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

Subject: Catawba Nuclear Station, Units 1 and 2
Docket Nos. 50-413 and 50-414
McGuire Nuclear Station, Units 1 and 2
Docket Nos. 50-369 and 50-370
NRC Bulletin No. 88-09
"Thimble Tube Thinning In Westinghouse Reactors"

By letters dated December 22, 1988, October 1, 1990, October 9, 1990, and December 6, 1990, Duke Power provided the NRC with the current schedule for inspecting the incore instrument guide thimbles at the McGuire and Catawba Nuclear Stations. The inspection schedule has been revised based on the methodology and criteria established in the Westinghouse Owner's Group Report titled "Bottom Mounted Instrumentation Flux Thimble Wear," dated January 1991. The results of this re-evaluation are given in the following table:

	Catawba 1	Catawba 2	McGuire 1	McGuire 2
Current Schedule	EOC-6	EOC-4	EOC-7	EOC-8
New Schedule	EOC-7	EOC-5	EOC-10	EOC-8

It should be noted that, based on the re-evaluation, the McGuire inspections could have been extended until the EOC-13 (Unit 1) and EOC-11 (Unit 2). However, Duke Power does not feel it is prudent to wait such an extended period of time between inspections due to scheduled upflow modifications and a change in the fuel vendor.

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Attached is the wear calculation for Catawba Unit 2 which is typical of the wear calculations performed for each of the four units.

Very truly yours,

M. S. Tuckman

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Attachment

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Catawba Unit 2 Incore Instrument Guide Thimble Wear Examination

The last eddy current test on Catawba unit 2 occurred at the end of cycle 3. The data was reviewed in four categories.

I. Wear on thimbles that previously had no wear.
II. Wear on thimbles that had wear and were not repositioned.
III. Wear at previous wear location on repositioned thimbles.
IV. Wear at new wear location on repositioned thimbles.

These categories were reviewed and the most limiting of each was determined. In addition, if the most limiting case was capped, the second most limiting case for that category was determined. These cases were reviewed against the new criteria set forth in the Westinghouse Owner's Group (WOG) report "Bottom Mounted Instrumentation Flux Thimble Wear." These criteria are outlined below.

1) <u>Measurement Uncertainty</u>

Hot cell examinations of worn thimble segments show that eddy current identifies the scar as deep or deeper than it actually is. Therefore, it is not necessary to add any uncertainty to the eddy current indication. Uncertainty was not add to the previous analysis. The WOG report confirms this assumption.

2) <u>Thimble Wall Loss</u>

The report determined that a thimble can safely remain in service with up to 80% wall loss. This is significantly greater than the 60% wall loss criteria currently implemented.

3) <u>Thimble Wear Progression</u>

Flux thimble wall loss (wear depth) versus operating time follows an exponentially decreasing curve. Currently a linear model is used to predict wall loss. The equation for the exponentially decreasing curve is shown below.

$$W_a = W_d \left(\frac{N_a}{N_d}\right)^{0.67}$$

where: N_a = Accumulated time at which wear depth is to be calculated
N_d = Operating time accumulated before inspection
W_a = Percent Wear Depth at time N_a
W_d = Percent Wear Depth at the time of the inspection

3) Thimble Wear Progression (Cont.)

Using this exponential equation for wear and substituting the 80% maximum wear criteria for W_a, the maximum number of mode 4 days the unit can operate before the 80% through wall criteria is meet can be determined

$$N_a = N_d \left(\frac{80\%}{W_d}\right)^{\frac{1}{0.67}}$$

Category I

The most limiting case for category I was location N06 which had 38% through wear in one cycle (378 mode 4 or better days). This location was capped at the end of cycle 3. The second most limiting case for category I was location L10 which had 19% through wear in one cycle. Using the new criteria with the data at location L10 gives the following:

$$N_a = 378 \left(\frac{80\%}{19\%}\right)^{\frac{1}{0.67}}$$

$\therefore N_a = 3231$ days at mode 4 or better

The number of mode 4 or better days of operation before the next inspection is required is

$$N_i = N_a - N_d$$

3231 - 378 = 2853 days at mode 4 or better

Category II

The most limiting case for category II was location N04 which had 27% through wall wear at EOC 2 and 33% through wall wear at EOC 3 in the same location. Using the new criteria on location L10 gives the following:

