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November 23, 2009

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

SUBJECT: Duke Energy Carolinas, LLC (Duke)
McGuire Nuclear Station, Unit 1
Docket Number 50-369
Relief Request 09-MN-003 Request for Additional Information

On June 29, 2009 Duke submitted Relief Request 09-MN-003 pursuant to 10 CFR 50.55a(a)(3)(i), requesting NRC approval for an alternative to the reactor vessel inservice inspection interval requirements of the ASME Code, Section XI, IWB-2412.

On November 13, 2009, the NRC Staff electronically requested additional information regarding this relief request. This additional information, along with the Duke response, is attached.

If you have any questions or require additional information, please contact P. T. Vu at (980) 875-4302.

Sincerely,

H D Brewer for

Bruce H. Hamilton

Attachment

A047
NRR

xc:

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ATTACHMENT

Relief Request 09-MN-003

Response to NRC Request for Additional Information

McGuire Unit 1

Response to NRC Request for Additional Information

Question 1: One flaw, in plate material B5012-1, with a through wall extent of 0.43 inches, exceeds the "allowable number of flaws" criteria in SECY-07-0104. Confirm from previous inspections whether any increase in flaw size has been observed.

Response:

The detection of a flaw with a through-wall extent of 0.43 in. is attributed to the improvement of inspection technology, instead of an increase in flaw size. During the first 10-year reactor vessel inservice inspection (ISI) in 1992, examiners reported no flaw indications and recorded only geometric indications. During the second vessel ISI in 2001, examiners reported six indications on W12, the Middle to Lower Shell Circ. Weld, 1RPV-9-442. Changes in technology and methods between the two inspections include improvements in probe and calibration block designs, and the use of Performance Demonstration Initiative (PDI) qualified techniques.

Probes used for the first interval ISI were as follows:

- 45-degree shear wave, 1.0 MHz, two 1.2 by 0.75 in. elements for full volume primary detection
- 60-degree shear wave, 1.0 MHz, two 0.97 by 0.75 in. elements for full volume primary detection
- 70-degree longitudinal wave, 1.0 MHz, two transmitting elements: 0.75 by 0.37 in., one receiving element: 1.5 by 0.75 in. for near surface primary detection

Probes used for the second interval ISI were as follows:

- 45-degree shear wave, 1.0 MHz, one transmitting element: 1.2 by 0.75 in., one receiving element: 1.2 by 0.75 in. for full volume primary detection
- 45-degree longitudinal wave, 2.7 MHz, one transmitting element: 1.1 by 0.75 in., one receiving element: 1.1 by 0.75 in. for full volume primary detection
- 70-degree longitudinal wave, 1.3 MHz, two transmitting elements: 1.5 by 0.37 in., one receiving element: 1.5 by 0.75 in. for near surface primary detection.

The probes used for the second interval ISI reflected the optimization required to successfully demonstrate a PDI qualified procedure. Using the 45-degree longitudinal probe with a higher frequency and calibrating on smaller side drilled holes increased the sensitivity of the examination to identification of flaws. The longitudinal wave allowed the sound energy to better penetrate the cladding, increasing the ability to interrogate for flaws within the component. The increased size of the transmitting elements of the 70-degree longitudinal probe for the near surface region increases penetration and reduces beam spread, increasing the ability of the examination to detect a flaw.

The calibration blocks for the first interval ISI contained the following structures:

- Full volume calibration block #50377:
  - Clad thickness of 0.255 in.
  - Side drilled hole of 0.375 in. dia.
- Near surface calibration block #50304:
  - Clad thickness of 0.180 in.
  - Side drilled hole of 0.0625 in. dia.

The calibration blocks for the second interval ISI contained the following structures:

- Full volume calibration block #RPV-95001:
  - Clad thickness of 0.250 in.
  - Side drilled hole of 0.125 in. dia.
- Near surface block #RPV-95001
  - Clad thickness 0.250 in.
  - Side drilled hole of 0.0625 in. dia.

Calibration on the full volume block with the smaller diameter holes increased the sensitivity and detection capability for the inspection method used during the second interval examination. For the near surface blocks, calibrating on holes of the same diameter through a thicker cladding increased the sensitivity and detection capability for the second interval examination.

Finally, the largest flaw was measured as being 0.43 in. through wall. The calculated aspect ratio (a/t) of 2.4% was well below the acceptance limit of 7.6%. The analyst characterized the flaw to be sub-surface, meaning it is judged to be due to fabrication and not attributed to a service related degradation mechanism.

Question 2: The licensee proposed to defer the ASME Code required volumetric examination of the McGuire Unit 1 reactor pressure vessel full penetration pressure retaining Category B-A and B-D welds for the third in-service inspection interval until 2020. The methodology used to demonstrate the acceptability of extending the inspection intervals for Category B-A and B-D welds was based on the methodology used in WCAP-16168-NP-A, Revision 2, "Risk-Informed Extension of Reactor Vessel In-Service Inspection Interval." The submittal attachment, Relief Request (RR) 09-MN-003, included the nozzle-to-vessel welds and the nozzle inside radius section. Table 4.2-1, "Evaluation of Upper Shelf Energy for McGuire Unit 1 Beltline Region Materials at 54 Effective Full Power Years (EFPY)," of the Application to Renew the Operating Licenses of McGuire Nuclear Station Units 1 & 2 and Catawba Nuclear Station Units 1 and 2, Technical Information (ML0116601450), identified beltline nozzle materials which were not included in Table 3, "Details of TWCF Calculation - Performed for 60 Effective Full Power Years," of the RR. These materials are as follows: nozzle shell plate B5453-2, nozzle shell plate B5011-2, nozzle shell plate B5011-3, nozzle shell longitudinal weld seams 1-422A, B, C, and the nozzle shell to intermediate shell circumferential weld seam. Analysis of these beltline materials must be added to Table 3.

