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

August 11, 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: BRAIDWOOD STATION, UNITS 1 AND 2 - ISSUANCE OF AMENDMENT NO. 229 RE: REMOVAL OF BRAIDWOOD, UNIT 2, REACTOR VESSEL STUD 35 COMMITMENT AND INCREMENTATION OF UNIT 1 AMENDMENT NO. TO 229 (EPID L-2021-LLA-0226)

Dear Mr. Rhoades:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 229 to Renewed Facility Operating License No. NPF-77 for Braidwood Station, Unit 2, and has incremented the amendment number for Renewed Facility Operating License No. NPF-72 for Braidwood Station, Unit 1. The amendment is in response to your application dated December 9, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21343A427).

The amendment removes Braidwood, Unit 2, License Condition 2.C.(12)(d), regarding repair of reactor head closure stud hole location No. 35. The Braidwood, Unit 1, amendment number is incremented to 229 so it remains the same as Unit 2. The change to the Braidwood, Unit 1, license is administrative and no textual changes are made to its license.

A copy of the Safety Evaluation is also enclosed. A Notice of Issuance will be included in the Commission's monthly *Federal Register* notice.

Sincerely,

/RA/

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

Docket Nos. STN 50-456, STN 50-457

Enclosures:
1. Amendment No. 229 to NPF-77
2. Safety Evaluation

cc: Listserv

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

CONSTELLATION ENERGY GENERATION, LLC

DOCKET NO. STN 50-457

BRAIDWOOD STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 229
Renewed License No. NPF-77

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Constellation Energy Generation, LLC (the licensee) dated December 9, 2021, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance: (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the renewed operating license is amended by changes to the license as indicated in the attachment to this license amendment, and paragraph 2.C.(12)(d) of Renewed Facility Operating License No. NPF-77 is hereby amended to read as follows:

(d) Deleted.

3. This license amendment is effective as of the date of its issuance and shall be implemented within 60 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Nancy L. Salgado

Digitally signed by Nancy L. Salgado
Date: 2022.08.11 14:36:57 -04'00'

Nancy L. Salgado, Chief
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility Operating License

Date of Issuance: August 11, 2022

ATTACHMENT TO LICENSE AMENDMENT NO. 229

RENEWED FACILITY OPERATING LICENSE NO. NPF-77

BRAIDWOOD STATION, UNIT 2

DOCKET NO. STN 50-457

Replace the following page of the Renewed Facility Operating License. The revised page is identified by amendment number and contains marginal lines indicating the areas of change.

REMOVE	INSERT
License No. NPF-77 Page 6	License No. NPF-77 Page 6

(c) The flux thimble tube corrective actions, inspections, and replacements identified in the SER, Commitment No. 24, for Braidwood Units 1 and 2, shall be implemented in accordance with the schedule in the Commitment. Periodic eddy current testing/inspections of all flux thimble tubes shall be performed at least every two refueling outages {RFO], and the data shall be trended and retained in auditable form. A flux thimble tube shall not remain in service for more than two (2) operating fuel cycles without successful completion of eddy current testing for that thimble tube.

(d) Deleted

(13) Adoption of 10 CFR 50.69, “Risk-informed categorization and treatment of structures, systems, and components for nuclear power plants”

Constellation Energy Generation, LLC is approved to implement 10 CFR 50.69 using the processes for categorization of Risk-Informed Safety Class (RISC)-1, RISC-2, RISC-3, and RISC-4 structures, systems, and components (SSCs) using:

Probabilistic Risk Assessment (PRA) models to evaluate risk associated with internal events, including internal flooding, and internal fire; the shutdown safety assessment process to assess shutdown risk; the Arkansas Nuclear One, Unit 2 (ANO-2) passive categorization method to assess passive component risk for Class 2, Class 3, and non-Code class SSCs and their associated supports; and the results of non-PRA evaluations that are based on the IPEEE Screening Assessment for External Hazards, i.e., seismic margin analysis (SMA) to evaluate seismic risk, and a screening of other external hazards updated using the external hazard screening significance process identified in ASME/ANS PRA Standard RA-Sa-2009; as specified in the license amendment No. 198, dated October 22, 2018.

