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

October 18, 2018

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 NOS. 1 AND 2 – PROPOSED INSERVICE INSPECTION ALTERNATIVE HNP-ISI-ALT-05-07 (EPID L-2018-LLR-0070)

Dear Ms. Gayheart:

By letter dated April 6, 2018 (Agencywide Documents Access and Management System Accession No. ML18096B554), Southern Nuclear Operating Company (the licensee), requested approval of an alternative to the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section XI, for the Edwin I. Hatch Nuclear Plant (HNP), Units 1 and 2. The proposed alternative would apply to repair/replacement activities for moderately degraded 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 HNP.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(2), the licensee requested to use the proposed alternative, HNP-ISI-ALT-05-07, on the basis that compliance with the specified ASME Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality of safety.

The U.S. Nuclear Regulatory Commission (NRC) staff has completed its review of request for alternative HNP-ISI-ALT-05-07. As set forth in the enclosed safety evaluation, the NRC staff has determined that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.55a(z)(2). Accordingly, the NRC staff concludes that complying with the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. Therefore, the NRC staff authorizes the use of Alternative HNP-ISI-ALT-05-07 at HNP, Units 1 and 2, for the remainder of the fifth 10-year ISI interval, which ends on December 31, 2025.

All other requirements of ASME Code, Section XI, for which relief has not been specifically requested and approved in this request remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

The staff's review of proposed alternative GEN-ISI-ALT-2017-03, also submitted in the licensee's letter of April 6, 2018, for both HNP and the Joseph M. Farley Nuclear Plant, will be addressed in separate correspondence.

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 and 50-366

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-05-07

REGARDING REPAIR OR REPLACEMENT ACTIVITIES

FOR RESIDUAL HEAT REMOVAL SERVICE WATER PIPING

EDWIN I. HATCH NUCLEAR PLANT, UNIT NOS. 1 AND 2

SOUTHERN NUCLEAR OPERATING COMPANY

DOCKET NOS. 50-321 AND 50-366

1.0 INTRODUCTION

By letter dated April 6, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18096B554), Southern Nuclear Operating Company (SNC, or the licensee) submitted a request to the U. S. Nuclear Regulatory Commission (NRC) for use of a proposed alternative to certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, at the Edwin I. Hatch Nuclear Plant (HNP), Units 1 and 2. The licensee submitted the proposed alternative for the Residual Heat Removal Service Water (RHRSW) system for ASME Code Class 2 and 3 piping, during the fifth 10-year Inservice Inspection (ISI) Interval at HNP, which started on January 1, 2016, and is scheduled to end on December 31, 2025.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(z)(2), the licensee requested to use the proposed alternative, HNP-ISI-ALT-05-07, on the basis that compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality of safety.

The staff's review of proposed alternative GEN-ISI-ALT-2017-03, also submitted in the licensee's letter of April 6, 2018 (for both HNP and the Joseph M. Farley Nuclear Plant), will be addressed in separate correspondence.

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 of the ASME Code to the extent practical within the limitations of design, geometry, and material of construction of the components.

Paragraph 10 CFR 50.55a(z) states that alternatives to the requirements of paragraphs (b) through (h) of 10 CFR 50.55a or portions thereof 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 alternatives provide 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.

The licensee's submittal proposes an alternative to the requirements in of Articles IWC-3120, IWC-3130, IWD-3120(b), and IWD-3400 of ASME Code, Section XI, insofar as they relate to the evaluation, repair, and replacement of ASME Code Class 2 and 3 moderate energy piping systems with flaws.

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

3.0 TECHNICAL EVALUATION

3.1 Applicable Code Requirements

The affected components at HNP, Units 1 and 2, are ASME Code Class 2 and 3 RHRSW system piping, with a maximum operating pressure not exceeding 450 pounds per square inch gauge (psig) and temperature not exceeding 200 degrees Fahrenheit.

The applicable code of record for HNP for the fifth 10-year ISI interval is the 2007 Edition of the ASME Code, Section XI, with the 2008 Addenda. Subsection IWD-3120(b) requires that components exceeding the acceptance standards of IWD-3400 be subject to supplemental examination or to a repair/replacement activity.

3.2 Reason for Alternative Request

In its request for relief from the requirements of the ASME Code, Section XI, repair or replacement activities for degraded RHRSW piping, the licensee stated that the repair of moderately degraded piping could require a plant shutdown, resulting in additional radiological dose to workers and increased overall plant risk. The licensee further stated that plant shutdown activities result in additional dose and plant risk that would be inappropriate when a degraded condition is demonstrated to retain adequate margin to complete the component's function. The licensee also stated that the use of an acceptable alternative analysis method in lieu of taking an immediate action for a degraded condition provides an opportunity to perform additional extent of condition examinations of the affected systems, while at the same time allowing the licensee time for safe and orderly long-term repair actions, if necessary. Additionally, the licensee stated that removal of degraded piping from service could also have a detrimental overall risk impact by requiring a plant shutdown, thus requiring use of systems that are in standby during normal operation. The licensee stated that compliance with the current code requirements could result in hardship, without a compensating increase in the level of quality and safety.

