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

April 21, 2014

Mr. Ernest J. Kapopoulos, Jr.
Vice President
Shearon Harris Nuclear Power Plant
Duke Energy Progress, Inc.
5413 Shearon Harris Road
New Hill, NC 27562-9300

SUBJECT: SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1 – RELIEF REQUEST I3R-12 FOR ALTERNATIVE REPAIR OF ACCUMULATOR FILL VALVE PIPING WELD (TAC NO. MF3059)

Dear Mr. Kapopoulos:

By letter dated November 7, 2013, to the U.S. Nuclear Regulatory Commission (NRC), as supplemented by letter dated November 25, 2013, Duke Energy Progress, Inc. (the licensee) submitted Relief Request I3R-12 for Shearon Harris Nuclear Power Plant, Unit 1. The licensee requested to use alternatives for certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), for the third 10-year Inservice Inspection Program for the repair of a leaking weld at the accumulator fill valve.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(ii), the licensee requested relief from article IWC-3122 of Section XI of the ASME Code and proposed to use modified ASME Code Case N-513-3 to permit a leaking valve to remain in service from October 20 to October 30, 2013, on the basis that complying with the specified ASME Code requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

The NRC staff reviewed the subject request and concludes, as set forth in the enclosed safety evaluation that the licensee has adequately addressed all of the regulatory requirements set forth in 10 CFR 50.552(a)(3)(ii). Therefore, the NRC staff authorizes the use of Relief Request I3R-12 from October 20, 2013, until repair activities were completed in accordance with ASME Section XI, Appendix IX, on October 30, 2013.

If you have any questions, please contact the Project Manager, Andrew Hon at 301-415-8480.

Sincerely,

Lisa M. Regner, Acting 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

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELIEF REQUEST I3R-12: REACTOR VESSEL CLOSURE HEAD

ALTERNATIVE REPAIR OF ACCUMULATOR FILL VALVE PIPING WELD

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-400

1.0 INTRODUCTION

By letter dated November 7, 2013 (Agencywide Documents Access and Management System Accession Number ML13316A313), Duke Energy Progress, Inc. (the licensee) requested relief from certain requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code (ASME Code), for the third 10-year Inservice Inspection Program at Shearon Harris Nuclear Power Plant, Unit 1. The licensee submitted Relief Request I3R-12 as an alternative for the repair of a leaking weld at the accumulator fill valve.

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.55a(a)(3)(ii), the licensee requested relief from article IWC-3122 of Section XI of the ASME Code and proposed to use modified ASME Code Case N-513-3 to permit a leaking valve to remain in service from October 20 to October 30, 2013, on the basis that complying with the specified ASME Code requirement would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

2.0 REGULATORY EVALUATION

Section 50.55a(g)(4) of 10 CFR specifies 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 the ASME Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," to the extent practical within the limitations of design, geometry, and materials of construction of the components.

Section 50.55a(a)(3) of 10 CFR states that alternatives to the requirements of paragraph (g) of 10 CFR 50.55a may be used, when authorized by the U.S. Nuclear Regulatory Commission (NRC), if the licensee demonstrates (i) the proposed alternatives would provide an acceptable level of quality and safety or (ii) compliance with the specified requirements would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

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 the Commission to authorize, the alternative requested by the licensee.

3.0 TECHNICAL EVALUATION

RELIEF REQUEST I3R-12

The affected component is the ASME Class 2 socket weld joining the accumulator 'C' fill line 2SI1-157SA-1 to the accumulator 1C-SA fill isolation valve, 1SI-188 of the safety injection system. The licensee stated that the ASME Code examination category is C-H and the Item Number is C7.10 (pressure retaining components) for the subject valve. The pipe is 1-inch nominal pipe size, schedule 40, with a thickness of 0.133 inch. The pipe material is ASTM A-312, Grade TP304 stainless steel. The design pressure and temperature are 700 pounds per square inch (psi) and 200 degrees F, respectively. The NRC staff notes that the subject component could also be classified under Examination Category C-F-1, Item Number 5.30 (socket weld) of the ASME Code, Section XI, Table IWC-2500-1. The NRC staff further notes that both examination categories do not affect the proposed alternative.

The valve is part of the safety injection system that consists of multiple water reservoirs and flow paths to provide emergency cooling water to the reactor coolant system. Valve 1SI-188 is operated from the main control board and opened to fill the 'C' accumulator.

The code of record is the ASME Code, Section XI, 2001 Edition through the 2003 Addenda. The ASME Code, Section XI, subsection IWC, "Requirements for Class 2 Components of Light-Water Cooled Power Plants," subparagraph IWC-3122.2, "Acceptance by Repair/Replacement Activity," states, in part, that "...a component whose examination detects flaws that exceed the acceptance standards of Table IWC-3410-1 is unacceptable for continued service until...the component is corrected by a repair/replacement activity..."

