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

March 8, 2019

Ms. Cheryl A. Gayheart
Regulatory Affairs Director
Southern Nuclear Operating Company, Inc.
3535 Colonnade Parkway
Birmingham, AL 35243

SUBJECT: EDWIN I. HATCH NUCLEAR PLANT, UNIT NO. 1 – PROPOSED INSERVICE INSPECTION ALTERNATIVE HNP-ISI-ALT-05-08 (EPID L-2018-LLR-0073)

Dear Ms. Gayheart:

By letter dated May 17, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18137A406), as supplemented by e-mail dated May 18, 2018 (ADAMS Accession No. ML18298A197), Southern Nuclear Operating Company (SNC, the licensee), requested approval from the U.S. Nuclear Regulatory Commission (NRC) for relief from certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV code), Section XI, IWA-4000 at Edwin I. Hatch Nuclear Plant (Hatch), Unit 1. SNC requested authorization to use Code Case N-513, Revision 4 (Code Case N-513-4), "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1" for the temporary acceptance of a through-wall leak identified in a 30-inch Class 3 elbow in the "A" Loop Plant Service Water System (PSWS).

The licensee submitted the proposed alternative pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 50.55a(z)(2) on the basis that the ASME Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality or safety.

On May 18, 2018, as documented in an NRC memorandum dated June 6, 2018 (ADAMS Accession No. ML18143A007), the NRC staff verbally authorized the use of alternative HNP-ISI-ALT-05-08. This letter documents the NRC staff's final review of request for alternative HNP-ISI-ALT-05-08. As set forth in the enclosed safety evaluation, the NRC staff has determined that the licensee has demonstrated that the proposed alternative provides reasonable assurance of structural integrity of the subject piping elbow, and that complying with the ASME Code, Section XI, 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 staff authorizes the use of the proposed alternative in HNP-ISI-ALT-05-08 until the conclusion of the Unit 1 spring 2020 refueling outage (1R29), or until the temporary acceptance criteria of Code Case N-513-4 are exceeded, or until the leak rate exceeds 20 gallons per minute, whichever event occurs first.

All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested and authorized by NRC staff remain applicable, including a third-party review by the Authorized Nuclear Inservice Inspector.

The NRC staff recently approved two separate, but related, alternative requests for Hatch based on the application of Code Case N-513-4. By letter dated October 18, 2018 (ADAMS Accession No. ML18289A619), the NRC staff approved alternative request HNP-ISI-ALT-05-07 (submitted in the licensee's letter dated April 6, 2018), to allow the application of Code Case N-513-4, with noted exceptions, to repair/replacement activities for moderately degraded, high energy ASME Code Class 2 and 3 piping in the Residual Heat Removal Service Water system during the fifth 10-year Inservice Inspection (ISI) interval at Hatch, Units 1 and 2.

By letter dated November 30, 2018 (ADAMS Accession No. ML18320A057), the NRC staff approved alternative request GEN-ISI-ALT-2017-03 (also submitted in the licensee's letter dated April 6, 2018), for both Hatch, Units 1 and 2, and the Joseph M. Farley Nuclear Plant, Units 1 and 2. The approved alternative allows the licensee to apply Code Case N-513-4 for the evaluation and temporary acceptance of flaws in moderate energy Class 2 and 3 piping in lieu of specified ASME Code requirements for the remainder of the fifth 10-year ISI intervals for the respective units.

If you have any questions, please contact the Project Manager, Randy Hall, at 301-415-4032 or by e-mail at Randy.Hall@nrc.gov.

Sincerely,

Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-321

Enclosure:
Safety Evaluation

cc: Listserv

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR ALTERNATIVE HNP-ISI-ALT-05-08

REGARDING REPAIR OR REPLACEMENT ACTIVITIES

FOR PLANT SERVICE WATER PIPING

EDWIN I. HATCH NUCLEAR PLANT, UNIT NO. 1

SOUTHERN NUCLEAR OPERATING COMPANY

DOCKET NO. 50-321

1.0 INTRODUCTION

By letter dated May 17, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18137A406), as supplemented by e-mail dated May 18, 2018 (ADAMS Accession No. ML18298A197), Southern Nuclear Operating Company (SNC, the licensee), requested approval from the U.S. Nuclear Regulatory Commission (NRC) for relief from certain requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (B&PV code), Section XI, IWA-4000 at Edwin I. Hatch Nuclear Plant (Hatch), Unit 1. SNC requested authorization to use Code Case N-513, Revision 4 (Code Case N-513-4), "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping Section XI, Division 1" for the temporary acceptance of a through-wall leak identified in a 30-inch Class 3 elbow in the "A" Loop Plant Service Water System (PSWS).

