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ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
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Shearon Harris Nuclear Power Plant, Unit No. 1
Docket No. 50-400/Renewed License No. NPF-63

Subject: Relief Request I3R-15, Reactor Vessel Closure Head Nozzle Repair Technique, Inservice Inspection Program –Third Ten-Year Interval, Response to Request for Additional Information

Ladies and Gentlemen:

Duke Energy Progress, Inc. (Duke Energy), requested NRC approval of relief request I3R-15 for the Shearon Harris Nuclear Power Plant, Unit 1 (HNP) inservice inspection program in a letter dated April 2, 2015 (ADAMS Accession No. ML15092A236). At the time of the request, there were no known flaws that required repair in the reactor vessel closure head nozzles. HNP subsequently identified three flaws that require repair as a result of examinations of the reactor head performed in the current refueling outage. In response, Duke Energy revised and supplemented relief request I3R-15 in a letter dated April 15, 2015 (ADAMS Accession No. ML15105A521), which superseded the original request. The revised relief request requested an expedited approval by April 28, 2015.

The NRC transmitted a draft request for information to HNP on April 20, 2015, which was discussed in a teleconference that afternoon. The formal request for information was received on April 21, 2015. The Duke Energy response to that request is enclosed.

As a result of a change to the outage schedule, the need date for approval of this request is extended to May 1, 2015, to support startup from the current refueling outage.

This document contains no new regulatory commitments.

Please refer any questions regarding this submittal to Dave Corlett, HNP Regulatory Affairs Manager, at (919) 362-3137.

Sincerely,

Benjamin C. Waldrep

Enclosure: Response to Request for Additional Information

cc: Mr. J. D. Austin, NRC Sr. Resident Inspector, HNP
Ms. M. Barillas, NRC Project Manager, HNP
Mr. V. M. McCree, NRC Regional Administrator, Region II

Shearon Harris Nuclear Power Plant, Unit No. 1
Docket No. 50-400/Renewed License No. NPF-63

Relief Request I3R-15, Reactor Vessel Closure Head Nozzle Repair Technique
Inservice Inspection Program – Third Ten-Year Interval

Response to Request for Additional Information

Duke Energy Progress, Inc. (Duke Energy), requested NRC approval of relief request I3R-15 for the Shearon Harris Nuclear Power Plant, Unit 1 (HNP) inservice inspection program in a letter dated April 2, 2015 (ADAMS Accession No. ML15092A236). At the time of the request, there were no known flaws that required repair in the reactor vessel closure head nozzles. HNP subsequently identified three flaws that require repair as a result of examinations of the reactor head performed in the current refueling outage. In response, Duke Energy revised and supplemented relief request I3R-15 in a letter dated April 15, 2015 (ADAMS Accession No. ML15105A521), which superseded the original request.

The NRC staff determined that additional information was needed to complete its review. The Duke Energy response to that request follows.

Request 1

Section 4 of the relief request (page 5 of 27) states that abrasive water jet machining (AWJM) remediation on the portion of the remaining nozzle will be optional as part of the repair procedure. Discuss the technical basis why the AWJM remediation is an optional step in the proposed relief request whereas it is a required step in previous repairs.

Response 1

AWJM remediation removes a thin layer of material and also imparts compressive residual stresses to the remediated surfaces. If the inside diameter temper bead (IDTB) “half nozzle” weld repair is not remediated with AWJM, the life expectancy for the modification, as stated in Section 6 of the Relief Request, relative to primary water stress corrosion cracking (PWSCC) is estimated at 2.2 effective full power years (EFPY) for a postulated flaw in the repaired Alloy 600 nozzle to reach the ASME limit of 75-percent through-wall. The estimate is based on a quantitative approach to PWSCC life expectancy that considers immediate PWSCC initiation, a constant rapid crack growth rate independent of stress intensity, and ASME B&PV Code Section XI acceptance criteria. The minimum design life of a non-AWJM IDTB modification exceeds two calendar years.

HNP refueling outages are scheduled approximately every 18 months. If flaws attributable to PWSCC have been identified, the re-inspection interval is every refueling outage as required by 10 CFR 50.55a(g)(6)(ii)(D)(5). Any potential flaw in the inspected region should be detected prior to reaching the ASME Code limit of 75-percent through-wall and HNP would take corrective actions. Assurance of safety is provided without the use of AWJM, which is therefore considered optional in the request.

Request 2

Section 6 of the relief request (page 13 of 27) states that the design life of the repair without the AWJM remediation is 2.2 effective full power years (EFPY).