$$N_a = 1285 \left(\frac{80\%}{33\%}\right)^{\frac{1}{0.67}}$$

$\therefore N_a = 4818$ days at mode 4 or better

The number of mode 4 or better days of operation before the next inspection is

$$N_i = N_a - N_d$$

4818 - 1285 = 3533 days at mode 4 or better

Category III

The most limiting case for category III is location G05 which had 48% through wall wear at EOC 2 and 50% through wall wear at EOC 3 (1285 mode 4 or higher days) in the same location. Using the new criteria on location G05 gives the following:

$$N_a = 1285 \left(\frac{80\%}{50\%}\right)^{\frac{1}{0.67}}$$

$$\therefore N_a = 2591 \text{ days at mode 4 or better}$$

The number of mode 4 or better days of operation before the next inspection is

$$N_i = N_a - N_d$$

$$2591 - 1285 = 1306 \text{ days at mode 4 or better}$$

Category IV

The most limiting case for category IV was location J01 which had 37% through wear at EOC 2 and 40% through wear at EOC 3 in a new location. This location was capped at the end of cycle 3. The second most limiting case for category IV was location L05 which had 43% through wear at EOC 2 and 21% through wear at EOC 3 (378 mode 4 or higher days) in a new location. Using the new criteria with the data at location L10 gives the following:

$$N_a = 378 \left(\frac{80\%}{21\%}\right)^{\frac{1}{0.67}}$$

$$\therefore N_a = 2783 \text{ days at mode 4 or better}$$

The number of mode 4 or better days of operation before the next inspection is

$$N_i = N_a - N_d$$

$$2783 - 378 = 2405 \text{ days at mode 4 or better}$$

From these analyses it can seen that the wear at location G05 is the most limiting. Therefore, after 1306 mode 4 or higher days of operation Catawba 2 should be inspected. Using future estimates of Catawba 2 cycle lengths, the inspection time can be determined.

Future Catawba 2 Cycle Estimates

Cycle	EFPD Including ±10 window	Mode 4 Cycle Length (EFPD x 1.24*)	Accumulative Mode 4 Days
4	360	446	446
5	385	477	923
6	385	477	1400
7	385	477	1877

Since the most limiting thimble G05 is estimated to reach the 80% through wall criteria in 1306 mode 4 or higher days, Catawba 2 can operate to EOC 5 before needing inspection.

* Cycle 2 had 384 mode 4 or higher days with a cycle length of 287 EFPD, and Cycle 3 had 378 mode 4 or higher days with a cycle length of 331 EFPD. 1.24 is the average ratio of mode 4 to EFPD for these two cycles.

Evaluation of Previously Capped Thimbles

Currently five (5) thimbles are capped at Catawba Unit 2; L11, L15, N14, J01, and N06. Of these L11, L15, and N14 were bent and must remain capped. J01 and N06 were capped at EOC 3 as a result of the analysis performed using the "old" criteria. Applying the new criteria to J01 yields the following result.

$$N_a = 378\left(\frac{80\%}{40\%}\right)^{\frac{1}{0.67}}$$

$$\therefore N_a = 1064 \text{ days at mode 4 or better}$$

The number of mode 4 or better days of operation before the next inspection is

$$N_i = N_a - N_d$$

$$1064 - 378 = 686 \text{ days at mode 4 or better}$$

Applying the new criteria to N06 yields the following result.

$$N_a = 378\left(\frac{80\%}{38\%}\right)^{\frac{1}{0.67}}$$

$$\therefore N_a = 1148 \text{ days at mode 4 or better}$$

The number of mode 4 or better days of operation before the next inspection is

$$N_i = N_a - N_d$$

$$1148 - 378 = 770 \text{ days at mode 4 or better}$$

Therefore, since J01 would reach the 80% through wall limit in 686 mode 4 or higher days, and since N06 would reach the 80% through wall limit in 770 mode 4 or higher days, these thimbles will not be uncapped. These thimbles would reach the 80% through wall wear limit before the EOC 5 (estimated at 923 mode 4 or higher days).