3.3 Proposed Alternative and Basis for Use

The licensee requested approval to apply the evaluation methods of ASME Code Case N-513-4, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping, Section XI, Division 1," with some modifications. Specifically, the licensee

is seeking to use this Code Case for Class 2 and 3 piping components of the RHRSW system that meet the operational and configuration limitations of Code Case N-513-4, paragraphs 1(a), 1(b), and 1(d). Additionally, the licensee is seeking to expand the scope of Code Case N-513-4, paragraph 1(c), to include RHRSW system piping with a maximum operating pressure of 450 psig. Code Case N-513-4, paragraph 1(c), limits the use of the Code Case to liquid systems that do not exceed an operating temperature of 200 degrees Fahrenheit and a maximum operating pressure of 270 psig.

The licensee cited NRC Generic Letter (GL) 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," which was intended to address the acceptability of limited degradation of piping within certain operating conditions. The GL defined conditions under which it would be acceptable to use temporary non-Code repairs of piping with NRC approval. ASME recognized that relatively small flaws could remain in service without risking the structural integrity of the piping system and developed Code Case N-513. Code Case N-513 provides evaluation methods and conditions to temporarily accept flaws, including through-wall flaws for moderate energy Class 2 and 3 piping, without performing repair/replacement activities. The latest NRC-approved revision of Code Case N-513 is ASME Code Case N-513-3, which is approved for generic use by licensees 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. In summary, ASME Code Case N-513-3 provides criteria, with one NRC condition, which allows licensees to temporarily accept flaws, including through-wall flaws in moderate energy Class 2 or 3 pipes without performing repair or replacement activities. That condition states, "The repair or replacement activity temporarily deferred under the provisions of this Code Case shall be performed during the next scheduled outage."

The licensee stated that ASME recognized the limitations in Code Case N-513-3 that prevented usage of the Code Case for piping components such as elbows, reducers, branch connections, external tubing or piping attached to heat exchangers. Consequently, ASME revised the Code Case, and the latest revision, Code Case N-513-4, to include piping components not included in Code Case N-513-3. Specifically, ASME Code Case N-513-4 contains several revisions, including the applicability of the Code Case beyond straight pipes, to include elbows, bent pipes, reducers, expanders, and branch tees. However, ASME Code Case N-513-4 has not yet been approved by the NRC staff for generic use by licensees.

Therefore, the licensee provided a high level overview of the differences between ASME Code Case N-513-3 and ASME Code Case N-513-4 in its application dated April 6, 2018. The licensee stated that Code Case N-513-4 includes the following changes listed below:

1. Revised the maximum allowed time of use from no longer than 26 months, to the next scheduled 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.

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 change in leakage rate would require re-inspection of the flaw and re-evaluation of the original analysis that justified use of the Code Case. Additionally, paragraph 1(f) of Code Case N-513-4 requires the licensee to consider the effects of leakage in demonstrating system operability and performing flood analyses. In its proposal, the licensee stated that for a leaking flaw, the allowable leakage rate will be determined by dividing the critical leakage rate by a factor of safety of four. The licensee stated that it will determine the critical leakage rate as the lowest value of maximum leakage that can be tolerated, based on the maximum allowable loss of inventory, or the maximum leakage that can be tolerated relative to flooding, among other considerations. Additionally, during the temporary acceptance period, the leaking flaws will be monitored daily, as required by paragraph 2(f) of Code Case N-513-4. Significant changes in leakage rate will require re-inspections to be performed according to paragraph 2(a) of Code Case N-513-4.

In addition to meeting the requirements of Code Case N-513-4 (as modified by the plant-specific conditions discussed above), the licensee stated that it will include the following two additional requirements as part of its request:

1) The number of augmented examination locations shall be increased from 5, the current number for Code Case N-513-4, to 10.

2) The leakage shall be stopped throughout the temporary acceptance period using an engineered mechanical clamping device, sufficient in design to withstand the maximum operating pressure and removable, such that the periodic inspections defined in paragraph 2(e) of Code Case N-513-4 may be performed.

The proposed alternative will be applicable until the end of the fifth 10-year ISI interval, which is December 31, 2025 for both HNP units. An ASME Code, Section XI, compliant repair or replacement will be completed prior to exceeding the allowable conditions defined in this request, or at the next scheduled refueling outage, whichever comes first.

