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919-362-2502

10 CFR 50.55a

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ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Shearon Harris Nuclear Power Plant, Unit No. 1
Docket No. 50-400

Subject: Relief Request I3R-14, Deferral of Reactor Vessel Inspections
Inservice Inspection Program – Third Ten-Year Interval

Ladies and Gentlemen:

Pursuant to 10 CFR 50.55a(a)(3)(i), Duke Energy Progress, Inc., hereby requests NRC approval of the attached relief request for the Shearon Harris Nuclear Power Plant, Unit 1 (HNP) inservice inspection program, third ten-year interval.

Relief is requested in accordance with 10 CFR 50.55a(a)(3)(i). The provisions of this relief are applicable to the third ten-year inservice inspection interval for HNP which commenced on May 2, 2007 and will end on May 1, 2017.

HNP requests approval of this request by February 25, 2015, to support the Spring 2015 refueling outage.

This document contains no new regulatory commitments.

Please refer any questions regarding this submittal to John Caves at (919) 362-2406.

Sincerely,

Ernest J. Kapopoulos, Jr.

Enclosure: Relief Request I3R-14, Deferral of Reactor Vessel Inspections

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

Shearon Harris Nuclear Power Plant, Unit 1
Docket No. 50-400

Relief Request I3R-14
Deferral of Reactor Vessel Inspections
Inservice Inspection Program – Third Ten-Year Interval

Proposed Alternative
in Accordance with 10 CFR 50.55a(a)(3)(i)
Alternative Provides Acceptable Level of Quality and Safety

1. ASME Code Components Affected

The affected component is the Shearon Harris Nuclear Power Plant, Unit 1 (HNP) reactor vessel (RV), specifically the following American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code Section XI (Reference 1) examination categories and item numbers covering examinations of the RV. These examination categories and item numbers are from IWB-2500 and Table IWB-2500-1 of the ASME BPV, Code Section XI.

Category B-A welds are defined as “Pressure Retaining Welds in Reactor Vessel”
Category B-D welds are defined as “Full Penetration Welded Nozzles in Vessels”

Examination Category	Item No.	Description
B-A	B1.11	Circumferential Shell Welds
B-A	B1.12	Longitudinal Shell Welds
B-A	B1.21	Circumferential Head Welds
B-A	B1.22	Meridional Head Welds
B-A	B1.30	Shell-to-Flange Weld
B-A	B1.40	Head-to-Flange Weld
B-D	B3.90	Nozzle-to-Vessel Welds
B-D	B3.100	Nozzle Inner Radius Areas

2. Applicable Code Edition and Addenda

The applicable Code Edition and Addenda is the ASME BPV Code Section XI, “Rules and Inservice Inspection of Nuclear Power Plant Components,” Code 2001 Edition through the 2003 Addenda (Reference 1). Throughout this request the ASME BPV Code, Section XI, is referred to as “the Code.”

3. Applicable Code Requirements

IWB-2412, Inspection Program B, requires volumetric examination of essentially 100% of RV pressure retaining welds identified in Table IWB-2500-1 once per each ten-year interval. The HNP third ten-year inservice inspection (ISI) interval began on May 2, 2007 and is scheduled to end on May 1, 2017.

4. Reason for Request

An alternative is requested from the requirement of IWB-2412, Inspection Program B, that volumetric examination of essentially 100% of RV pressure retaining, Examination Category B-A and B-D welds, be performed once per each ten-year interval. Extension of the inspection interval for Examination Category B-A and B-D welds from ten years to up to twenty years will result in a reduction in person-rem exposure and examination costs.

5. Proposed Alternative and Basis for Use

Duke Energy proposes to defer the Code required volumetric examination of the HNP RV full penetration pressure retaining Category B-A and B-D welds for the third ISI interval, currently scheduled for 2015, until the fourth ISI interval, and to perform the required examinations in 2024, plus or minus one refueling outage. This date is consistent with the latest revised ISI implementation plan documented in Pressurized Water Reactor Owners Group letter OG-10-238 (Reference 2).

