFP-100-2, Revision 2, Administrative Control of Transfer of Fuel or Special Nuclear Material Between or Within the Spent Fuel Pool(s) or Vaults – Historical Document
 - e. LFP-100-5, Revision 9, Administrative Control of Transfer of Fuel or Special Nuclear Material Between or Within the Spent Fuel Pool(s) or Vaults – Historical Document [CEG Confidential]
 - f. LU1999-07, UFSAR Change Package
 - g. NUREG-0519, "Safety Evaluation Report related to the operation of LaSalle County Station, Units 1 and 2," dated February 1982
6. Procedures supporting SIL 152 RAI Response (bulleted list of procedure number, revision, and titles for each site)
7. CEG white paper "QDC SIL 152 Road Map"
8. TDP-0140, Revision 5, Technical Design Procedure "New and Spent Fuel Storage Rack Criticality Calculations"

6.0 AUDIT CONCLUSION

There were no regulatory decisions made during the audit. There were no open items needing further clarification and no deviation from the audit plan.

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