3.4 NRC Staff Evaluation

ASME Code Case N-513-3 is approved for generic use by licensees in NRC Regulatory Guide (RG) 1.147, "Inservice Inspection Code Case Acceptability, ASME Section XI, Division 1," Revision 18, with one condition. As noted above, the latest revision, ASME Code Case N-513-4, has not been approved by the NRC for generic use at this time. The NRC staff has determined that this specific request by SNC is limited in scope because: it is applicable only to the RHRSW system piping with plant-specific conditions that are unique to HNP (i.e., for maximum operating pressure not to exceed 450 psig), and with proposed augmented licensee conditions, which are not included in Code Case N-513-4.

The NRC staff notes that moderately degraded piping could require a plant shutdown within the action statement timeframes required by the plant Technical Specifications (TSs) to repair

observed piping degradation. Shutdown activities would result in additional dose and plant risk, despite adequate safety margins to maintain safety functions during the existence of degraded conditions. The use of an acceptable alternative in lieu of immediate action for a degraded condition will allow the licensee to perform additional extent of condition examinations on the affected RHRSW piping systems while allowing time for ASME Code repair/replacement actions as needed. Actions to immediately remove degraded piping from service could also have a detrimental overall risk impact by necessitating a plant shutdown, thus requiring use of a system that is in standby during normal operation. Accordingly, the NRC staff finds that conformance with certain current Code requirements may result in hardship without a compensating increase in the level of quality and safety.

In its review of the licensee's proposal, the NRC staff evaluated the adequacy of the proposed alternative in maintaining the structural integrity of piping components as identified in ASME Code Case N-513-4, along with the specific conditions outlined in SNC's request for alternative HNP-ISI-ALT-05-07. ASME Code Case N-513-3, which is approved conditionally for use in RG 1.147, Revision 18, provides alternative evaluation criteria for temporary acceptance of flaws, including through-wall flaws, in moderate energy Class 2 and 3 pipes. However, ASME Code Case N-513-3 contains certain limitations that the licensee considers restrictive for its RHRSW piping system and could result in an unnecessary plant shutdown. Specifically, Code Case N-513-3 is limited to straight pipe with provisions for flaws that extend for a short distance, at the pipe to fitting weld, into the fitting. 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 Code Case N-513-3, but are addressed in Code Case N-513-4. Additionally, both Code Cases N-513-3 and N-513-4 specify operational conditions that do not encompass the HNP RHRSW maximum system operating pressure of 450 psig.

Given that the previous revision of ASME Code Case N-513 (i.e., ASME Code Case N-513-3), is conditionally approved for use in RG 1.147, Revision 18, and is incorporated by reference in 10 CFR 50.55a, the NRC staff focused its review on the principal differences between ASME Code Cases N-513-3 and N-513-4, and the licensee's stated exception to Code Case N-513-4, along with the proposed additional conditions in request for alternative HNP-ISI-ALT-05-07.

ASME Code Case N-513-4 specifies that the repair or replacement activity temporarily deferred under the provisions of the Code Case shall be performed no later than the next scheduled refueling outage. The NRC staff finds that ASME Code Case N-513-4 appropriately addresses the only NRC condition on the use of ASME Code Case N-513-3, and, therefore, finds this provision acceptable for this alternative request.

The evaluation and acceptance criteria of ASME Code Case N-513-4 have been revised to include flaws in elbows, bent pipe, reducers, expanders, and branch tees using a simplified approach, 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 in December 1996. The flaw evaluation methodology approach in ASME 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. Code Case N-513-4 also applies this methodology to reducers, expanders, and branch tees.

The NRC staff finds that the flaw evaluation and acceptance criteria in ASME Code Case N-513-4 for elbows, bent pipe, reducers, expanders, and branch tees are acceptable for this alternative request, because the flaw evaluation methods in the Code Case are consistent with ASME Code Section XI, and the 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.

Additionally, ASME 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 determined that the flaw evaluation criteria in ASME Code Case N-513-4 for straight or bent piping, as appropriate, can be applied to heat exchanger external tubing or piping. The staff determined the methods for evaluating flaws in straight pipe are acceptable since they are allowed currently in ASME Code Case N-513-3. For bent pipe, the acceptability was described above. The NRC staff further finds that it is acceptable to include heat exchanger external tubing or piping in the RHRSW system within the scope of this alternative request, because only those heat exchanger external tubing or piping flaws that are able to be characterized and monitored for leakage in accordance with Code Case N-513-4 will be subject to application of this alternative, and the Code Case provides acceptable methods for the evaluation for these flaws.

