

BALTIMORE GAS AND ELECTRIC COMPANY

CALVERT CLIFFS NUCLEAR POWER PLANT

UNIT 2

Docket No. 50-318

License No. DPR-69

SUMMARY OF STARTUP TESTING

FOR CYCLE FIVE

SUMMARY OF STARTUP TESTING  
FOR  
CALVERT CLIFFS UNIT TWO CYCLE FIVE

I. The following tests were conducted for the Startup at Calvert Cliffs Unit Two for Cycle Five. All tests were conducted in a manner similar to Initial Startup (Reference 1).

- A. CEDM/CEA Performance Test
- B. RCS Flow Verification
- C. Initial Criticality
- D. CEA Symmetry Check
- E. Critical Boron Concentration Measurements
- F. Isothermal Temperature and Power Coefficient Measurements
- G. Group Rod Worth Measurements
- H. Power Distribution Measurements

II. The results of these tests and comparison with predictions are as follows:

- A. The proper functioning of the CEDMs and CEA position indication was verified through insertion and withdrawal of CEAs. All CEAs reached a 90% insertion in less than 3.1 seconds at hot, full flow conditions. The slowest CEA (57) reached 90% insertion in 2.56 seconds. Due to a faulty reed switch stack on CEA 44, only the 100% insertion time was measured. A time of 2.58 seconds was measured for 100% insertion which is less than required for 90% insertion.

- B. Reactor Coolant Flow was verified to be consistent with previous testing.
- C. Initial criticality was achieved at 1415 ppm Boron with CEA Group 5 at 70" withdrawn. Predicted value was 1373 ppm Boron.
- D. The CEA Symmetry Check verified that all CEAs were attached to their extension shafts. An evaluation of the quantitative reactivity change for dual CEAs yielded an azimuthal tilt estimate of less than 8%. Acceptance limit is less than 10%.
- E. Critical Boron Measurements - Table 1.
- F. Isothermal Temperature and Power Coefficients - Table 2.
- G. CEA Group Worth Measurements - Table 3.
- H. Power Distribution Measurements - Table 4, Figure 1 and 2.

III. All tests were within acceptance limits.

TABLE 1

CRITICAL BORON MEASUREMENTS

	<u>Measured</u>	<u>Predicted</u>
All Rods Out, 532°F	1437 ppm	1395.4 $\pm$ 100 ppm
CEA Group's Inserted 5,4,3,2,1	1162 ppm	1115.5 $\pm$ 100 ppm

TABLE 2

ISOTHERMAL TEMPERATURE COEFFICIENTS AND POWER COEFFICIENTS

	<u>Measured</u>	<u>ITC</u> <u>Predicted</u>
Zero Power, CEA Group 5 at 102" Withdrawn	+0.196 x 10 <sup>-4</sup> delta Rho/°F	+0.232 $\pm$ 0.3 x 10 <sup>-4</sup> delta Rho/°F
50% Power, CEA Group 5 at 102" Withdrawn	-0.030 x 10 <sup>-4</sup> delta Rho/°F	-0.041 $\pm$ 0.3 x 10 <sup>-4</sup> delta Rho/°F
100% Power, CEA 5 Group at 102" Withdrawn	-0.388 x 10 <sup>-4</sup> delta Rho/°F	-0.335 $\pm$ 0.3 x 10 <sup>-4</sup> delta Rho/°F

POWER COEFFICIENT

50% Power, CEA Group 5 at 102" Withdrawn	-1.20 x 10 <sup>-4</sup> delta Rho/% Power	-1.18 $\pm$ 0.3 x 10 <sup>-4</sup> delta Rho/% Power
100% Power, CEA Group 5 at 102" Withdrawn	-1.07 x 10 <sup>-4</sup> delta Rho/% Power	-1.07 $\pm$ 0.3 x 10 <sup>-4</sup> delta Rho/% Power

TABLE 3

CEA GROUP WORTH MEASUREMENTS

	<u>Measured</u> <u>(% delta Rho)</u>	<u>Predicted</u> <u>(% delta Rho)</u>
Group 5	0.433	$0.448 \pm 0.067$
Group 4	0.149	$0.169 \pm 0.025$
Group 3	0.695	$0.752 \pm 0.113$
Group 2	0.533	$0.554 \pm 0.083$
Group 1	<u>0.809</u>	<u><math>0.902 \pm 0.135</math></u>
TOTAL	2.619	$2.825 \pm 0.283$