The licensee submitted the proposed alternative pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Section 50.55a(z)(2) on the basis that the ASME Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality or safety.

On May 18, 2018 (ADAMS Accession No. ML18143A007), the NRC staff verbally authorized the use of Alternative HNP-ISI-ALT-05-08 until the conclusion of the Unit 1 spring 2020 refueling outage (1R29), or until the temporary acceptance criteria of Code Case N-513-4 are exceeded, or until the leak rate exceeds 20 gallons per minute, whichever event occurs first.

2.0 REGULATORY EVALUATION

Paragraph 10 CFR 50.55a(g)(4), Inservice inspection standards requirement for operating plants, states, in part:

> Throughout the service life of a boiling or pressurized water-cooled nuclear power facility, components (including supports) that are classified as ASME Code Class 1, Class 2, and Class 3 must meet the requirements, except design and access provisions and preservice examination requirements, set forth in Section XI, to the extent practical within the limitations of design, geometry, and materials of construction of the components.

Pursuant to 10 CFR 50.55a(z), alternatives to the requirements of paragraphs (b) through (h) of this section may be used when authorized by the Director, Office of Nuclear Reactor Regulation. A proposed alternative must be submitted and authorized prior to implementation. The licensee must demonstrate that: (1) the proposed alternative would provide an acceptable level of quality and safety; or (2) compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Guidance in ASME Code Case N-513, Revision 3 (Code Case N-513-3) is approved for generic use in NRC Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 18 (ADAMS Accession No. ML16321A336), with one condition. This RG is incorporated into NRC regulations by reference in 10 CFR 50.55a. Code Case N-513-3 provides criteria that allow licensees to temporarily accept flaws, including through-wall flaws, in moderate energy Class 2 or 3 piping without performing repair or replacement activities. Code Case N-513-4 contains several revisions including expanding the applicability of the code case beyond straight pipe to include elbows, bent pipe, reducers, expanders, and branch tees. Code Case N-513-4 has not been approved by the NRC for generic use.

Based on the above, and subject to the following technical evaluation, the NRC staff finds that regulatory authority exists for the licensee to request and for the NRC to authorize the alternative requested by the licensee.

3.0 TECHNICAL EVALUATION

3.1 The Licensee's Request for Alternative

3.1.1 ASME Code Components Affected

The affected component is an ASME Code, Class 3, Plant Service Water System (PSWS) elbow, downstream of valve 1P41-F305A, on the south side of the strainer pit.

3.1.2 Applicable Code Editions and Addenda

The applicable ASME Code, Section XI, Edition and Addenda for the fifth 10-year Inservice Inspection Interval (ISI) at Hatch Unit 1 are the 2007 Edition through 2008 Addenda. The fifth ISI interval at Hatch Unit 1 began on January 1, 2016 and is scheduled to end on December 31, 2025.

3.1.3 Applicable Code Requirement

Subsection IWA-4000 of ASME Code Section XI provides requirements for welding, brazing, metal removal, and installation of repair/replacement activities.

3.1.4 Reason for Request

On May 14, 2018, the licensee discovered a 3 gallon per minute (gpm) through-wall leak in a 30-inch ASME Code Class 3 elbow in the PSWS. The licensee stated that the leak is on Unit 1 "A" Loop, downstream of valve 1P41-F305A on the south side of the strainer pit. The leaking elbow cannot be isolated and would require a plant shutdown to repair.

The NRC approved ASME Code Case N-513-3 for generic use and it provides criteria to allow temporary acceptance of flaws, including through-wall flaws in moderate energy Class 2 or 3 piping without performing repair or replacement activities in accordance with ASME Code Section XI, Article IWA-4000. However, it does not address the evaluation of flaws in piping elbows. The licensee proposes to use Code Case N-513-4 which contains revisions that include the evaluation of flaws, including through-wall flaws in elbows, bent pipe, reducers and branch tees.

