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

October 30, 2009

Chris L. Burton, Vice President
Shearon Harris Nuclear Power Plant
Carolina Power & Light Company
Post Office Box 165, Mail Zone 1
New Hill, North Carolina 27562-0165

SUBJECT: SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1 – REQUEST FOR RELIEF NO. I3R-05 FOR THE THIRD 10-YEAR INSERVICE INSPECTION INTERVAL REGARDING REQUIREMENTS FOR THE SERVICE WATER SYSTEM (TAC NO. ME0013)

Dear Mr. Burton:

By letter dated October 24, 2008, Carolina Power & Light Company, now doing business as Progress Energy Carolinas, Inc. (the licensee), submitted Relief Request No. I3R-05 (RR 13R-05), pertaining to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, requirements for the service water system during the third 10-Year Inservice Inspection (ISI) Interval at the Shearon Harris Nuclear Power Plant, Unit 1 (HNP).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii), the licensee proposed to defer permanent ASME Code repair of a degraded Code Class 3 service water piping socket weld at HNP until adequate time was available for the repair, but no later than the next scheduled refueling outage. The licensee requested relief because the proposed temporary non-Code repair deviates from the requirements of the ASME Code, 2001 Edition with addenda through 2003, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," Article IWA-5250(a)(3), "Corrective Action."

Based on the information provided in RR I3R-05, the Nuclear Regulatory Commission (NRC) staff concluded that the proposed alternative provides reasonable assurance of the operational readiness of the service water system and that the implementation of additional ASME Code requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety. The NRC staff also finds that the licensee's proposed alternative continues to provide reasonable assurance of structural integrity and is, therefore, acceptable.

Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the NRC staff authorizes the ISI program alternatives proposed in RR I3R-05 for the third 10-year ISI interval at the HNP.

However, it should be noted that in the course of the NRC review of RR I3R-05, the permanent ASME Code repair of the degraded Code Class 3 service water piping socket weld at HNP was completed during the spring 2009 refueling outage. Therefore, the NRC evaluation serves to validate the approach used at HNP for the duration of the non-Code repair, as well as close out the commitments made in the licensee's application regarding compensatory measures put in place prior to the permanent ASME Code repair of the degraded weld.

The NRC staff's safety evaluation is enclosed. If you have any questions regarding this matter, please contact Marlayna Vaaler at (301) 415-3178.

Sincerely,

Thomas H. Boyce, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-400

Enclosure: Safety Evaluation

cc w/enclosure: Distribution via ListServ

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

REQUEST FOR RELIEF NO. I3R-05 FOR APPROVAL OF TEMPORARY NON-CODE REPAIR AND DEFERRAL OF CODE REPAIR OF DEGRADED SERVICE WATER SYSTEM PIPING

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

CAROLINA POWER & LIGHT COMPANY

DOCKET NO. 50-400

1.0 INTRODUCTION

By letter dated October 24, 2008, Carolina Power & Light Company (the licensee), now doing business as Progress Energy Carolinas, Inc., submitted Relief Request No. I3R-05 (RR 13R-05), pertaining to the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), Section XI, requirements for the service water system during the third 10-Year Inservice Inspection (ISI) Interval at the Shearon Harris Nuclear Power Plant, Unit 1 (HNP).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) 50.55a(g)(5)(iii), the licensee proposed to defer permanent ASME Code repair of a degraded Code Class 3 service water piping socket weld at HNP until adequate time was available for the repair, but no later than the next scheduled refueling outage. The licensee requested relief because the proposed temporary non-code repair deviates from the requirements of the ASME Code, 2001 Edition with addenda through 2003, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," Article IWA-5250(a)(3), "Corrective Action."

The U.S. Nuclear Regulatory Commission (NRC) staff evaluated the licensee's request for relief and the proposed alternative pursuant to 10 CFR 50.55a(a)(3)(ii), in order to determine that compliance with the ASME Code requirement would result in hardship without a compensating increase in the level of quality and safety.

2.0 REGULATORY REQUIREMENTS

As specified by 10 CFR 50.55a(g), inservice inspection of ASME Code Class 1, 2, and 3 components should be performed in accordance with the requirements of Section XI of the ASME Code and applicable addenda, except where specific written relief has been granted by the Commission pursuant to 10 CFR 50.55a(g)(6)(i).

