POST REFUELING PHYSICS TESTING
DAVIS-BESSE UNIT 1, CYCLE 2
POWER ESCALATION TESTING

The final sequence of power escalation testing was performed at the 100% power plateau at equilibrium conditions. This testing was performed to identify possible anomalies in the power distribution and to verify the acceptability of certain nuclear and thermal hydraulic parameters at full power.

The tests performed at this level were:

Core Power Distribution, PT 5175.02
Temperature Reactivity Coefficient, ST 5010.02
Power Doppler Reactivity Coefficient, PT 5175.03

This report is a supplement to the Post Refueling Physics Testing report submitted earlier, covering testing up to the 75% power level.

Core Power Distribution

Core equilibrium Xenon was established for this test. Core Power Distribution data, provided by the incore detector system, was used to evaluate core parameters and compare them with B&W predictions and design limits. The Worst Case Maximum Linear Heat Rate (MLHR), minimum DNBR and Quadrant Power Tilt were verified to be within design limits, and the nuclear enthalpy rise hot channel factor ($F^N_{\Delta H}$) and nuclear heat flux hot channel factor (F_Q) were also shown to be acceptable.

The measured values of total power peak and radial power peak were compared with the design predictions from the Physics Test Manual, and it was again found that the radial peak fell outside of its acceptance margin. The more important total power peak, however, was well within its acceptable range. The radial peak exceeded its predicted value by 5.23%, outside of the $\pm$5.0% limit, and the total power peak was 1.43% below the predicted value, within the accepted $\pm$7.5% deviation.

The B&W analysis of the radial peaking discrepancy showed that due to a wide margin of conservatism in the radial peaking uncertainties, the safety and operating limits would still remain valid. Further analysis by B&W, using more advanced software, showed that the radial peak was within the acceptance criteria. The reason for this is that the newer software eliminated the effects of the widely varying background signals of the incore detectors.

Moderator Temperature Coefficient Measurement

This test determined the Moderator Coefficient of reactivity (α_{MT}) for comparison with Technical Specification 3.1.1.3. The RCS conditions at the time of the test were 582°F, 2155 psig, CRG-7 at 91.9% W.D., CRG-8 at 22% W.D., and Reactor Power at 97.6% F.P.

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The test was performed by initiating RCS temperature ramps of $-3^{\circ}F$, $+8^{\circ}F$ and $-5^{\circ}F$, and measuring the reactivity changes associated with the temperature changes. The reactivity change measured was the control rod worth from the associated withdrawal or insertion due to the temperature change. Differential rod worth measurements were made both before and after the temperature changes to give accurate values for the differential rod worth. The temperature coefficient of reactivity, defined as $\alpha T = \Delta\rho/\Delta T_{ave}$, was figured for each temperature change. A weighted average of these three was calculated, giving an overall temperature coefficient of reactivity of -8.8×10^{-5} $\Delta K/K/^{\circ}F$, which met the acceptance criteria of being a negative value.

Since the Moderator Coefficient is defined as: Moderator Coeff = Temperature Coefficient - Doppler Coefficient, the Doppler Coefficient of reactivity, taken from the Physics Test Manual, was then subtracted from the calculated overall Temperature Coefficient of reactivity. This value, -0.7×10^{-4} $\Delta K/K/^{\circ}F$, the Moderator Coefficient of reactivity, was then compared to Technical Specifications and it was found that it met the acceptance criteria, being less negative than -3.0×10^{-4} $\Delta K/K/^{\circ}F$.

Doppler Coefficient of Reactivity

This test was performed for comparison with the B&W value given to ensure it met their acceptance criteria.

The method of determining the Power Doppler Coefficient involved changing the reactor power by 5% while maintaining a constant RCS T_{ave}. The resultant reactivity change, which was the control rod worth due to the associated rod motion, was measured using a strip chart recorder and a reactimeter. Again, differential rod worth measurements were made before and after the power changes to ensure accurate values for the differential rod worth. Corrections for possible changes in moderator temperature and Xenon reactivity were included, and the Power Doppler Coefficient was then determined by dividing the reactivity change by the change in reactor power level.

Two values for the Power Doppler Coefficient were obtained during the test; a value for when power was decreasing, and the other from when power was increasing.

The Power Doppler Coefficient from power decreasing was found to be -1.009×10^{-4} $\Delta K/K/\%$ Full Power, and the value for power increasing was found to be -0.807×10^{-4} $\Delta K/K/\%$ Full Power.

Both these values met the B&W acceptance criteria of being more negative than -0.55×10^{-4} $\Delta K/K/\%$ F.P.

This concluded the power escalation part of the Post Refueling Physics Testing Program for Cycle 2, with no notable disrepancies discovered. Since all parameters measured compared favorably to the predicted values and acceptance criteria, it was determined that Cycle 2 Technical Specifications and safety limits would remain valid.

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POST REFUELING PHYSICS TESTING

CORE POWER DISTRIBUTION - 100% F.P.

Parameter		Measured Value	Acceptance Criteria
Minimum DNBR		4.32	1.30
Quadrant Power Tilt		1.195	3.21
Worst Case Linear Heat Rate		12.3023	20.17
Maximum Linear Heat Rate	Level		
	1	8.97 KW/Ft.	16.2
	2	11.34	16.7
	3	11.96	17.3
	4	11.92	18.4
	5	11.26	17.6
	6	10.75	17.2
	7	8.49	16.8

Power Peaking

	Predicted	Measured	Acceptance	Deviation*
Total Peak	1.493	1.472	±7.5%	-1.43%
Radial Peak	1.213	1.28	±5.0%	5.23%

$$*\text{Deviation} = \frac{\text{measured-predicted}}{\text{measured}} \times 100$$

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