3.1.5 Licensee's Proposed Alternative and Basis for Use

The licensee's proposed alternative is to use ASME Code Case N-513-4 for the evaluation and temporary acceptance of a degraded PSWS piping elbow with a through-wall flaw. The licensee stated that it will follow all requirements of the code case and will take no exceptions. The licensee also imposed a maximum allowable leakage rate of 20 gpm. The licensee will perform a permanent repair/replacement activity at the next scheduled outage (1R29).

The licensee stated that the limitations in Code Case N-513-3 related to its use on piping components, such as elbows, bent pipe, reducers, expanders, branch tees, and external tubing or piping attached to heat exchangers, have been addressed in Code Case N-513-4. The licensee provided a high level overview of the changes from Code Case N-513-3 to Code Case N-513-4 in its application, as listed below:

1. Revised the maximum allowable time of use from no longer than 26 months to the next refueling outage.

2. Added applicability to piping elbows, bent pipe, reducers, expanders, and branch tees where the flaw is located more than $(R_0t)^{1/2}$ from the centerline of the attaching circumferential piping weld [R_0 is the outside pipe radius and t is the evaluation wall thickness surrounding the degraded area].

3. Expanded use to external tubing or piping attached to heat exchangers.

4. Revised to limit the use to liquid systems.

5. Revised to clarify treatment of Service Level load combinations.

6. Revised to address treatment of flaws in austenitic pipe flux welds.

7. Revised to require minimum wall thickness acceptance criteria to consider longitudinal stress in addition to hoop stress.

8. Other minor editorial changes to improve the clarity of the Code Case.

The licensee stated that significant changes in Code Case N-513-4 when compared to NRC approved Code Case N-513-3 are discussed in Reference 3 of its May 17, 2018 application, "Technical Basis for Proposed Fourth Revision to ASME Code Case N-513," from the Proceedings of the ASME 2014 Pressure Vessels & Piping Conference, July 20-24, 2014, Anaheim, California.

The licensee performed ultrasonic testing of the degraded elbow area and included the results in its May 18, 2018 e-mail. The licensee calculated the minimum required wall thickness, in accordance with Code Case N-513-4, to be 0.130-inch. The licensee stated that there is 4000 gpm of margin in the PSWS; however, the dewatering capacity in the area of the leak is 80 gpm. The licensee contends that the proposed allowable leakage rate, 20 gpm, provides quantitative measurable limits, which ensure the operability of the system and early identification of issues that could erode defense-in-depth and lead to adverse consequences.

3.1.6 Hardship Justification (as stated in the licensee's letter dated May 17, 2018)

To perform a Code repair, a plant shutdown would be required because the leak is not isolable during normal operation. Plant shutdown activities would result in additional plant risk that would be inappropriate when a degraded condition can be demonstrated to retain adequate margin to complete the components safety function. The use of an acceptable alternative analysis method in lieu of immediate action for the degraded condition will allow SNC to perform additional extent of condition examinations on the affected systems while allowing time for safe and orderly long-term repair actions if necessary. Actions to remove the degraded piping from service could have a detrimental overall risk impact by requiring a plant shutdown, thus requiring use of a system that is in standby during normal operation. Accordingly, compliance with the current code requirements results in a hardship without a compensating increase in the level of quality and safety.

3.1.7 Duration of Proposed Alternative

The licensee requested use of the proposed alternative until the conclusion of the Unit 1 spring 2020 refueling outage (1R29).

3.2 NRC Staff Evaluation

The NRC staff evaluated the adequacy of the proposed alternative, using Code Case N-513-4, in maintaining structural integrity of the "A" loop PSWS piping elbow located downstream of valve 1P41-F305A on the south side of the strainer pit. The NRC staff also evaluated the hardship or unusual difficulty without a compensating increase in the level of quality and safety if the licensee performed an ASME Code repair in accordance with ASME Code Section XI, IWA-4000.