(a) Discuss the approximate calendar days associated with 2.2 EFPY.

(b) Discuss the month and year of the scheduled refueling outages between now and the end of the third inservice inspection interval which ends on May 1, 2017.

(c) Discuss the approximate calendar days for the reactor vessel head inspections between the refueling outages.

Response 2

(a) 2.2 effective full power years is 803 effective full power days. Conservatively discounting the impact of operation at less than full power, including time for refueling outages, we can consider the 2.2 EFPY to correspond to 803 calendar days.

(b) There is only one refueling outage scheduled between now and May 1, 2017. Refueling outage 20 is currently scheduled to start on or about October 8, 2016. Refueling outage 21 is currently scheduled to start on or about April 14, 2018.

(c) There are 533 calendar days from April 24, 2015, to October 8, 2016. There are 553 calendar days from October 8, 2016, to April 14, 2018.

Request 3

Section 6 of the relief request (page 13 of 27) states that the Harris Nuclear Plant (HNP) will examine all repaired RVCH penetration nozzles every refueling outage in accordance with ASME Code Case N-729-1 as conditioned by 10 CFR 50.55a(g)(6)(ii)(D).

(a) 10 CFR 50.55a(g)(6)(ii)(D)(5) requires that all reactor vessel head penetration nozzles be examined once primary water stress corrosion cracking is found in a nozzle. Confirm that all reactor vessel head penetration nozzles at Unit 1 will be examined in all future refueling outages.

(b) Discuss the examination method for the non-repaired nozzles in the future inservice inspections.

Response 3

(a) All RVCH penetration nozzles at Unit 1 will be examined in all future refueling outages until the head is replaced.

(b) Non-repaired RVCH nozzles will be examined in accordance with Code Case N-729-1 and 10 CFR 50.55a(g)(6)(ii)(D), using a qualified ultrasonic examination procedure with demonstrated leak path assessment capability.

Request 4

The licensee stated in the April 15, 2015, cover letter that "...Calculations supporting this relief request were previously docketed supporting relief request I3R-13 in Duke Energy letter dated November 25, 2013 (ADAMS Accession No. ML13330A996)..." Discuss whether all calculations in relief request I3R-13 bound all reactor vessel head penetration nozzles as proposed in relief request I3R-15 dated April 15, 2015. The affected calculations include the evaluation of a postulated flaw in the J-groove weld that propagates into the reactor vessel head, the evaluation of a postulated flaw at the triple point, and the evaluation of the potential for the J-groove weld fragments falling into the reactor vessel and becoming loose parts. The discussion should include (a) applied loading conditions, (b) existing and future flaw sizes and configurations, (c) nozzles in all reactor vessel head locations, considering the impact of the uphill and downhill side, and (d) J-groove weld configurations, considering the impact of the uphill and downhill side. The licensee needs to demonstrate that the worst-case in terms of nozzles and flaws were used in the affected calculations.

Response 4

The calculations in relief request I3R-13 bound all reactor vessel head penetration nozzles as proposed in relief request I3R-15 dated April 15, 2015.

1. J-groove Weld Flaw Evaluation

For the J-groove weld flaw evaluation, the outermost penetration was explicitly modeled. At those locations, the applied loading conditions are either the same as or worse than all other locations in the RVCH. The initial flaw size for the J-groove weld is conservatively assumed to include all of the weld and buttering. This is highly conservative since the buttering sees post weld heat treatment, which would tend to reduce any welding residual stress in it, making it less susceptible to PWSCC. While the analysis considers crack growth on both uphill and downhill sides, the weld on the downhill side of the outermost nozzle has the largest area. Therefore, the largest possible initial flaw size on the downhill side is considered.

2. Triple Point Anomaly

For the triple point anomaly evaluation, the outermost penetration was explicitly modeled. At those locations, the applied loading conditions are either the same as or worse than all other locations in the RVCH. The initial flaw size for the triple point anomaly analysis is 0.100 inches, which is the same as or larger than any other relief request submission for a half nozzle IDTB repair configuration. Crack growth analysis determines the future flaw size and concludes that it is acceptable for the stated life. The outermost hillside nozzle is explicitly modeled, meaning that both extremes of interaction between the IDTB weld and the original J-groove weld are considered (i.e., these welds are very close to each other on the uphill side, and are relatively far away from each other on the downhill side).

3. J-groove weld fragments becoming loose parts

The evaluation for potential fragments of J-groove weld falling into the reactor vessel is generic with respect to location. It concludes that there are no known service conditions that could drive radial cracks and transverse cracks to intersect to produce a loose part.