In accordance with 10 CFR 50.55a(a)(3)(i), an alternate inspection interval is requested on the basis that the current inspection interval can be extended based on a negligible change in risk by satisfying the risk criteria specified in Nuclear Regulatory Commission (NRC) Regulatory Guide 1.174 (Reference 3).

The methodology used to demonstrate the acceptability of extending the inspection intervals for Category B-A and B-D welds, based on a negligible change in risk, is contained in Westinghouse topical report WCAP-16168-NP-A, Revision 3 (Reference 4). This methodology was used to develop a pilot plant analysis for RVs in Westinghouse, Combustion Engineering, and Babcock and Wilcox plant designs and is an extension of the work that was performed as part of the NRC Pressurized Thermal Shock (PTS) Risk Study (Reference 5). The critical parameters for demonstrating that this pilot plant analysis is applicable on a plant specific basis, as identified in WCAP-16168-NP-A, Revision 3, are identified in Table 1. By demonstrating that each plant specific parameter is bounded by the corresponding pilot plant parameter, the application of the methodology to the HNP RV is determined to be acceptable.

Table 1 Critical Parameters for Application of Bounding Analysis for HNP

Parameter	Pilot Plant Basis	HNP Plant Specific Basis	Additional Evaluation Required?
Dominant Pressurized Thermal Shock (PTS) Transients in the NRC PTS Risk Study are applicable	NRC PTS Risk Study (Reference 5)	PTS Generalization Study (Reference 6)	No
Through Wall Cracking Frequency (TWCF)	1.76E-08 Events per year (Reference 4)	6.59E-11 Events per year (Calculated per Reference 5)	No
Frequency and Severity of Design Basis Transients	7 heatup/cooldown cycles per year (Reference 4)	Bounded by 7 heatup/cooldown cycles per year	No
Cladding Layers (Single/Multiple)	Single Layer (Reference 4)	Single Layer	No

Additional information relative to the HNP RV inspection is provided in Table 2. This information confirms that satisfactory examinations have been performed on the HNP RV.

Table 2 Additional Information Pertaining to Reactor Vessel Inspection for HNP	
Inspection methodology:	The most recent ISI in 2006 of the Category B-A and B-D welds was performed to ASME Code Section XI, Appendix VIII requirements. Future ISIs will continue to be performed to this standard.
Number of past inspections:	Two 10-Year ISIs have been performed.
Number of indications found:	Two indications were identified in the beltline region during the most recent inservice inspection. Neither of these indications was within the inner 3/8th of the vessel thickness and both were acceptable per Table IWB-3510-1 of Section XI of the ASME Code. There are no indications within the inner 1" or 1/10th thickness of the RV beltline region. Therefore, evaluation of the flaw limits in the Alternate PTS Rule (Reference 7) is not required.
Proposed inspection schedule for balance of plant life:	The third ISI is scheduled for 2015. This inspection will be performed in 2024, plus or minus one refueling outage of the specified date. The proposed schedule is consistent with the latest revised ISI implementation plan documented in OG-10-238 (Reference 2).

Table 3 provides additional information relative to the calculation of the TWCF for HNP. The HNP License Renewal Application (LRA, Reference 8) and supplemental information (Reference 9) was used as the information source for the material property inputs listed in Table 3 for HNP. The neutron fluence values were updated as part of the Measurement Uncertainty Recapture (MUR) Power Uprate project (Reference 11). The fluence values for the intermediate shell and lower shell region materials are at the clad to base metal interface. The fluence values for the upper shell region materials are conservatively taken at the inner wetted surface.