Code Case N-513-3 provides alternative evaluation criteria for temporary acceptance of flaws, including through-wall flaws, in moderate energy Class 2 and 3 piping. However, Code Case N-513-3 is limited to straight pipe with provisions for flaws that extend for a short distance into the fitting at the pipe to the fitting weld. Evaluation criteria for flaws in elbows, bent pipe, reducers, expanders, branch tees and heat exchanger tubing and piping are not included within the scope of N-513-3. Code Case N-513-4 addresses these aforementioned limitations. Given that Code Case N-513-3 is conditionally approved for use in RG 1.147, Revision 18, the NRC staff focused its review on the differences between Code Cases N-513-3 and N-513-4 as they apply to the evaluation of the subject PSWS elbow.

The NRC staff also evaluated the licensee's proposed limitation on the leakage rate and its hardship justification.

3.2.1 Temporary Acceptance Period

Code Case N-513-3 specifies a temporary acceptance period of a maximum of 26 months. Code Case N-513-3 is accepted for use in RG 1.147, Revision 18, with the following condition:

The repair or replacement activity temporarily deferred under the provisions of this Code Case shall be performed during the next scheduled outage.

Code Case N-513-4 includes wording that limits the use of the code case to the next refueling outage and the licensee confirmed in its proposed alternative that it will repair the degraded elbow at the next refueling outage. Thus, the NRC staff finds that Code Case N-513-4 and the proposed alternative appropriately address the NRC condition on the use of Code Case N-513-3, and, therefore, the proposed temporary acceptance period for this alternative request is acceptable.

3.2.2 Flaw Evaluation Criteria for Elbows, Bent Pipe, Reducers/Expanders and Branch Tees.

Evaluation and acceptance criteria have been added to Code Case N-513-4 for flaws in elbows, bent pipe, reducers, expanders and branch tees using a simplified approach, which is based on the Second International Piping Integrity Research Group (IPIRG-2) program reported in NUREG/CR-6444, BMI-2192, "Fracture Behavior of Circumferentially Surface-Cracked Elbows," published December 1996.

The flaw evaluation methodology approach in Code Case N-513-4 for piping components is conducted as if in straight pipe by scaling hoop and axial stresses using ASME piping design code stress indices and stress intensification factors to account for the stress variations caused by the geometric differences. Equations used in the code case are consistent with the piping design by rule approach in ASME Code Section III, NC/ND-3600. NUREG/CR-6444 shows that this approach is conservative for calculating stresses used in flaw evaluations in piping elbows and bent pipe. The code case also applies this methodology to reducers, expanders and branch tees.

The NRC staff finds that the flaw evaluation and acceptance criteria in Code Case N-513-4 for elbows, bent pipe, reducers, expanders and branch tees are acceptable because the flaw evaluation methods in the code case are consistent with ASME Code Section XI and ASME Code Section III design by rule approach and provide a conservative approach as confirmed by comparing the failure moments predicted using this approach to the measured failure moments

from the elbow tests for through-wall circumferential flaws conducted as part of the IPIRG-2 program. The NRC staff finds that the proposed alternative is acceptable because it follows Code Case N-513-4 in analyzing the elbow flaw.

3.2.3 Flaw Evaluation in Heat Exchanger Tubing or Piping

Code Case N-513-4 has been revised to include heat exchanger external tubing or piping, provided that the flaw is characterized in accordance with Section 2(a) of the Code Case and leakage is monitored. Section 2(a) requires that the flaw geometry be characterized by volumetric inspection or physical measurement.

The NRC staff finds the proposed alternative does not involve heat exchanger piping or tubing. Therefore, this change is not applicable to the current proposed alternative.

3.2.4 Limit Use to Liquid Systems

Use of Code Case N-513-4 is specifically limited to liquid systems.

The NRC staff finds the proposed alternative is limited to a liquid system and, thus, is consistent with Code Case N-513-4.

3.2.5 Treatment of Service Load Combinations

Modifications in Code Case N-513-4 now make clear that all service load combinations must be considered in flaw evaluations to determine the most limiting condition. Although previously implied in Code Case N-513-3, Code Case N-513-4 makes this requirement clear. Therefore, the NRC staff finds this change acceptable.

3.2.6 Treatment of Flaws in Austenitic Pipe Flux Welds

The proposed alternative does not involve austenitic pipe flux welds. Therefore, this change is not applicable to the current proposed alternative.