On October 20, 2013, the licensee discovered that the weld of the socket joint on the downstream side of valve 1SI-188 was leaking. The defect is a through wall, circumferential, planar flaw in the weld metal of the socket joint between the pipe and valve body. The licensee reported that the flaw is in the face of the weld and was measured to be approximately 22/32 inches in circumferential length on October 21, 2013. The licensee stated that the flaw propagated to approximately 24/32 inches in length as measured on October 29, 2013. During the installation of a support associated with the valve repair on October 30, 2013, the valve was elevated. Subsequent to the support installation, the flaw length was approximately 1-1/32 inches. The weld effective throat is 0.198 inch. The circumference at the weld effective throat is approximately 5.375 inches. The outside diameter of weld at the effective throat is approximately 1.711 inches.

Valve 1SI-188 is the ASME Code, Section III, Class 2 pressure boundary. Line 2SI1-157SA-1 from 1SI-188 to the accumulator is ASME Class 2. The licensee noted that this location is not isolable from the 'C' accumulator. According to the licensee, the leak rate trend appears to have started on October 18, 2013, and increased from approximately 1 gallon per hour on October 20, 2013, to about 7.1 gallons per hour on October 30, 2013, prior to installation of the repair.

Technical Specification (TS) 3/4.5.1, "Accumulators," specifies that the accumulators must be operable in Modes 1, 2, and 3. When one accumulator is inoperable, the limiting condition for

operation of TS 3/4.5.1 requires that the inoperable accumulator be restored to OPERABLE status within 1 hour or be in at least HOT STANDBY within the next 6 hours and reduce pressurizer pressure to less than 1000 psig within the following 6 hours. The licensee performed operability determination for the 'C' accumulator and confirmed it was in OPERABLE but Degraded/Non-Conforming condition due to the 1SI-188 valve leakage.

Because valve 1SI-188 could not be repaired without isolating the 'C' accumulator from the reactor system and within the 1-hour allowed outage time for the 'C' accumulator, this repair would force the plant to be shut down as required by the above TS Action. Such forced shutdown is a hardship or unusual difficulty without a compensating increase in level of quality or safety. In lieu of repair, the licensee performed a flaw evaluation that demonstrated that structural integrity would be maintained up to a flaw length of 1.651 inches, providing assurance that adequate safety margins existed for continued operation. The licensee's operability determination also demonstrated that the 'C' accumulator would remain OPERABLE with the subject flaw in place until the repair could be completed on October 30, 2013.

The licensee completed the repair of the socket weld on October 30, 2013, using a mechanical clamp in accordance with Appendix IX of the ASME Code, Section XI. This relief request addresses the period of time from discovery until completion of the repair, which was needed to evaluate, develop, plan and implement the repair. ASME Code Case N-513-3, "Evaluation Criteria for Temporary Acceptance of Flaws in Moderate Energy Class 2 or 3 Piping," does not apply because the flaw is in the weld metal of a socket welded joint.

The proposed alternative is to use as-is, deferring repair for approximately 10 days to allow evaluation, design, planning, and implementation of the repair. The licensee stated that shutdown of the plant until completion of the repair does not have a compensating increase in the level of quality or safety, based upon a flaw evaluation and compensatory actions as described below.

a) The flaw geometry was characterized by physical measurement. The full pipe circumference at the flaw location was inspected to characterize the surface length of the flaw in the pipe section.
b) The through-wall flaw was classified as planar.
c) Only the single flaw was identified.
d) A flaw evaluation was performed to determine the conditions for flaw acceptance. The flaw evaluation demonstrated that structural integrity would be maintained up to a flaw length of 1.651 inches, providing assurance that adequate safety margins existed.
e) Frequent periodic surface inspections were performed to determine the flaw growth rate and to confirm the flaw length was well below the allowable length.
f) Leak-rate monitoring of the flaw by remote camera, and walkdowns confirmed the analysis conditions used in the evaluation remained valid.

The licensee stated that it ultrasonically examined wall thickness on the piping adjacent to the flawed weld. The licensee further stated that its ultrasonic examinations confirmed that general wall thinning is not a concern in the measured locations.

The licensee established administrative limits on leak rates to ensure the accumulator remained operable. If the administrative limits had been reached prior to implementation of the repair, the licensee stated that it would have reassessed the operability of the accumulator.

The licensee stated that it evaluated the potential effects of boric acid on nearby components in the boric acid control program. The licensee also evaluated continued active borated water leakage as acceptable in this case until the scheduled start of the refueling outage on November 9, 2013. The licensee stated that the overall degradation mechanism is likely to be stress corrosion cracking, exacerbated by a combination of high deadweight plus pressure stress being close to the service level 'A' ASME Code allowable, and noticeable vibration levels on the weld joint.

