



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

February 9, 2024

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: LASALLE COUNTY STATION, UNITS 1 AND 2 - ISSUANCE OF
AMENDMENT NOS. 262 AND 247 RE: REVISED DESIGN BASES OF
LOWER DOWNCOMER BRACES (EPID L-2023-LLA-0008)

Dear Mr. Rhoades:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment Nos. 262 and 247 for the LaSalle County Station, Units 1 and 2, respectively. The amendments consist of changes to Updated Final Safety Analysis Report to allow the use of plastic section properties in analysis of the lower downcomer braces in response to your application dated January 12, 2023, as supplemented by letter dated July 24, 2023.

A copy of our related safety evaluation is also enclosed. A Notice of Issuance will be included in the Commission's monthly *Federal Register* notice.

Sincerely,

/RA/

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

Docket Nos. 50-373 and 50-374

Enclosure:

1. Amendment No. 262 to NPF-11
2. Amendment No. 247 to NPF-18
3. Safety Evaluation

cc: Listserv



UNITED STATES
NUCLEAR REGULATORY COMMISSION
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CONSTELLATION ENERGY GENERATION, LLC

DOCKET NO. 50-373

LASALLE COUNTY STATION, UNIT 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 262
Renewed License No. NPF-11

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 January 12, 2023, as supplemented by letter dated July 24, 2023, 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. This license amendment is effective as of its date of issuance and shall be implemented within 30 days of the date of issuance. Implementation of the amendment shall also include revision of the Updated Final Safety Analysis Report as described in the licensee's letter dated January 12, 2023.

FOR THE NUCLEAR REGULATORY COMMISSION

Jeffrey A. Whited, Chief
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Date of Issuance: February 9, 2024



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

CONSTELLATION ENERGY GENERATION, LLC

DOCKET NO. 50-374

LASALLE COUNTY STATION, UNIT 2

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 247
Renewed License No. NPF-18

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 January 12, 2023, as supplemented by letter dated July 24, 2023, 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. This license amendment is effective as of its date of issuance and shall be implemented within 30 days of the date of issuance. Implementation of the amendment shall also include revision of the Updated Final Safety Analysis Report as described in the licensee's letter dated January 12, 2023.

FOR THE NUCLEAR REGULATORY COMMISSION

Jeffrey A. Whited, Chief
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Date of Issuance: February 9, 2024



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 262 AND 247 TO RENEWED

FACILITY OPERATING LICENSE NOS. NPF-11 AND NPF-18

CONSTELLATION ENERGY GENERATION, LLC

LASALLE COUNTY STATION, UNITS 1 AND 2

DOCKET NOS. 50-373 AND 50-374

1.0 INTRODUCTION

By application dated January 12, 2023 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML23013A076), as supplemented by letter dated July 24, 2023 (ML23205A151), Constellation Energy Generation, LLC (the licensee), submitted a license amendment request (LAR) to change the Updated Final Safety Analysis Report (UFSAR) (ML22111A258) for LaSalle County Station (LaSalle), Units 1 and 2.

The proposed changes would revise the UFSAR to allow the use of plastic properties in analysis of the lower downcomer bracing.

The supplemental letter dated July 24, 2023, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the U.S. Nuclear Regulatory Commission (NRC or Commission) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on April 18, 2023 (88 FR 23695).

2.0 REGULATORY EVALUATION

2.1 System Description

LaSalle Units 1 and 2 utilize a containment suppression chamber vent system consisting of 98 downcomer pipes open to the drywell and submerged below the water level of the suppression pool. These downcomers function as the path for pressure suppression of steam, liquid, and gases released in the drywell during a loss-of-coolant accident (LOCA). Each downcomer has a 23.5-inch internal diameter. The downcomers in the suppression pool are braced at elevation 721 feet (upper downcomer bracing) and at elevation 697 feet (lower downcomer bracing) to support the downcomers against bounding submerged structures loads. The upper bracing members are built-up I-shapes while the lower bracing members are 8-inch diameter XXS pipe sections. The downcomer vents are subjected to static and dynamic loads due to normal, upset, emergency, and faulted plant conditions.