The licensee will complete the updated implementation items listed in Attachment 1 of Exelon letter to NRC dated September 13, 2018, prior to implementation of 10 CFR 50.69. All issues identified in the attachment will be addressed and any associated changes will be made, focused scope peer reviews will be performed on changes that are PRA upgrades as defined in the PRA standard (ASME/ANS RA-Sa-2009, as endorsed by RG 1.200, Revision 2), and any findings will be resolved and reflected in the PRA of record prior to implementation of the 10 CFR 50.69 categorization process.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 229 TO RENEWED FACILITY

OPERATING LICENSE NO. NPF-77

CONSTELLATION ENERGY GENERATION, LLC

BRAIDWOOD STATION, UNIT 2

DOCKET NO. STN 50-457

1.0 INTRODUCTION

By letter dated December 9, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21343A427), Exelon Generation Company, LLC, submitted a license amendment request (LAR) to remove License Condition 2.C.(12)(d) in Renewed Facility Operating License No. NPF-77 for Braidwood Station (Braidwood), Unit 2. On February 1, 2022, Exelon Generation Company, LLC was renamed Constellation Energy Generation, LLC (Constellation, the licensee). The licensee stated that the license condition is no longer applicable as the pressure-temperature (P-T) limit curves have been updated for the period of extended operations and the U.S. Nuclear Regulatory Commission (NRC or Commission) has approved technical report, WCAP-16143, Revision 1, "Reactor Vessel Closure Head/Vessel Flange Requirements Evaluation for Byron/Braidwood Units 1 and 2," by letter dated October 28, 2015 (ML15232A441).

2.0 REGULATORY EVALUATION

Title 10 of the *Code of Federal Regulations* (10 CFR) 50.36, "Technical specifications," paragraph (a), requires that each operating license application for a production or utilization facility include proposed technical specifications (TSs) and a summary statement of the bases for such specifications. Paragraph (c) of 10 CFR 50.36 requires, in part, that TSs include the following categories related to facility operation: (1) safety limits and limiting safety systems settings; (2) limiting conditions for operation; (3) surveillance requirements; (4) design features; and (5) administrative controls.

Regulation 10 CFR 50.60, "Acceptance criteria for fracture prevention measures for light-water nuclear power reactors for normal operation," requires, in part, that all light-water nuclear power reactors, other than reactor facilities for which the certifications required under paragraph 50.82(a)(1) have been submitted, must meet the fracture toughness requirements for the reactor coolant pressure boundary set forth in appendix G to this part (i.e., 10 CFR Part 50, Appendix G).

Regulation 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," permits the licensee to request an amendment.

Regulation 10 CFR Part 50, Appendix G, “Fracture Toughness Requirements,” requires, in pertinent part, (1) sufficient fracture toughness for reactor pressure vessel (RPV) ferritic materials to provide adequate safety margins during any condition of normal operation, including anticipated operational occurrences and system hydrostatic tests; and (2) Pressure-Temperature (P-T) limits that satisfy the American Society of Mechanical Engineers (ASME) Code, Section XI, Appendix G, and the minimum temperature requirements during normal operation (including heatup and cooldown and anticipated operational occurrences), and pressure test operations.

3.0 TECHNICAL EVALUATION

In accordance with 10 CFR 50.90, the licensee proposed to delete License Condition 2.C.(12)(d) in the Braidwood, Unit 2, Renewed Facility Operating License No. NPF-77 which currently states:

> The Braidwood Unit 2 reactor head closure stud hole location No. 35 will be repaired no later than June 18, 2027, or before the end of the last refueling outage prior to the period of extended operation (whichever occurs later), so that all 54 reactor head closure studs are operable and tensioned during the period of extended operation.

The NRC staff has reviewed the background of the RPV head stud configuration, previous licensing actions, and relevant licensing basis information in evaluating the LAR as discussed below.

RPV Head Stud Configuration

Braidwood, Unit 2, began commercial operation in the fall of 1988 with a total of 54 studs in the RPV head closure flange. The licensee stated that in 1991, during the second refueling outage (RFO), RPV head closure stud location number 35 (stud 35) became stuck during RPV disassembly. The licensee further stated that the stud could not be removed without excessive or destructive methods. Because the stud was only withdrawn 15/32 inches (4 turns), the licensee decided to leave the stud in place during the RFO and protect it from borated water when the reactor cavity was flooded. At the time, the licensee evaluated the issue and concluded that the licensee could continue to safely operate with stud 35 tensioned and withdrawn 15/32 of an inch from the RPV flange.