The licensee requested relief and authorization of the proposed alternatives from the time of discovery on October 20, 2013, until completion of repair activities completed in accordance with the ASME Code, Section XI, Appendix IX, on October 30, 2013.

NRC STAFF EVALUATION

The licensee's proposed alternative is based on the modified ASME Code Case N-513-3 to demonstrate that the degraded valve is acceptable during the period from October 20 to October 30, 2013. However, the code case prohibits its use to leakage through socket welded joints. Also the code case limits its use to moderate energy piping with temperature and pressure less than 200 degrees F and 275 psi, respectively. As described above, the subject valve is a high energy pipe. It does not satisfy the above two limitations. The licensee asked for relief from these two limitations.

Aside from the limitations on applying the code case to socket welds and piping with pressure exceeding 275 psi, the licensee evaluated the flaw correctly as described in code case N-513-3. The code case specifies that flaw evaluations be conducted using the ASME Code, Section XI, nonmandatory Appendix C. For flaws in austenitic nonflux welds, Appendix C calls for a fully plastic limit load analysis as documented in article C-5000. The licensee applied the methodology of article C-5000, which does not specify an operating pressure limit. The NRC staff performed an independent flaw evaluation and confirmed that the licensee's analysis is acceptable and the licensee conservatively used the lower yield strength and ultimate tensile strength of the pipe material, rather than the higher strength properties of the weld metal.

The NRC staff notes that while the code case is not applicable to the subject weld or the pressure at which it operates, the stainless steel from which the subject weld is constructed has sufficient fracture toughness that it is not likely to break catastrophically, but leakage would increase if the flaw grew. The NRC staff also notes that the licensee established administrative limits on the leak rate to ensure the accumulator remained operable and monitored the leak rate by remote camera monitoring, walkdowns, and surface inspections to determine flaw growth rate. Moreover, the flaw was only left in place for a short period of time to prepare for the repair.

The flaw was initially measured to be 22/32 inches in circumferential length on October 21, 2013. One day prior to the repair, on October 29, 2013, the flaw was measured to have grown to 24/32 inches in length, still well below the maximum allowable length. The compensatory actions to monitor the flaw growth confirmed the analysis conditions used in the flaw evaluation

remained valid until repairs could be completed on October 30, 2014, providing reasonable assurance of the structural integrity of the subject valve.

The NRC staff finds that it is a hardship or unusual difficulty for the licensee to shut down the plant, possibly causing unnecessary transients and perturbations, in order to perform the required ASME Code repair. An ASME Code repair will not result in a compensating increase in the level of quality and safety in light of fact that the licensee repaired the leakage using a mechanical clamp 10 days after the leakage discovery.

In summary, the NRC staff finds that the licensee has demonstrated reasonable assurance of the structural integrity of the subject valve from October 20 to October 30, 2013, based on its flaw evaluation and leakage monitoring in accordance with the ASME Code Case N-513-3.

4.0 CONCLUSION

As set forth above, the NRC staff has determined that the proposed alternative provides reasonable assurance of structural integrity of the subject valve. The NRC staff finds that complying with the specified ASME Code requirements 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(a)(3)(ii) and is in compliance with the requirements of the ASME Code, Section XI for which relief was not requested. Therefore, the NRC staff authorizes the use of Relief Request I3R-12 from October 20, 2013, until repair activities were completed in accordance with ASME Section XI, Appendix IX, on October 30, 2013 at Shearon Harris Nuclear Power Plant, Unit 1.

All other requirements of the ASME Code, Section XI, and 10 CFR 50.55a(g)(6)(ii)(D) for which relief was not specifically requested and authorized herein by the NRC staff remain applicable, including the third party review by the Authorized Nuclear Inservice Inspector.

Principal Contributor: J. Kusnick

Date: April 21, 2014

If you have any questions, please contact the Project Manager, Andrew Hon at 301-415-8480.

Sincerely,

/RA/

Lisa M. Regner, Acting 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

DISTRIBUTION:
PUBLIC
LPL2-2 R/F
RidsNrrDorlLpl2-2
RidsAcrsAcnw_Mail CTR
RidsNrrPMShearonHarris
RidsNrrLABClayton
RidsRgn2MailCenter
RidsNrrDeEpnb
JTsao, NRR
JKusnick, NRR
JNick, EDO

ADAMS Accession No.: ML14104B405 ***by memo ML14098A065**

OFFICE	LPL2-2/PM	LPL2-2/LA	NRR/DE/EPNB*	LPL2-2/BC (A)
NAME	AHon	BClayton	TLupold	LRegner
DATE	04/15/14	04/21/14	04/04/14	04/21/14

OFFICIAL RECORD COPY