As stated in 10 CFR 50.55a(g)(5)(iii), if a licensee determines that conformance with certain ASME Code requirements is impractical for its facility, the licensee shall notify the Commission and submit, as specified in 10 CFR 50.4, information to support those determinations. In RR I3R-05, the licensee requested NRC authorization in accordance with 10 CFR 50.55a(g)(5)(iii) to allow temporary non-code repair of a service water piping drain during the third 10-year ISI interval at HNP. The ISI Code of Record for the third 10-year ISI interval at HNP is the 2001 Edition through the 2003 Addenda of the ASME Code, Section XI. According to 10 CFR 50.55a(a)(3), alternatives to the requirements of paragraph 50.55a(g) may be used, when authorized by the NRC, if an applicant demonstrates that the proposed alternatives would provide an acceptable level of quality and safety or if the specified requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

3.0 TECHNICAL EVALUATION

3.1 Component for Which Relief Was Requested

Socket-to-piping carbon steel weld on line 3SW1-267SA-1, a 1-inch grab sample location and floor drain via isolation valve 1 SW-272. This piping section is welded to line 3SW30-25SA-1, the "A" train emergency service water (ESW) discharge header to the auxiliary reservoir.

3.2 Applicable ASME Code Requirements

Per NRC Inspection Manual Part 9900 Technical Guidance, "Operability Determinations & Functionality Assessments for Resolution of Degraded or Nonconforming Conditions Adverse to Quality or Safety," Section C. 12: "If a leak is discovered in a Class 1, 2, or 3 component while conducting an inservice inspection, maintenance activity, or during facility operation, any corrective measures to repair or replace the leaking component must be performed in accordance with IWA-4000 of Section XI [of the ASME Code]."

3.3 Flaw Detection

The flaw was identified during operator rounds. The plant was in Mode 1 at 100 percent power.

3.4 Licensee's Proposed Alternative

Relief is requested from ASME Code, Section XI, Article IWA-4000 requirements to defer the code repair of the identified through-wall flaw until the next outage of sufficient duration, but no later than the next refueling outage, provided the conditions of Generic Letter (GL) 90-05, "Guidance for Performing Temporary Non-Code Repair of ASME Code Class 1, 2, and 3 Piping," are met.

3.5 Impracticality Determination

As stated in GL 90-05, an ASME Code repair is required for Code Class 1, 2, and 3 piping unless specific written relief is granted by the NRC. Relief is appropriate when performance of the repair at the time of discovery is determined to be impractical.

A repair is considered to be impractical if:

- The flaw detected during plant operation is in a section of Class 3 piping that cannot be isolated to complete a code repair within the time period permitted by the limiting condition for operation of the affected system as specified in the plant Technical Specifications, and

- Performance of code repair necessitates a plant shutdown.

The identified flaw was a pinhole leak through the middle of a socket welded joint. The welded joint joins the 1-inch drain pipe to a 1-inch sockolet fitting. The 1-inch sockolet fitting is welded to the "A" train ESW discharge header, 3SW30-25SA-1. To repair this weld, the 30-inch ESW system would need to be taken out of service and drained. Additionally, several other portions of the ESW and its associated components would need to be taken out of service while this train is being repaired.

The HNP Technical Specifications (TS) Limiting Condition for Operation (LCO) associated with less than two independent water loops of the ESW system operable is 72 hours or be in at least hot standby within the next 6 hours and cold shutdown within the following 30 hours.

3.6 Licensee's Basis for Use

The licensee notes that the leak is on the weld between the 1 inch socket and the piping upstream of valve 1SW-272. The drain line is for the "A" train ESW discharge header. The pinhole leak is not at the weld toe, but appears to emanate from the middle of the weld and is attributed to crevice corrosion. Crevice corrosion is a localized phenomenon that results in wall thinning and has occurred on other ESW piping in the past at HNP, especially at welds.

The toe of a weld or gaps between layers of a weld bead will act as the 'crevices' in which local corrosion cells can develop. A single flaw or defect in the weld material can create a site for an active corrosion cell which will eventually corrode through the weld material and create the leak path. Based on past inspections where through-wall leaks have occurred, this phenomenon is localized and does not propagate outwards from the initial leak location. Due to the localized nature of this mechanism, the overall material loss resulting from the corrosion is generally minimal. In this way it is similar to pitting corrosion. Ultrasonic testing (UT) measurements around the area of the leak verify that wall loss of the general area is not of concern.

