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

Subject: Catawba Nuclear Station, Unit 2
Docket No. 50-414
NRC Bulletin No. 88-09
Incore Instrument Guide Thimble Wear Examination

Gentlemen:

As requested by your staff, attached is my report on the incore instrument thimble wear examination conducted on Catawba Nuclear Station, Unit 2 at the end of Cycle 3.

Very truly yours,

Hal B. Tucker

CRL/1/lcs

Attachment

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CATAWBA NUCLEAR STATION, UNIT 2

END OF CYCLE 3 INCORE GUIDE THIMBLE EXAMINATION

The incore instrument thimbles of Catawba Unit 2 were examined for indications of wear during the period of June 10-19, 1990. Twenty-six (26) of the fifty-eight (58) thimbles showed measurable wear, with ten thimbles having measurable wear at more than one location. The maximum wall loss was 50%, measured at location G-05. The amount and distribution of thimble wear observed from this test is consistent with expectations derived from previous information. A map of the Catawba 2 core showing the thimble locations and the amount of wear observed at each location is attached. Two thimbles (N06 and J01) were capped prior to Cycle 4 startup due to the examination results.

The test method utilized for the Catawba 2 inspections involved a 3-D probe driver, a digital encoder (for probe positioning), and an EB-188-FTTA eddy current probe with data gathering and reduction performed on a MIZ-18 system. All testing was performed by Echoram (a Westinghouse subsidiary). Westinghouse has stated that the 10% uncertainty is on the conservative side. System calibrations were performed every 4 hours using a standard tube containing machined, tapered defects of 10%, 20%, 41%, 61%, and 80% maximum wall loss. The standard defects are each less than 1 inch in axial length, and 90° in circumferential extent. These methods are very similar to those used previously at both McGuire Units and Catawba Units with good success. Distances of the wear locations from the top of the thimbles are more accurate this cycle due to improvements in Westinghouse's equipment.

A 60% allowable wall loss was determined by a finite element analysis of the Catawba 2 incore thimbles. The scar model used in the finite element analysis was a flat bottom scar of 90° circumferential extent and 1.5 inches axial length, which should provide conservative stress intensities relative to the actual wear scar. The peak stress intensity calculated at 60% through wall wear and a system pressure of 2500 psi was 19.87 ksi, as compared to an allowable intensity of 25.7 ksi from the ASME Boiler and Pressure Vessel Code. A linear wear rate model is currently considered by Westinghouse to be conservative with respect to the actual wear rate at high wear values.

Ten thimbles were repositioned prior to Cycle 3 startup as a result of the EOC-2 examinations. The thimbles that were repositioned are at core locations D-12, D-10, G-09, B-08, J-08, M-07, J-01, G-05, L-05, and K-06.

The only increases in the old wear scars are listed below:

Thimble	EOC-3 Data	EOC 2 Data	Wear Rate (WR) (%/day)	# of Days Before Reaching 60%
J08	41%	35%	.01587	1197 days
G09	47%	43%	.01058	1228 days
G05	50%	48%	.00529	1890 days

Cycle 3 length was 378 days with RCP's operating.

The allowable operating time until the 60% through wall limit is reached is given by:

Allowable Operating Time (days) = [60% - #%]/WR

The wear rate is calculated by:

WR (%/day) = #% / # of days over which the wear took place

where:

#% = percent through wall wear observed

It should be noted that the 10% uncertainty factor is no longer added because Westinghouse believes this linear wear rate model is conservative in itself.

There is no problem with continuing operation due to the old wear scar data. The new wear marks which occurred due to the repositioning range from No Detectable Degradation (NDD) to 40% at location J01. The second highest wear is only 21%. To be conservative, J01 was capped prior to start-up of Cycle 4. Four of these thimbles had new wear locations which were not in the general area of the old wear marks. These new wear marks ranged from 10%-26% throughwall. For conservatism, all degradation was assumed to have occurred during Cycle 3 (378 days). The most limiting wear scar was 26% at M07. The wear rate is therefore .06878%/day. This wear should not reach 60% until after 494 days. This would easily allow for another cycle of operation since Cycle 4 is designed for approximately 350 effective full power days of operation (or approx. 411 days at or above mode 4).

The through wall wear for the other 16 thimbles ranged from 9%-38%. The cutoff point for selecting thimbles to be capped or repositioned was determined to be 45% measured through wall wear. Even though there were no thimbles in this category with 45% through wall wear, thimble N-06 showed a wear of 38% after having No Detectable Degradation (NDD) at the EOC-2. This thimble was capped for conservatism. The next most limiting thimble (located at N04) had 33% through wall wear. The wear rate for this thimble is 0.0257%/day yieding an allowable operating time of 1050 days. This wear rate was calculated based on total wear and 1285 days of operation at or above mode 4 since the installation of the thimbles. The tentative plan is to reinspect the thimbles at the end of Cycle 4 to determine any further action. This schedule may change based on the release of the Westinghouse Owner's Group Report which is expected to be out by December 31, 1990.

The thimble at C-07 was capped at the end of Cycle 2 as a precautionary measure, as the probe did not insert far enough during the test to fully inspect the thimble. The thimble at location C-07 was uncapped and tested during this examination. No detectable degradation was found so this thimble was left uncapped for Cycle 4 operation.

CATAWBA UNIT 2, EOC 3
INCORE FLUX THIMBLE EDDY CURRENT RESULTS

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
						218" 40%			NDD						1
		NDD			NDD		226" 9%								2
							238" 11%		232" 11%		NDD		NDD		3
	NDD	228" 33%					NDD								4
				251" 43%				232" 50%		NDD		198" 30%			5
221" 22%		156" 38%			235" 38%		138" 27%						181" 19%		6
			248" 29%			NDD			NDD			NDD			7
NDD		254" 11%		NDD		166" 41%			149" 23%		NDD	NDD	157" 38%		8
	NDD							242" 47%		NDD				153" 30%	9
				275" 19%		NDD					150" 37%				10
NDD				NDD			NDD			NDD				NDD	11
					NDD			NDD			216" 16%				12
		201" 25%		NDD			NDD						NDD		13
		233" 23%				NDD			NDD		NDD				14
				155" 25%			NDD								15

XXX - Distance from top of thimble
YYY - Throughwall wear (NDD indicates No Detectable Degradation)

NOTE: Thimbles with more than one defect are listed on the next page.

The following thimbles had more than one defect:

Thimble	Wear	Location
J08	13%	164"
	31%	168"
	17%	206"
	21%	211"
G09	10%	42"
	29%	157"
K06	10%	199"
	27%	203"
	20%	233"
G05	19%	230"
*L10	12%	132"
M07	26%	159"
	14%	247"
L05	21%	249"
B08	17%	196"
J01	37%	221"
*A09	27%	216"

*These thimbles were not repositioned at the EOC-2.