Table 3 Details of TWCF Calculation for HNP RV @ 55 Effective Full Power Years								
Inputs								
Reactor Coolant System Temperature, T_{RCS} [°F]:		N/A	Intermediate / Lower Shell T_{wall} [inches]:					7.94
			Upper Shell T_{wall} [inches]:					9.44
#	Region & Component Description	Material or Flux Type	Cu [wt%]	Ni [wt%]	R.G. 1.99 Pos.	CF [°F]	$RT_{NDT(u)}$ [°F]	Fluence [10^{19} Neutron/ cm^2, E>1 MeV][(a)]
1	Intermediate Shell (IS) Plate (A9153-1)	SA-533	0.09	0.46	1.1	58.0	60	6.88
2	Intermediate Shell Plate (B4197-2)	SA-533	0.09	0.50	1.1	58.0	91	6.88
3	Lower Shell (LS) Plate (C9924-1)	SA-533	0.08	0.47	1.1	51.0	54	6.71
4	Lower Shell Plate (C9924-2)	SA-533	0.08	0.47	1.1	51.0	57	6.71
5	IS Longitudinal Weld (BC)	LINDE 124	0.05	0.91	1.1	68.0	-20	2.74
6	IS Longitudinal Weld (BD)	LINDE 124	0.05	0.91	1.1	68.0	-20	2.74
7	LS Longitudinal Weld (BA)	LINDE 124	0.05	0.91	1.1	68.0	-20	2.67
8	LS Longitudinal Weld (BB)	LINDE 124	0.05	0.91	1.1	68.0	-20	2.67
9	IS to LS Circumferential Weld (AB)	LINDE 124	0.03	0.94	2.1	49.1	-20	6.65
10	Upper Shell (US) Plate (C0224-1)[(a)]	SA-533	0.12[(a)]	0.57[(a)]	1.1	82.4	-1[(a)]	0.344
11	Upper Shell Plate (C0123-1)	SA-533	0.12	0.60	1.1	83.0	42	0.344
12	US to IS Circumferential Weld (AC)	LINDE 124	0.06	0.91	1.1	82.0	-20	0.344
13	US Longitudinal Weld (BE)	LINDE 124	0.06	0.91	1.1	82.0	-20	0.344
14	US Longitudinal Weld (BF)	LINDE 124	0.06	0.91	1.1	82.0	-20	0.344

Table 3 Details of TWCF Calculation for HNP RV @ 55 Effective Full Power Years (cont'd)						
Outputs						
Methodology Used to Calculate ΔT_{30}:			Regulatory Guide 1.99, Revision 2 (Reference 10)			
	Controlling Material Region # (From Above)	RT_{MAX-XX} [˚R]	Fluence [10^{19} Neutron/cm^2 E>1 MeV]	Fluence Factor	ΔT_{30} [°F]	$TWCF_{95-XX}$
Axial Weld – AW	2	624.26	2.74	1.269	73.59	2.85E-13
Circumferential Weld - CW	2	635.03	6.65	1.454	84.36	2.70E-17
Plate – PL	2	635.35	6.88	1.460	84.68	2.67E-11
$TWCF_{95-TOTAL}$ ($\alpha_{AW}TWCF_{95-AW} + \alpha_{CW}TWCF_{95-CW} + \alpha_{PL}TWCF_{95-PL}$):						6.59E-11

Note for Table 3:
(a) Only the limiting upper shell plate material (C0123-1) was evaluated previously for License Renewal (Reference 9). The material property input for upper shell plate C0224-1 is plant-specific.

6. Duration of Proposed Alternatives

This request is applicable to the HNP ISI program for the third and fourth ISI intervals.