From 1991 to 1994, the licensee tensioned stud 35 during plant operation and stud 35 remained in the RPV flange during RFOs. However, the licensee indicated that the protruding portion of stud 35 was an obstacle to fuel movements during RFOs. As such, in the spring of 1994, the licensee evaluated the condition where the RPV could be placed in service without stud 35 tensioned. The licensee concluded that the increased stud stresses and flange separation in the area corresponding to stud 35 and the adjacent studs were not significant, and the O-ring configuration would ensure the RPV flange remain sealed during reactor operation. The licensee’s evaluation concluded that, without stud 35 tensioned, the structural integrity of the RPV satisfied the 1971 Edition of the ASME Code, Section III, with addenda, through Summer 1973.

In the spring 1994 RFO, the licensee removed the portion of stud 35 that protruded above the RPV flange and started up from the RFO with 53 studs tensioned at Unit 2. The licensee revised the updated final safety analysis report (UFSAR) Table 5.3-2, “Reactor Vessel Design Parameters,” to reflect the new configuration, which was submitted to the NRC as part of the periodic UFSAR update in accordance with 10 CFR 50.71(e) (9812160122 in the Legacy Library).

During the 2002 RFO, the licensee removed stud 35 from the RPV flange hole. The licensee stated that the RPV flange hole threads showed significant damage and the RPV flange hole could not be reused as found. As a remedy, the licensee bored a larger hole in the RPV flange hole and then machining new threads in the RPV flange hole. However, the vendor’s equipment malfunctioned during the repair. As a result, the licensee decided not to continue the repair in the 2002 RFO and to continue operating Unit 2 with 53 studs tensioned during operation. The licensee made an engineering change allowing the new configuration of the RPV flange hole in stud location 35 (i.e., no stud in location 35).

Licensing Actions

The NRC staff notes that a separate but relevant licensing action associated with the malfunctioned stud 35 is the development of P-T limit curves in Braidwood TS because P-T curves restrict pressure and temperature for the RPV bolted condition to ensure the structural integrity of the RPV flange.

By letter dated October 3, 2005 (ML052780469), the licensee requested an exemption from the requirements of 10 CFR 50.60. The licensee’s exemption request proposed to use Attachment 6 to its October 3, 2005, letter, WCAP-16143, "Reactor Vessel Closure Head/Vessel Flange Requirements Evaluation for Byron/Braidwood Units 1 and 2," published in November 2003 (i.e., Revision 0) for calculating the P-T limit curves for Byron and Braidwood units, in lieu of 10 CFR 50, Appendix G, paragraph IV.A.2.c, as required by 10 CFR 50.60(a). As part of the exemption request, the licensee also requested a corresponding TS change to add WCAP-16143 as a reference in TS 5.6.6, "Reactor Coolant System (RCS) Pressure and Temperature Limits Report (PTLR).” The NRC staff noted that at the time WCAP-16143, Revision 0, considered the 54-stud configuration in its analyses.

By letter dated November 22, 2006 (ML061890003), the NRC approved the exemption request. In addition, by letter dated November 27, 2006 (ML062610513), the NRC issued Amendment No. 142 for Braidwood, Unit 2, to permit the addition of WCAP-16143, Revision 0, to TS 5.6.6, “Reactor Coolant System (RCS) PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR),” as an approved analytical method in developing the P-T limits in the PTLR.

In 2013, as part of the license renewal application for Unit 2, the licensee committed to repair stud hole location 35 as documented in Commitment Item No. 48 on page A-49 of NUREG-2190, Volume 2, “Safety Evaluation Report Related to the License Renewal of Byron Station, Units 1 and 2, and Braidwood Station, Units 1 and 2,” published in December 2015 (ML15350A041). Commitment Item No. 48 became the subject License Condition 2.C.(12)(d).

As part of the license renewal application, the licensee noted that WCAP-16143, Revision 0, analyzes the original 54-stud configuration, not the 53-stud configuration. Also, the licensee stated that the P-T limits curves at the time did not reflect the period of extended operation. By letter dated October 16, 2014 (ML14290A097), the licensee submitted a LAR to use Attachment 4 to its October 16, 2014, letter, WCAP-16143, Revision 1, which updated the analyses to

include the 53-stud configuration as well as the 54-stud configuration. WCAP-16143, Revision 1, demonstrates that the 53-stud configuration is acceptable in cold-shutdown, hot shutdown, hot standby, startup, and power Modes (Modes 1 to 5 as defined in TS Table 1.1-1) in lieu of the 54-stud configuration as required for these operating modes in the prior licensing basis.