An additional change incorporated in ASME Code Case N-513-4 specifically limited its use to liquid systems. The NRC staff finds this change acceptable for this alternative request, since ASME Code Case N-513-3 is essentially intended for liquid systems, and is not intended to apply to air or other compressible fluid systems.

A further change incorporated in ASME Code Case N-513-4 clarified that all service load combinations must be considered in flaw evaluations to determine the most limiting condition. This requirement was not stated in ASME Code Case N-513-3; thus, it was subject to interpretation. Code Case N-513-4 explicitly states this requirement. Therefore, the NRC staff finds this change acceptable.

Another change incorporated in ASME Code Case N-513-4 contains modifications that include a reference to ASME Code Section XI, Appendix C, C-6320, to address flaws in austenitic stainless steel pipe flux welds. The ASME Code, Section XI, Appendix C, C-6000, permits the use of elastic plastic fracture mechanics criteria in lieu of limit load criteria to analyze flaws in stainless steel pipe flux welds. Equation 1 of the Code Case was also revised to be consistent with ASME Code, Section XI, Appendix C, C-6320, so the equation can be used for flaws in austenitic stainless steel pipe flux welds. The NRC staff finds this acceptable for this alternative request, because the modifications to the Code Case now include the appropriate methods for the evaluation of stainless steel pipe flux welds in accordance with Section XI of the ASME Code.

The NRC staff notes that for acceptance of a degraded piping component to remain in service temporarily, Code Case N-513-4 requires a licensee to perform flaw characterization, flaw evaluation, periodic monitoring, and extent of condition examinations. Additionally, in applying Code Case N-513-4, SNC will calculate the allowable postulated flaw sizes for various pipe sizes under the maximum operating pressure of the HNP RHRSW system (i.e., 450 psig). If the flaw size ultimately exceeds the allowable size, the degraded component will no longer satisfy the acceptance criteria of Code Case N-513-4, and alternative HNP-ISI-ALT-05-07 would no

longer be applicable, thus the licensee would be required to take actions in accordance with the applicable ASME Code requirements and plant TSs. In addition, the licensee stated that the allowable leakage rate will be determined by dividing the critical leakage rate by a safety factor of four. The NRC staff finds that applying a safety factor of four to the critical leakage rate provides quantitatively measurable limits, which ensure operability of the system and early identification of issues that could erode defense-in-depth and lead to adverse consequences. Moreover, the licensee stated that the leakage will be stopped by an engineered device, which will be removed periodically for inspections. The licensee will also perform more frequent augmented examinations as stated in the request, as an additional condition on the use of this alternative. Additionally, the NRC staff also finds that eliminating the leakage with an engineered device during the duration of the temporary acceptance period will further assure that flaw growth, if any, will be limited during continued plant operation.

In summary, the NRC staff finds the licensee's request for alternative HNP-ISI-ALT-05-07 acceptable because: (1) the licensee has demonstrated that the 450 psig pressure will not significantly affect the structural integrity of the subject piping components, (2) the licensee will perform additional augmented examinations beyond those required by Code Case N-513-4 (i.e., examinations at ten locations versus five), (3) the licensee will use engineered devices to stop the leakage during the temporary acceptance period, (4) the licensee will monitor the potential leakage and the leakage rate for the subject piping components, (5) the licensee will perform the required flooding analysis, (6) the licensee will demonstrate operability of the affected component, and (7) the licensee will perform an ASME Code repair/replacement of the component during the next refueling outage, or when it exceeds the conditions of alternative HNP-ISI-ALT-05-07, whichever occurs first. The NRC staff's authorization of this alternative does not imply generic NRC acceptance of ASME Code Case N-513-4.

4.0 CONCLUSION

As set forth above, the NRC staff finds that the proposed alternative provides reasonable assurance of structural integrity of the RHRSW piping components at HNP. The NRC staff finds that complying with the requirements of 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 authorizes the use of alternative HNP-ISI-ALT-05-07, Version 1.0, at HNP, Units 1 and 2, until the end of the fifth 10-year ISI interval, which started on January 1, 2016 and will end on December 31, 2025.

All other requirements of ASME Code, Section XI, for which relief has not been specifically requested and approved in this request remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: R. Kalikian, NRR

Date: October 18, 2018

SUBJECT: EDWIN I. HATCH NUCLEAR PLANT, UNIT NOS. 1 AND 2 – PROPOSED INSERVICE INSPECTION ALTERNATIVE HNP-ISI-ALT-05-07 (EPID L-2018-LLR-0070) DATED OCTOBER 18, 2018

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ADAMS Accession No. ML18289A619 ***via email**

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OFFICE	DMLR/MPHB/BC*	DORL/LPLII-1/BC	DORL/LPLII-1/PM
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