TABLE 4

POWER DISTRIBUTION MEASUREMENTS

	<u>50% Power</u>		<u>100% Power</u>	
	<u>Measured</u>	<u>Acceptance</u> <u>Limits</u>	<u>Measured</u>	<u>Acceptance</u> <u>Limits</u>
$F_{xy}^T$	1.685	<1.785	1.6184	<1.700
$F_r^T$	1.5875	<1.720	1.5395	<1.650
$T_q$	0.0220	<0.030	0.0189	<0.030

UNIT II, CYCLE 5

Measured @ 47.6% Power, Equilibrium Xenon, Bank 5 at 105.0" Withdrawn, 43 MWD/T

Measured Predicted % Diff.			1 0.7890 0.7816 +0.95		2 0.8526 0.9560 -10.82		X						
% Diff. = $\frac{\text{Measured} - \text{Predicted}}{\text{Predicted}} \times 100$	3 0.7949 0.7993 -0.55		4 1.0695 1.1103 -3.67		5 1.2239 1.2596 -2.83		6 0.8613 0.8848 -2.66	7 0.8057 0.8279 -2.68	Y				
	8 0.8514 0.8548 -0.40		9 1.0766 1.0668 +0.92		10 0.9466 0.9666 -2.07		11 0.9431 0.9599 -1.75	12 0.9956 1.0369 -3.98	13 0.7374 0.7598 -2.95	W			
	14 0.8514 0.8546 -0.37		15 1.1179 1.1205 -0.23		16 0.9933 0.9790 +1.46		17 1.2666 1.2555 +0.88	18 0.9901 0.9793 +1.10	19 1.2148 1.2512 -2.91	20 0.9114 0.9325 -2.26	V		
	21 0.7949 0.7989 -0.50		22 1.0766 1.0665 +0.95		23 0.9933 0.9788 +1.48		24 1.0225 0.9782 +4.53	25 1.0470 1.0131 +3.35	26 1.2048 1.1662 +3.31	27 0.9551 0.9800 -2.54	28 1.0926 1.0881 +0.41	T	
	29 1.0695 1.1094 -3.60		30 0.9466 0.9660 -2.01		31 1.2666 1.2561 +0.84		32 1.0470 1.0184 +2.81	33 1.2653 1.1911 +6.23	34 1.0238 0.9784 +4.64	35 1.2028 1.1962 +0.55	36 0.8692 0.8610 +0.95	S	
P  M	37 1.2239 1.2581 -2.72		38 0.9431 0.9591 -1.67		39 0.9901 0.9775 +1.29		40 1.2048 1.1652 +3.40	41 1.0238 0.9819 +4.27	42 1.1000 1.0428 +5.49	43 0.8696 0.8575 +1.41	44 0.7967 0.7711 +3.32	R	
	45 0.7890 0.7796 +1.21		46 0.8613 0.8830 -2.46		47 0.9956 1.0360 -3.90		48 1.2148 1.2461 -2.51	49 0.9551 0.9733 -1.87	50 1.2028 1.1923 +0.88	51 0.8696 0.8594 +1.19	52 0.9196 0.8626 +6.61	53 1.0853 0.9906 +9.56	N
	54 0.8526 0.9523 -10.47		55 0.8057 0.8279 -2.68		56 0.7374 0.7598 -2.95		57 0.9114 0.9325 -2.26	58 1.0926 1.0881 +0.41	59 0.8692 0.8610 +0.95	60 0.7967 0.7711 +3.32	61 1.0853 0.9906 +9.56	62 0.8016 0.7503 +6.84	L

UNIT II, CYCLE 5

Measured @ 97% Power, Equilibrium Xenon, Bank 5 at 105.0" Withdrawn, 187 MWD/T

1	2
0.7562	0.8277
0.7455	0.9109
+1.44	-9.13

$$\% \text{ Diff.} = \frac{\text{Measured} - \text{Predicted}}{\text{Predicted}} \times 100$$

## REFERENCES

1. Calvert Cliffs Nuclear Power Plant Unit 2, Startup Test Report, May 12, 1977.