7. Precedents

1. *Palo Verde Nuclear Generating Station, Units 1, 2, and 3 – Relief Request No. RR-40, Reactor Vessel Weld Examination Interval Extension (TAC Nos. ME1634, ME1635, and ME1636)*, dated February 22, 2010 (ADAMS Accession Number ML100290415).
2. *Safety Evaluation of Relief Requests to Extend the Inservice Inspection Interval for Reactor Vessel Examinations for Salem Nuclear Generating Station, Unit Nos. 1 and 2 (TAC Nos. ME1478, ME1479, ME1480 and ME1481),*" dated February 22, 2010 (ADAMS Accession Number ML100491550).
3. *Arkansas Nuclear One, Unit 2 – Request for Alternative ANO2-ISI-004, to Extend the Third 10-Year Inservice Inspection Interval for Reactor Vessel Weld Examinations (TAC No. ME2508)*, dated September 21, 2010 (ADAMS Accession Number ML102450654).
4. *Joseph M. Farley Nuclear Plant, Unit 2 (Farley Unit 2) – Relief Request for Extension of the Reactor Vessel Inservice Inspection Date to the Year 2020 (Plus or Minus One Outage) (TAC No. ME3010)*, dated July 12, 2010 (ADAMS Accession Number ML101750402).
5. *Three Mile Island Nuclear Station, Unit 1 (TMI-1) – Request to Extend the Inservice Inspection Interval for Reactor Vessel Weld and Internal Examinations, Proposed Alternative Request Nos. RR-09-01 and RR-09-02 (TAC Nos. ME2483 and ME2484),* dated September 21, 2010 (ADAMS Accession Number ML102390018).
6. *Surry Power Station Units 1 and 2 – Relief Implementing Extended Reactor Vessel Inspection Interval (TAC Nos. ME8573 and ME8574)*, dated April 30, 2013 (ADAMS Accession Number ML13106A140).

7. *McGuire Nuclear Station, Unit 2, Relief 10-MN-002 to Extend the Inservice Inspection Interval for Reactor Vessel Category B-A and B-D Welds (TAC Nos. ME7329 and ME 7330),* dated September 6, 2012 (ADAMS Accession Number ML12249A175).

8. References

1. *ASME Boiler and Pressure Vessel Code, Section XI, 2001 Edition with the 2003 Addenda*, American Society of Mechanical Engineers, New York.
2. *OG-10-238*, *Revision to the Revised Plan for Plant Specific Implementation of Extended Inservice Interval per WCAP-16168-NP-A, Revision 1, "Risk-Informed Extension of the Reactor Vessel In-Service Inspection Interval" PA-MSC-0120*, July 12, 2010 (ADAMS Accession Number ML11153A033).
3. NRC Regulatory Guide 1.174, Revision 1, *An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis*, November 2002.
4. WCAP-16168-NP-A, Revision 3, *Risk-Informed Extension of Reactor Vessel In-Service Inspection Interval*, October 2011 (ADAMS Accession Number ML113060207).
5. NUREG-1874, *Recommended Screening Limits for Pressurized Thermal Shock*, March, 2010.
6. NRC Letter Report, *Generalization of Plant-Specific Pressurized Thermal Shock (PTS) Risk Results to Additional Plants*, December 14, 2004 (ADAMS Accession Number ML042880482).
7. Code of Federal Regulations, 10 CFR Part 50.61a, *Alternate Fracture Toughness Requirements for Protection against Pressurized Thermal Shock Events*, U.S. Nuclear Regulatory Commission, Washington D. C., Federal Register, Volume 75, No. 1, dated January 4, 2010, and No. 22 with corrections to part (g) dated February 3, 2010, March 8, 2010, and November 26, 2010.
8. *Shearon Harris, Unit 1, Application for Renewal of Operating License*, Progress Energy, Inc., November 2006 (ADAMS Accession Number ML063350270).
9. *Letter Report HNP-07-104*, *Shearon Harris Nuclear Power Plant, Unit No. 1 Docket No. 50-400 / License No. NPF-63*, Progress Energy, Inc., August 16, 2007 (ADAMS Accession Number ML072350080).
10. NRC Regulatory Guide 1.99, Revision 2, *Radiation Embrittlement of Reactor Vessel Materials*, May 1988.
11. *Shearon Harris, Unit 1, Request for License Amendment, Measurement Uncertainty Recapture Power Uprate,* Progress Energy, Inc., April 28, 2011 (ADAMS Accession Number ML 11124A180).