2.2 Proposed Change

As stated in the LAR, during an interface with the NRC regarding a non-conforming condition related to the pool swell profile, it was identified that analyses 187, 187K, and Revision 0 of Calculation L-002547 use plastic section modulus, contrary to the station license commitments. As part of the Revision 0 evaluation, the licensee identified that incorrect bounding loads were considered in the analyses of the upper and lower downcomer bracing members, and that corrected bounding loads resulted in stresses exceeding the design basis allowable limit. Analysis L-002547 was revised (Revision 0A) and provided in Attachment 3 of the LAR to re-evaluate the downcomer bracing members and gusset plate section based on the bounding loads. For the upper downcomer bracing members, elastic section properties are used, consistent with the current licensing basis. For the lower downcomer bracing members and the gusset plate section, plastic section modulus is used in support of the LAR.

2.3 Regulatory Requirements and Guidance

The NRC staff identified the following regulatory requirements applicable to this LAR:

- Criterion 2 “Design bases for protection against natural phenomena,” in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 Appendix A, “General Design Criteria for Nuclear Power Plants,” as it relates to the design of structures, systems, and components (SSCs), requires, in part, that the SSCs important to safety shall be designed to withstand the effects of natural phenomena such as tornadoes, earthquakes, and hurricanes without loss of capability to perform their safety functions.
- Criterion 4 “Environmental and dynamic effects design bases,” in 10 CFR Part 50 Appendix A, requires that nuclear power plant SSCs important to safety be designed to accommodate the effects of, and be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. These SSCs shall be protected against certain dynamic effects, including pipe-whipping and discharging fluids.
- Criterion 50 “Containment design basis,” in 10 CFR Part 50 Appendix A requires that “The reactor containment structure, including access openings, penetrations, and the containment heat removal system shall be designed so that the containment structure and its internal compartments can accommodate, without exceeding the design leakage rate and with sufficient margin, the calculated pressure and temperature conditions resulting from any loss-of-coolant accident. This margin shall reflect consideration of (1) the effects of potential energy sources which have not been included in the determination of the peak conditions, such as energy in steam generators and as required by § 50.44 energy from metal-water and other chemical reactions that may result from degradation but not total failure of emergency core cooling functioning, (2) the limited experience and experimental data available for defining accident phenomena and containment responses, and (3) the conservatism of the calculational model and input parameters.”

The NRC staff determined that the following guidance is relevant to this LAR:

- NUREG-0800, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition (SRP), section 3.6.2, “Determination of Rupture

Locations and Dynamic Effects Associated with the Postulated Rupture of Piping”
(ML16088A041)

- NUREG-0808 “Mark II Containment Program Load Evaluation and Acceptance Criteria” (ML072710552, non-public)
- Regulatory Guide (RG) 1.243 “Safety-Related Steel Structures and Steel-Plate Composite Walls for Other Than Reactor Vessels and Containments” endorses the procedures and standards of the 2018 edition of American National Standards Institute (ANSI)/American Institute of Steel Construction (AISC) 690, “Specification for Safety-Related Steel Structures for Nuclear Facilities.” RG 1.243 notes that ANSI/AISC N690-18 is compatible with ANSI/AISC 360-16, “Specification for Structural Steel Buildings.”

3.0 TECHNICAL EVALUATION

3.1 Background

Analysis No. L-002547, Revision 0A, re-evaluated the downcomer lower bracing and gusset plates for the bounding loads and using plastic section properties. The upper downcomer bracing members are evaluated using elastic section properties, consistent with the current licensing basis.

Section 3.6.2.3.1 of the UFSAR specifies the existing design basis and loading for pipes and restraints for the prevention of or escalation of dynamic effects with a pipe rupture. Section 3.8.3.2 of the UFSAR specifies the applicable codes and standards that are adopted in the design and construction of the structures internal to the containment. The UFSAR references section 5.3.3.4 of the Design Assessment Report (DAR) (ML19296B878) for applicable codes to design and construction of the downcomer bracing. Consistent with the recommendation by DAR, Table 3.8-9, “Seismic Category 1 Structures – Load Combination – Structural Steel Elastic Design,” of the UFSAR specifies the allowable design stress for Abnormal/Extreme Environmental loading to be “1.6 AISC Allowable \leq 0.95Fy.” This allowable stress is consistent with ANSI/AISC N690-18, which permits allowable strength to be multiplied by 1.6 for extreme environmental and abnormal load combinations.