By letter dated October 28, 2015 (ML15232A441), the NRC staff approved the use of WCAP-16143, Revision 1, for developing P-T limit curves as shown in license amendment No. 186. The NRC staff determined that WCAP-16143, Revision 1, analyzed and compared the results for both 53- and 54-stud configurations and that the 53-stud configuration is acceptable. The NRC staff further determined that WCAP-16143, Revision 1, adequately addresses the impact of the missing stud in terms of stress and fracture mechanics analyses of the RPV flange. The NRC staff concluded that WCAP-16143, Revision 1, has demonstrated that the structural integrity and leak tightness of the RPV flange with 53 studs are continuously maintained.

Relevant Licensing Basis

As part of its evaluation of the subject LAR, the NRC staff also reviewed whether other relevant licensing basis information, i.e., TS requirements, would be affected by the removal of the License Condition 2.C.(12)(d) as discussed below.

First, the NRC staff reviewed TS Table 1.1-1 which defines operational conditions for various Modes such as startup and hot standby. TS Table 1.1-1 footnote (b) states that “All required reactor vessel head closure bolts fully tensioned…”, and footnote (c) states that “One or more required reactor vessel head closure bolts less than fully tensioned…”. These two footnotes address the 53-stud configuration in various operational modes. The NRC staff finds that these two footnotes will not be affected by the removal of the subject license condition because they are supported by the analyses of WCAP-16143, Revision 1.

Second, the NRC staff reviewed TS 5.6.6 to determine whether its requirements will be affected by the removal of the subject license condition. The NRC staff noted that TS 5.6.6.b.3 specifies WCAP-16143 to be used as an acceptable analytical method for developing the P-T curves without mentioning Revision 1 of the report. However, TS 5.6.6.b requires that the analytical methods used to develop P-T curves “shall be those previously reviewed and approved by the NRC,” and TS 5.6.6.b.5 requires that “… The PTLR will contain the complete identification for each of the TS referenced Topical Reports used to prepare the PTLR (i.e., report number, title, revision, date, and any supplements) …”. The NRC determined that even though TS 5.6.6.b.3 does not specify Revision 1 of WCAP-16143; WCAP-16143, Revision 1, was previously reviewed and approved by the NRC. Therefore, the NRC staff finds that TS 5.6.6.b.3 and TS 5.6.6.b.5 will not be affected by the removal of the subject license condition.

Third, TS 5.6.6.b.4 discusses an NRC-approved exemption request in an NRC letter dated August 31, 2020, and an NRC-approved methodology for developing P-T limits in an NRC letter dated September 18, 2020 (ML20022A336 and ML20163A046, respectively). The NRC staff determined that the exemption and methodologies cited in TS 5.6.6.b.4 are not related to the RPV stud issue and, therefore, TS 5.6.6.b.4 will not be affected by the removal of the subject license condition.

Fourth, by letter dated October 27, 2021 (ML21300A074), the licensee submitted Braidwood, Unit 2, PTLR, Revision 8, in accordance with TS 5.6.6. The PTLR, Revision 8, contains P-T limit curves that are valid for 57 effective full power years for the use in the period of extended operation. The licensee developed the P-T limit curves in the PTLR, Revision 8, based on the

53-stud configuration per WCAP-16143, Revision 1. As such, the NRC staff finds that PTLR, Revision 8, supports the removal of the license condition and is not affected by its removal.

Based on the NRC-approved license amendments to address the changes to the RPV closure flange stud configuration and associated analyses in NRC-approved WCAP-16143, Revision 1, the NRC staff finds that License Condition 2.C.(12)(d) is no longer necessary for the Renewed Facility Operating License NPF-77 for Braidwood, Unit 2.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Illinois State official was notified of the proposed issuance of the amendment on June 9, 2022. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes requirements with respect to installation or use of a facility's components located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding dated March 22, 2022 (87 FR 16252). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principle Contributor: J Tsao

Date of issuance: August 11, 2022

SUBJECT: BRAIDWOOD STATION, UNITS 1 AND 2 - ISSUANCE OF AMENDMENT NO. 229 RE: REMOVAL OF BRAIDWOOD, UNIT 2, REACTOR VESSEL STUD 35 COMMITMENT AND INCREMENTATION OF UNIT 1 AMENDMENT NO. TO 229 (EPID L-2021-LLA-0226) DATED AUGUST 11, 2022

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ADAMS Accession No.: ML22173A181

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