The licensee states that in order to comply with the ASME Code repair requirement, the plant would need to be shut down. As noted in GL 90-05: "The rather frequent instances of small leaks in some Class 3 systems, such as service water systems, could lead to an excessive

number of plant start-up and shutdown cycles with undue and unnecessary stress on facility systems and components if the facilities were to perform a code repair when the leakage is identified." Since the NRC staff has determined that temporary non-code repair of Class 3 piping that cannot be isolated without a plant shutdown is justified in some instances, the licensee requests approval for its temporary non-code repair of code Class 3 piping, based on the impracticality in performing an ASME Code repair while the plant is operating.

Per the guidelines of GL 90-05, the licensee proposed to defer repair of the identified flaw until the next scheduled outage exceeding 30 days but no later than the next refueling outage. To ensure that the acceptance criteria of GL 90-05 were met, HNP implemented compensatory actions to detect changes in the condition of the identified defect.

The licensee stated that deferral of the code repair of the identified through-wall flaw would not impact the capability of the ESW system to perform its intended safety-related function, based on the following:

1. The loss of flow from the ESW system was negligible compared to the total system flow. Even with a conservatively estimated leak rate of one drop every five minutes, the minimum design ESW flow through the "A" train ESW discharge header is approximately 16,000 to 18,000 gallons per minute;

2. The leak is on the weld and not the pipe wall. Based on past ESW through-wall leak analyses, a weld leak is indicative of crevice corrosion which typically creates a localized flaw with no mechanism to propagate rapidly into the adjoining pipe or tee section. Thus, the leak will not expand significantly unless a new failure mechanism is introduced;

3. There is no concern of diversion of flow since the leak is downstream of all ESW loads and is very small;

4. Based on non-destructive evaluation UT measurements adjacent to the weld and on the HNP Civil/Structural Design Engineering evaluation, there is no impact on the structural integrity of the ESW line involved;

5. The leak is not affecting any other equipment important to safety in the immediate area;

6. In accordance with the guidance of GL 90-05, an augmented inspection of 5 similar locations has been performed. These inspections did not reveal any locations approaching minimum wall thickness or any areas of concern. The measurements also indicate that a system wide failure mechanism is unlikely to be the cause of the subject leak.

The licensee stated that there were no other identified leaks in the ESW system. The pinhole leak would be repaired by replacing the affected line during the next refueling outage. Until this replacement, the leak rate will be monitored weekly and ultrasonic measurements of the area of the leak will be taken every three months, both of which meet the requirements of GL 90-05.

The licensee completed and provided in the submittal a flaw evaluation in accordance with GL 90-05. The conclusion of the flaw analysis determined that the flaw was acceptable for use in the GL 90-05 basis for continued operation under the guidelines of the augmented inspections outlined in GL 90-05. The licensee concluded that continued operation without code repair until the next refueling outage, RFO-15, was acceptable in accordance with the requirements of GL 90-05.

3.7 Staff Evaluation

The licensee stated that a through-wall pinhole leak caused by crevice corrosion was found during operation in the ESW system at HNP. At the time of finding the flaw, the plant was in Mode 1 at 100 percent power. The flaw was located on the weld between the 1-inch socket and the piping upstream of valve 1SW-272. The root cause for the pinhole leak was attributed to crevice corrosion. Crevice corrosion progression is localized and generally very slow, and will not usually lead to a catastrophic failure of the degraded component with proper monitoring.

Generally, an ASME Code repair would be required to address any identified through-wall flaw in an ASME Code Class 3 component in order to restore the structural integrity of the component, independent of the operational mode of the facility. However, the licensee chose to implement GL 90-05, which provides a basis to allow temporary non-code repairs for Class 3 piping. On April 16, 2008, the NRC issued Revision 1 to the NRC Regulatory Issue Summary 2005-20, "Revision to NRC Inspection Manual Part 9900 Technical Guidance, 'Operability Determinations & Functionality Assessments for Resolution of Degraded or Nonconforming Conditions Adverse to Quality or Safety'." Section C.11 of the updated NRC Inspection Manual Part 9900 states, in part, that the NRC staff accepts GL 90-05 for conclusively establishing that a technical specification required ASME Code Class 3 piping system that contains a flaw has adequate structural integrity. Section C.12 states, in part, that the licensee may evaluate the structural integrity of Class 3 piping by evaluating the flaw using the criteria of paragraph C.3.a of Enclosure 1 to GL 90-05. Further, relief from ASME Code requirements is needed even if the structural integrity is found acceptable when applying GL 90-05.