Section 6.2, “Acceptance Criteria,” of Attachment 3 to the LAR, references SRP 3.6.2. SRP 3.6.2, section III.4.A, “Dynamic Analysis Criteria,” permits a 10 percent increase of minimum specified design yield strength to account for strain rate effects under dynamic loading. The increased allowable stress accounting for the SRP 3.6.2 10 percent increase results in an allowable stress of 1.1 times the UFSAR minimum of 1.6 times AISC Allowable or 0.95Fy.

3.2 NRC Staff Evaluation

The NRC staff reviewed the load combinations and analysis results and observed that load combination 7-2 produces the maximum stresses in the bracing members and gusset plates. Load combination 7-2, which is an Abnormal/Extreme combination, is a summation of forces due to dead loads (D), accident temperature load, safety/relief valve load (SRV), LOCA loads, and safe shutdown earthquake. Consistent with LaSalle, Units 1 and 2, Mark II DAR, the licensee conservatively assumed all the loads in combination 7-2 occur simultaneously and the peak responses of the individual transient loads are combined by the absolute sum method, even though probabilistically all peak effects will not occur at the same time. In section 7.1.3.3 of the LAR analysis, load combination 7-2 results in a maximum combined stress interaction ratio

of 0.99 (less than 1.0) for a lower bracing member. The calculation of the maximum forces on the bracing is conservative because the instantaneous peak response induced by loads such as earthquake, SRV discharge, LOCA, etc., may not occur simultaneously. Furthermore, section 2.3.2.2 of NUREG-0808 states that “the probability that a number of impulsively loaded downcomers experience the load in the same direction at the same instant is extremely small, a number of the downcomers may have a fraction of the load acting in the same direction at roughly the same time.”

To achieve an interaction ratio of less than 1.0, the licensee proposed to use plastic section properties for the 8-inch XXS pipe bracing members in the analysis along with an increased allowable stress factor of 1.1 as described in NUREG-0800, SRP 3.6.2 to account for strain rate effects under dynamic loading. In response to a request for additional information (RAI) issue (c) provided in the July 24, 2023, letter, the licensee noted that the recent American Institute of Steel Construction (AISC) codes (including the AISC N690 nuclear code) used plastic section properties for flexural capacity of beams. The licensee further noted in the response that the use of plastic section properties still maintains the overarching criterion, which is to allow for the safe shutdown of the plant. The NRC staff evaluated the use of plastic section properties for the 8-inch XXS pipe and noted that the XXS pipe has a diameter to wall thickness ratio (D/t) of 10.6. In accordance with the latest ANSI (American National Standards Institute)/AISC 360, table B4.1b, the XXS pipe D/t ratio falls in the compact range, and compact sections can achieve the plastic moment capacity without local buckling. Chapter F8 of the latest ANSI/AISC 360 determines the nominal flexural strength of a compact pipe by the yield stress multiplied by the plastic section modulus. Therefore, the NRC staff finds the use of plastic section properties for the lower bracing members to be reasonable as it is consistent with the latest ANSI/AISC 360 specifications.

