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

July 15, 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: LASALLE COUNTY STATION, UNIT 1 — PROPOSED ALTERNATIVE I4-R13 FOR REPAIR OF RECIRCULATION FLOW CONTROL VALVES (EPID L-2022-LLR-0028)

Dear Mr. Rhoades:

By application dated March 2, 2022 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML22061A000), as supplemented by letters dated March 3 and 4, 2022 (ML22062B658 and ML22063B176, respectively), Constellation Energy Generation, LLC (the licensee) submitted request I4-R13 in accordance with paragraph 50.55a(z)(2) of Title 10 of the *Code of Federal Regulations* (10 CFR) for a proposed alternative to certain requirements of 10 CFR 50.55a, "Codes and standards," for LaSalle County Station (LaSalle), Unit 1.

During the February 2022 refueling outage L1R19 for LaSalle, Unit 1, the licensee identified two degraded reactor recirculation flow control valves. Section XI of the American Society for Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (ASME Code), as incorporated in 10 CFR 50.55a, requires, in part, that the repair of these valves be performed in accordance with the applicable construction code. The proposed alternative to the ASME Code, Section XI, would allow the licensee to use enhanced visual testing for the repair of the two valves, instead of performing the liquid penetrant testing and radiographic examinations required by the construction code. Specifically, pursuant to 10 CFR 50.55a(z)(2), the licensee requested to use the proposed alternative on the basis that complying with the specific ASME Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the application, as supplemented, and concluded that the licensee adequately addressed the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, on March 7, 2022, the NRC staff verbally authorized the licensee to use the proposed alternative described in its application, as supplemented, at LaSalle, Unit 1, for the repair of the two degraded reactor recirculation flow control valves during refueling outage L1R19. By email dated March 7, 2022 (ML22066A762), the NRC staff provided a summary of the verbal authorization to the licensee. The enclosed safety evaluation documents the NRC staff's detailed technical basis for the verbal authorization.

All other ASME Code, Section XI, requirements for which an alternative was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

If you have any questions, please contact Bhalchandra Vaidya at 301-415-3308 or via email to Bhalchandra.Vaidya@nrc.gov.

Sincerely,

Scott P. Wall Digitally signed by Scott P. Wall Date: 2022.07.15 12:09:08 -04'00'

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

Docket No. 50-373

Enclosure:
Safety Evaluation

cc: ListServ

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

PROPOSED ALTERNATIVE REQUEST I4-R13

FOR THE REPAIR OF RECIRCULATION FLOW CONTROL VALVES

LASALLE COUNTY STATION, UNIT 1

CONSTELLATION ENERGY GENERATION, LLC

DOCKET NO. 50-373

1.0 INTRODUCTION

By application dated March 2, 2022 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML22061A000), as supplemented by letters dated March 3 and 4, 2022 (ML22062B658 and ML22063B176, respectively), Constellation Energy Generation, LLC (the licensee) submitted request I4-R13 in accordance with paragraph 50.55a(z)(2) of Title 10 of the *Code of Federal Regulations* (10 CFR) for a proposed alternative to certain requirements of 10 CFR 50.55a, "Codes and standards," for LaSalle County Station (LaSalle), Unit 1.

During the February 2022 refueling outage L1R19 for LaSalle, Unit 1, the licensee identified two degraded reactor recirculation flow control valves. Section XI of the American Society for Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (ASME Code), as incorporated in 10 CFR 50.55a, requires, in part, that the repair of these valves be performed in accordance with the applicable construction code. The proposed alternative to the ASME Code, Section XI, would allow the licensee to use enhanced visual testing (EVT-1) for the repair of the two valves, instead of performing the liquid penetrant testing (PT) and radiographic examinations required by the construction code. Specifically, pursuant to 10 CFR 50.55a(z)(2), the licensee requested to use the proposed alternative on the basis that complying with the specific ASME Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

On March 7, 2022, the U.S. Nuclear Regulatory Commission (NRC) staff verbally authorized the licensee to use the proposed alternative described in its application, as supplemented, at LaSalle, Unit 1, for the repair of the two degraded reactor recirculation flow control valves during refueling outage L1R19. By email dated March 7, 2022 (ML22066A762), the NRC staff provided a summary of the verbal authorization to the licensee. This safety evaluation documents the NRC staff's detailed technical basis for the verbal authorization.