Response:

While the pilot plant analyses in WCAP-16168-NP-A, Revision 2, and in NUREG-1874 (References 4 and 5 of RR 09-MN-003), the technical basis for the alternate PTS Rule (10CFR50.61a), did not consider materials outside of those immediately adjacent to the reactor core, the nozzle shell course materials identified in question 2, along with their appropriate properties and fluence values, have conservatively been added to a revised Table 3 below.

Due to the low fluence that these materials are subjected to, their resulting shifts in reference temperature due to irradiation damage are not sufficient to cause them to have limiting RT_{MAX-XX} values. Since the TWCF calculation is affected solely by the limiting RT_{MAX-XX} values, the addition of these materials has no impact on the TWCF calculations for the McGuire Unit 1 reactor vessel.

There were two errors identified in Table 3 during the development of the response to question 2. The column headers for Chemistry Factor (C.F) and Regulatory Guide (R.G) 1.99 Position were interchanged. Also, Table 3 identified axial welds 3-442A, B, and C as intermediate shell welds when in fact these are lower shell welds. These errors have been corrected in the Table 3 below.

Table 3 Details of TWCF Calculation – Performed for 60 Effective Full Power Years (EFPY)

Inputs

Reactor Coolant System Temperature, T_{RCS}[°F]:	N/A	T_{wall} [inches]:	8.84

#	Region/Component Description	Material / Flux Type	Cu [wt%]	Ni [wt%]	R.G. 1.99 pos.	C.F. [°F]	Un-Irradiated RT_{NDT} [°F]	Fluence [10^{19} Neutron/cm^2, E > 1.0 MeV]
1	Int. Plate B5012-1	A 533B	0.110	0.610	2.1	62.5	34.0	3.80
2	Int. Plate B5012-2	A 533B	0.140	0.610	1.1	100.3	0.0	3.80
3	Int. Plate B-5012-3	A 533B	0.110	0.660	1.1	74.9	-13.0	3.80
4	Low. Plate B5013-1	A 533B	0.140	0.580	1.1	99.1	0.0	3.63
5	Low. Plate B5013-2	A 533B	0.100	0.510	1.1	65.0	30.0	3.63
6	Low. Plate 5013-3	A 533B	0.100	0.550	1.1	65.0	15.0	3.63
7	Int. Ax. Weld 2-442A	Linde 1092	0.199	0.846	2.1	156.5	-50.0	2.16
8	Int. Ax. Weld 2-442B	Linde 1092	0.199	0.846	2.1	156.5	-50.0	3.09
9	Int. Ax. Weld 2-442C	Linde 1092	0.199	0.846	2.1	156.5	-50.0	3.09
10	Low. Ax. Weld 3-442A	Linde 1092	0.213	0.867	2.1	194.4	-50.0	2.96
11	Low. Ax. Weld 3-442B	Linde 1092	0.213	0.867	2.1	194.4	-50.0	2.06
12	Low. Ax. Weld 3-442C	Linde 1092	0.213	0.867	2.1	194.4	-50.0	2.96
13	Int./Lower Circ. Weld 9-442	Linde 1091	0.051	0.096	1.1	37.5	-70.0	3.59
14	Noz. Shell Plate B5453-2	A 533B	0.14	0.58	1.1	99.1	15	0.113
15	Noz. Shell Plate B5011-2	A 533B	0.10	0.54	1.1	65.0	27	0.113
16	Noz. Shell Plate B5011-3	A 533B	0.13	0.56	1.1	89.8	0	0.113
17	Noz. Ax Weld 1-442A	N/A	0.199	.846	1.1	200.4	-50	0.092
18	Noz. Ax. Weld 1-442B	N/A	0.199	.846	1.1	200.4	-50	0.064
19	Noz. Ax. Weld 1-442C	N/A	0.199	.846	1.1	200.4	-50	0.092
20	Int./Noz. Circ Weld 8-442	Linde 1092	0.183	0.704	1.1	174.3	-56	0.113

Outputs

Methodology Used to Calculate ΔT_{30}:	Regulatory Guide 1.99, Revision 2

	Controlling Material Region # (From Above)	RT_{MAX-XX} [R]	Fluence [10^{19} Neutron/cm^2, E > 1.0 MeV]	FF (Fluence Factor)	ΔT_{30} [°F]	$TWCF_{95-XX}$
Axial Weld – AW	12	659.91	2.96	1.287	250.22	2.88E-09
Circumferential Weld - CW	2	593.32	3.59	1.332	133.63	5.52E-29
Plate – PL	2	594.59	3.80	1.345	134.90	1.23E-12
$TWCF_{95-TOTAL}$ ($\alpha_{AW}TWCF_{95-AW} + \alpha_{PL}TWCF_{95-PL} + \alpha_{CW}TWCF_{95-CW}$):						6.60E-09