Additionally, the NRC staff evaluated the licensee’s use of the 10 percent increase in yield strength per NUREG-0800, SRP 3.6.2, section III.4.A. The 10 percent increase in yield strength is intended to account for the higher yield strength of steel materials due to dynamic or impulsive loading that may produce high strains rates. The controlling load combination, 7-2, includes LOCA and SRV load cases, which are characterized as dynamic loads per the following report descriptions. Sections 2.1 and 2.2 of NUREG-0808, describe the loading following a postulated LOCA to be a mixture of air and steam carried through the downcomers into the suppression pool as pool swell loads followed by condensation oscillation (CO) that produce sinusoidal pressures in the drywell and wetwell system. A second type of condensation-driven oscillation, called chugging, is characterized by discrete bursts of pressure oscillations in the wetwell. Section 2.3 of NUREG-0808 states in part for a Mark II facility, chugging-induced lateral loads on the downcomer control over the initial CO load, and the loads occur near the downcomer exit and are characterized to be dynamic and impulsive in nature. The CO and chugging LOCA load are used directly in combination with other maximum loads such as SRV (safety/relief valve load) and seismic dynamic load, for the evaluation of structures, piping, and equipment. According to the LaSalle Mark II DAR, the SRV actuation and discharge causes oscillating pressure throughout the suppression pool, resulting in dynamic loads on the pool boundary and submerged structures. Because the LOCA and SRV load cases in combination 7-2 are characterized as dynamic loading, the use of the 10 percent increase in yield stress of the downcomer bracing is justified. Therefore, the NRC staff finds the increase in the allowable bending and axial stress of the downcomer bracing and gusset plates reasonable for dynamic loading.

The NRC staff also noted that the Analysis L-002547, Revision 0A, did not evaluate the welded connections of the lower downcomer bracing. In response to RAI issue (e) provided in the July 24, 2023 letter, the licensee noted that, “the downcomer bracing gusset plate welds are either Complete Joint Penetration (CJP) welds or through-thickness Partial Joint Penetration (PJP) welds with a reinforcing fillet weld, which provide a weld strength equal to or greater than the base metal.” Figure 2.1-2: “Lower Downcomer Gusset Plate Dimensions,” provides typical weld details for the gusset plate connections to the bracing members. Based on its review of those details, the NRC staff concludes that the gusset plate welds are either complete joint penetration welds or through-thickness partial joint penetration welds, and that the section properties of these welds would be equivalent to the section properties of the base metal (gusset plates and bracing members). Furthermore, the weld material strength is equal to or higher than the structural steel base metal strength, and therefore, the welds are conservative and acceptable.

The LAR did not evaluate the structural integrity of the downcomer piping for the potential plastic deflection of lower bracing. The NRC staff performed an independent engineering assessment of a downcomer pipe for postulated plastic displacements of the lower bracing (elevation 697 feet) to determine the stress levels at upper downcomer bracing (elevation 721 feet). The NRC staff conservatively considered the downcomer as a cantilevered pipe that is fixed supported at the upper bracing elevation and free at the lower bracing elevation. By applying displacements of ± 1 inch at the free-end, the NRC staff determined that the downcomer pipe stresses are well within the yield strength of the $\frac{1}{4}$ inch thick 24-inch diameter stainless-steel pipe. Based on the NRC staff’s evaluation, the downcomer will continue to perform its intended function despite the extreme case scenario of a safe shutdown earthquake and LOCA causing the lower downcomer bracing to deflect beyond the yield strain limit.

Based on its review, as discussed above, and considering the conservatisms for the application of the load combination, the NRC staff finds that the licensee has provided reasonable assurance that the updated analysis of the lower downcomer bracing utilizing plastic section properties continues to meet the intent of 10 CFR, part 50, appendix A, Criterion 2 and Criterion 4, for the protection against natural phenomena. The NRC staff also finds that the requirements of 10 CFR part 50, appendix A, Criterion 50, are met as the path for pressure suppression of steam, liquid and gases released in the drywell during a LOCA will be maintained despite the low probability post yield deflections of the downcomer bracing.

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 January 18, 2024. The State official had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR, part 20. The NRC staff has determined that the amendment involves no significant change in the types or significant increase in the amounts 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 amendment involves no significant hazards consideration and there has been no public comment on such finding by April 18, 2023 (88 FR 23695, dated April 18, 2023). Accordingly, the amendment meets 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.

Principal Contributors: Shaohua Lai, NRR
Ata Istar, NRR

Date of Issuance: February 9, 2024

SUBJECT: LASALLE COUNTY STATION, UNITS 1 AND 2 - ISSUANCE OF AMENDMENT NOS. 262 AND 247 RE: REVISED DESIGN BASES OF LOWER DOWNCOMER BRACES (EPID L-2023-LLA-0008) DATED FEBRUARY 9, 2024

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