3.2.7 Minimum Wall Thickness Acceptance Criteria to Consider Longitudinal Stress

Although it is unlikely that a minimum wall thickness calculated based on the longitudinal stress would be limiting when compared to a minimum wall thickness calculated based on hoop stress, Code Case N-513-4 includes revisions that require consideration of longitudinal stress in the calculation of minimum wall thickness. Previous versions of the code case only required the use of hoop stress. The NRC staff finds that the proposed alternative is acceptable because it will ensure that the more limiting of the longitudinal or hoop stress is used to determine minimum wall thickness.

3.2.8 Leakage Monitoring for Through-Wall Flaws

Code Case N-513-3 requires through-wall leakage to be observed via daily walkdowns to confirm that the analysis conditions used in the evaluation remain valid. Code Case N-513-4 modifies this requirement by continuing to require that leakage be monitored daily, but now allows other techniques to be used to monitor leakage, such as using visual equipment or leakage detection systems to determine if leakage rates are changing. The NRC staff finds this change acceptable because Code Case N-513-4 continues to require through-wall leaks to be

monitored daily and the expanded allowable monitoring methods should have no adverse impact. In addition, the licensee affirmed that the leaking flaw(s) will be monitored daily as required by paragraph 2(f) of Code Case N-513-4 to confirm the analysis conditions.

3.2.9 Leakage Rate

Code Case N-513-3, Paragraph 1(d) states:

> The provisions of this Case demonstrate the integrity of the item and not the consequences of leakage. It is the responsibility of the Owner to demonstrate system operability considering effects of leakage.

Code Case N-513-4 modified the last sentence, now located in paragraph (f), to state:

> It is the responsibility of the Owner to consider effects of leakage in demonstrating system operability and performing plant flooding analyses.

The maximum allowable leakage rate under the proposed alternative is 20 gpm. The proposed maximum leakage rate of 20 gpm provides a safety factor of 4 when compared to the 80 gpm combined dewatering capacity of the 2 sump pumps for the area with the leaking elbow. The NRC staff notes that the PSWS has a 4000 gpm flow margin. Therefore, leakage at or below 20 gpm would have no impact on the cooling capability of the PSWS at the slightly reduced flow rate. The NRC staff finds that the licensee's proposed allowable leakage rate is acceptable because it will provide sufficient time for corrective measures to be taken before a significant increase in leakage would erode defense-in-depth and result in adverse consequences.

3.2.10 Hardship Justification

The NRC staff finds that performing a plant shutdown to repair the subject piping elbow would unnecessarily cycle the unit, resulting in an increase in personnel exposure and plant risk. Therefore, the NRC staff determines that compliance with the specified ASME Code repair requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

3.3 Summary

The NRC staff finds that the proposed alternative will provide reasonable assurance of the structural integrity of the PSWS piping because: (1) Code Case N-513, Revision 4 addresses the NRC condition in RG 1.147, Revision 18, for Revision 3 of Code Case N-513; (2) flaw evaluations in component types added to Revision 4 of Code Case N-513 are based on acceptable methodologies; and (3) the method for determining the allowable leakage rate is adequate to provide early identification of a significant increase in leakage. In addition, complying with ASME Code Section XI requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

4.0 CONCLUSION

As set forth above, the NRC staff determines that the licensee has demonstrated the proposed alternative provides reasonable assurance of structural integrity of the subject piping elbow, and that complying with ASME Code, Section XI, 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 staff authorizes the use of the proposed alternative in HNP-ISI-ALT-05-08 until the conclusion of the Unit 1 spring 2020 refueling outage (1R29), or until the temporary acceptance criteria of Code Case N-513-4 are exceeded, or until the leak rate exceeds 20 gallons per minute, whichever event occurs first.

All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested and authorized by NRC staff remain applicable, including a third-party review by the Authorized Nuclear Inservice Inspector.

The NRC staff notes that approval of this alternative does not imply NRC approval of ASME Code Case N-513-4 for generic use.

Principal Contributor: R. Davis, NRR

Date: March 8, 2019

SUBJECT: EDWIN I. HATCH NUCLEAR PLANT, UNIT NO. 1 – PROPOSED INSERVICE INSPECTION ALTERNATIVE HNP-ISI-ALT-05-08 (EPID L-2018-LLR-0073) DATED MARCH 8, 2019

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