Guidance is provided in GL 90-05 for assessing both the structural integrity of the flawed piping by a flaw evaluation and the overall degradation of the system by an augmented inspection. Section C, "Evaluation Guideline," of Enclosure 1 to GL 90-05 states, in part, that the licensee can only use this provision if the flaw was detected during operation and an impracticality determination was made. The licensee, in section 4.0 of the submittal, stated that to repair the weld, the 30-inch ESW system would need to be taken out of service and drained. Additional systems and components would also need to be taken out of service while the system was drained. Technical specifications provide only a limited 72-hour timeframe for this evolution. The staff finds that the licensee identified the flaw during 100 percent power operations and provided sufficient basis for impracticality of compliance. Therefore, the staff finds the licensee met this requirement for implementation of GL 90-05 as a proposed alternative.

Section C of Enclosure 1 to GL 90-05 also states, in part, that a root cause determination and flaw characterization should be performed. The licensee provides the root cause and characterization of the flaw in Sections 6.1 and 6.3 of the submittal, and as detailed in the

licensee's basis above. The staff finds that the licensee met these evaluation requirements for the implementation of GL 90-05 as a proposed alternative.

Section C of Enclosure 1 to GL 90-05 requires a flaw evaluation. As stated in Section C.12 of NRC Inspection Manual Part 9900, Section C.3.a of GL 90-05 provides an NRC acceptable flaw evaluation guideline for through-wall flaws. The staff reviewed the licensee's flaw evaluation, provided in Section 6.5 of the submittal, against this guideline. The staff finds that the licensee's assumption that the pinhole leak had an opening diameter of 1/16-inch was conservative. Further the staff agrees with the licensee's calculated stress intensity factor of approximately 8 ksi(in)$^{0.5}$ and finds it to be less than the critical stress intensity factor which represents the fracture toughness of the material. As stated in GL 90-05, this value is 35 ksi(in)$^{0.5}$ for ferritic steel. Therefore, the staff finds that the licensee has met this criterion for implementation of GL 90-05 as a proposed alternative.

Section C of Enclosure 1 to GL 90-05 finally requires that augmented inspection be performed. The licensee states that augmented inspection of five other similar locations was performed. Ultrasonic testing measurements did not reveal any piping approaching minimum wall thickness or any other areas of concern. The licensee provided sufficient detail in Section 6.2 of the submittal for the staff to agree with the licensee's findings. In Section 6.6 of the submittal, the licensee states that the leak will be visually inspected weekly by HNP Operations until it is repaired. In addition, qualitative assessment of leakage will be performed at least weekly to determine any degradation of structural integrity. Finally, ultrasonic measurements of where the flaw is located will be performed every 3 months. The staff finds that these inspections meet and satisfy the requirements for the implementation of GL 90-05 as a proposed alternative.

The staff finds that the licensee has successfully met all requirements and taken all actions necessary to implement GL 90-05 as a proposed alternative to support the licensee's submittal.

4.0 CONCLUSION

Based on the information provided in the licensee's submittal, the NRC staff concludes that the licensee proposed alternative continues to provide reasonable assurance of the operational readiness of the service water system, and that requiring an ASME Code repair immediately could result in a plant shutdown, which would cause a hardship or unusual difficulty without a compensating increase in the level of quality or safety. Therefore, pursuant to 10 CFR 50.55a(a)(3)(ii), the proposed alternative in RR I3R-05 is authorized for the third 10-year ISI interval at the Shearon Harris Nuclear Power Plant, Unit 1. The relief granted is authorized by law and will not endanger life or property or the common defense and security, and is otherwise in the public interest given due consideration to the burden upon the licensee that could result if the requirements were imposed on the facility. All other requirements of the ASME Code, Section XI, for which relief has not been specifically requested remain applicable, including third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: J. Collins

Date: October 30, 2009

The NRC staff's safety evaluation is enclosed. If you have any questions regarding this matter, please contact Marlayna Vaaler at (301) 415-3178.

Sincerely,

/RA/

Thomas H. Boyce, Chief
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-400

Enclosure: Safety Evaluation

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