2.0 REGULATORY EVALUATION

The regulations in 10 CFR 50.55a(g)(4) state, in part, that ASME Code Class 1, 2, and 3 components (including supports) must meet the requirements, except the design and access

provisions and the preservice examination requirements, set forth in Section XI, “Rules for Inservice Inspection of Nuclear Power Plant Components,” of the applicable editions and addenda of the ASME Code to the extent practical within the limitations of design, geometry, and materials of construction of the components.

The regulations in 10 CFR 50.55a(g)(4)(ii) require, in part, that inservice examination of components and system pressure tests conducted during successive 10-year inservice inspection intervals (i.e., after the initial 10-year interval) must comply with the latest edition and addenda of the ASME Code (or the optional ASME Code cases) incorporated by reference in 10 CFR 50.55a(a) 18 months before the start of the 10-year interval subject to the conditions listed in 10 CFR 50.55a(b).

The regulations in 10 CFR 50.55a(z) state, in part, that alternatives to the requirements in paragraphs (b) through (h) of 10 CFR 50.55a may be authorized by the NRC if the licensee demonstrates that: (1) the proposed alternative provides an acceptable level of quality and safety, or (2) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

3.0 TECHNICAL EVALUATION

3.1 Licensee’s Request

3.1.1 Components Affected

The affected components are the reactor recirculation flow control valves 1B33-F060A (valve A) and 1B33-F060B (valve B) for LaSalle, Unit 1.

3.1.2 Applicable ASME Code Requirements

The 2007 Edition through 2008 Addenda of the ASME Code, Section XI, is applicable to the current inservice inspection interval at LaSalle, Unit 1. The weld repairs for valves A and B must meet the requirements of paragraph IWA-4411 of the ASME Code, Section XI, which states, in part, that “welding, brazing, fabrication, and installation shall be performed in accordance with the Owner’s Requirements and … in accordance with the Construction Code of the item.” The applicable construction code is the 1971 Edition with the Summer 1972 Addenda of the ASME Code, Section III. The 1971 Edition of the ASME Code, Section III, includes the following requirements applicable to the repair of valves A and B:

- Paragraph NB-2571 requires, in part, that the internal surface of the component be examined using magnetic particle or liquid penetrant methods after machining.

- Paragraph NB-2578 states that elimination of defects shall be in accordance with paragraph NB-2538. Subparagraph NB-2538(a)(3) states that “after defect elimination, the area is re-examined by the magnetic particle method … or the liquid penetrant method … to assure that the defect has been removed or the indication reduced to an acceptable size.”

- Subparagraph NB-2539.4 requires each repaired weld to be examined by magnetic particle or liquid penetrant methods, and repair cavities, the depth of which exceeds the lesser of 3/8 inches or 10 percent of the section thickness, to be radiographed.

3.1.3 Reason for Request

During the February 2022 refueling outage L1R19 for LaSalle, Unit 1, the licensee discovered excessive wear in the internals and lower body of valves A and B. The valves would require repair in accordance with Section XI and Section III of the ASME Code. The repair of the valves would consist of machining and grinding the inside surface of the valves and building up the inner surface with weld metal, installing the new valve internals, and welding an anti-rotation device into place.

In accordance with 10 CFR 50.55a(z)(2), the licensee stated that compliance with the requirements specified in Section 3.1.2 of this safety evaluation would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The licensee stated, in part, that performing the required PT and radiographic examinations was a hardship due to the significant radiologic dose that would be received by personnel performing these examinations.

3.1.4 Proposed Alternative

The licensee proposed to use EVT-1 in lieu of PT for the various stages of the repair for both the pressure-retaining weld buildup on the valve body as well as for the installation of a fillet weld to fix the anti-rotation device in place. In addition, the licensee would not perform the radiographic examinations.

3.2 NRC Staff's Evaluation

The licensee stated that the repairs of valves A and B would consist of machining and grinding the inside surface of the valves and building up the inner surface with weld metal, installing the new valve internals, and welding an anti-rotation device into place. The worn areas of valves A and B would be machined to restore the valve body dimensions and tolerances that support internal components. As part of the repair, additional weld material will be applied to valve A and machined to approximately 0.157 inches above the required minimum wall thickness in the area of wear. While no additional weld material buildup was planned for valve B, the licensee stated that welding may be required in the final repair plan. The final configuration of valve B would leave the valve with greater than 0.200 inches above the required minimum wall thickness in the area of wear.

To enhance design and performance of valves A and B, the licensee stated it would install modified lower plug guides made of 316 stainless steel, Stellite-overlayed material. The modified guides includes an anti-rotation segment similar to the original guide design. The material of the anti-rotation segment is specified as 304L stainless steel material. The anti-rotation segment will be fillet welded or partial penetration welded along its entire outer curved edge on the top face with an appropriately qualified and suitable material for the design of the weld joint.

The licensee proposed to use EVT-1 in lieu of PT for the various stages of the repair for both the pressure-retaining weld buildup on the valve body as well as for the installation of a fillet weld to fix the anti-rotation device in place. EVT-1 is an examination technique that uses remote camera equipment to perform visual inspections of components. The effectiveness of EVT-1 has been extensively researched by the NRC, and this research is summarized in NUREG/CR-7246, "Reliability Assessment of Remote Visual Examination," dated August 2018 (ML18228A516). The research found that EVT-1 provides generally reliable detection (i.e.,

80 percent probability of detection at 95 percent confidence level) of flaws with crack openings wider than approximately 25 microns (0.001 inches). EVT-1 is not considered to be equivalent to PT, and EVT-1 is more sensitive to issues such as lighting angle, viewing angle, and surface scratches, which can hide small cracks. The use of EVT-1, as opposed to PT, could result in small cracks being left in the welds. While not as effective as PT, the NRC staff finds that the use of EVT-1 provides reasonable assurance that if there is significant cracking in the welded surfaces it would be detected.

As part of the proposed alternative, the licensee would not perform a radiographic examination of the final repair. Radiographic examinations are used to detect possible subsurface weld defects, such as porosity, lack of fusion, and slag. Not performing the radiographic examinations increases the probability that such weld defects will remain in the repair. The EVT-1 may be able to detect surface-breaking flaws but would be unable to detect embedded flaws.

The licensee stated that it performed wear rate calculations to ensure that wear does not challenge the minimum wall thickness due to the internal design change for the valves. The licensee calculated a wear rate of 0.00015 inches per operating cycle for the flow control components of valves A and B. Uncertainties in the calculations were addressed through conservative assumptions described in the licensee's letter dated March 3, 2022. The licensee stated that the calculated wear rate is sufficiently low to support operation with the modified valve designs to the end of the operating life for the plant.

The weld buildups and final repairs for valves A and B would restore the required minimum wall thickness with possible small weld defects left in place. The NRC staff notes that the primary damage mechanism in the area to be repaired is wear. The NRC staff determined that the presence of small cracks or weld defects, such as porosity and slag, would not significantly increase the risk of structural failure of the repaired areas. The licensee stated that the wear on valves A and B was associated with a sustained operation in low-flow conditions. The licensee has taken corrective actions to significantly reduce the time spent operating under such conditions in the future. The NRC staff determined that additional wear of the repaired areas would not be expected since the modified lower plug guides will be made of 316 stainless steel and the anti-rotation device will be welded into place. In addition, the wear rate calculations show that the valve body is not expected to experience thinning due to wear below the minimum wall thickness for current licensed life of the facility. Therefore, the NRC staff concludes that, given the nature of the subject repair, EVT-1 is sufficient to provide reasonable assurance of the structural integrity of the repaired valves.

The licensee estimated that performing the required PT examination would result in a radiological dose that is 2.326 person-rem higher than performing the proposed EVT-1 examination. The licensee also estimated that performing the required radiographic examination would result in a radiological dose of 0.906 person-rem. In accordance with 10 CFR 50.55(z)(2), the NRC staff finds that it would be a hardship for the licensee to perform the PT and radiographic examinations required by the ASME Code because of the higher radiological dose that would be received in comparison to the proposed alternative.

Based on the above, the NRC staff finds that the licensee has demonstrated that compliance with the specified PT and radiographic examination requirements in the ASME Code for the repair of valves A and B would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety in accordance with 10 CFR 50.55a(z)(2).

4.0 CONCLUSION

As set forth above, the NRC staff determined that the licensee's proposed alternative for the repair of valves A and B would provide reasonable assurance of the structural integrity of the valves. The NRC staff also determined that complying with the specified PT and radiographic examination requirements in the ASME Code for the repair of valves A and B would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Therefore, the NRC authorizes the licensee to use the proposed alternative described in its application, as supplemented, at LaSalle, Unit 1, for the repair of valves A and B during refueling outage L1R19.

All other ASME Code, Section XI, requirements for which an alternative was not specifically requested and approved remain applicable, including third-party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: Stephen Cumblidge, NRR

Date: July 15, 2022

SUBJECT: LASALLE COUNTY STATION, UNIT 1 — PROPOSED ALTERNATIVE I4-R13 FOR REPAIR OF RECIRCULATION FLOW CONTROL VALVES (EPID L-2022-LLR-0028) DATED JULY 15, 2022

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