BALTIMORE
GAS AND
ELECTRIC

CHARLES CENTER • P.O. BOX 1475 • BALTIMORE, MARYLAND 21203

ARTHUR E. LUNDVALL, JR.
VICE PRESIDENT
SUPPLY

November 1, 1982

Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

ATTENTION: Mr. R. A. Clark, Chief
Operating Reactors Branch #3
Division of Licensing

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 1, Docket No. 50-317
Report of Startup Testing for Cycle Six

Gentlemen:

Startup Testing for Calvert Cliffs Unit 1, Cycle 6 was completed on July 17, 1982. A summary of the results of those tests was submitted October 15, 1982 under a cover letter which incorrectly referenced Unit 2, Docket No. 50-318.

This letter supersedes and replaces the cover letter dated October 15, 1982.

Very truly yours,

BALTIMORE GAS AND ELECTRIC COMPANY

A. E. Lundvall
Vice President, Supply

AEL:MEB:fld

Enclosure

cc: J. A. Biddison, Esquire
G. F. Trowbridge, Esquire
D. H. Jaffe, NRC
P. W. Kruse, CE
R. E. Architzel, NRC/CC

A001

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October 15, 1982

Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

ATTENTION: Mr. R. A. Clark, Chief
Operating Reactors Branch #3
Division of Licensing

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 2, Docket No. 50-318
Report of Startup Testing for Cycle Six

Gentlemen:

Startup Testing for Calvert Cliffs Unit 2, Cycle 6 was completed on July 17,1982. A summary of the results of those tests is enclosed.

Very truly yours,

BALTIMORE GAS AND ELECTRIC COMPANY

A. E. Lundvall, Jr.
Vice President - Supply

AEL:MEB:fld

Enclosure (40 copies)

cc: J. A. Biddison, Esquire
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BALTIMORE GAS AND ELECTRIC COMPANY

CALVERT CLIFFS NUCLEAR POWER PLANT

UNIT 1

Docket No. 317

License No. DPR-53

SUMMARY OF STARTUP TESTING FOR SIXTH CYCLE

SUMMARY OF STARTUP TESTING FOR CALVERT CLIFFS UNIT ONE CYCLE SIX

I. The following tests were conducted for the Startup of Calvert Cliffs Unit One for Cycle Six. 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 Coefficient Measurements
G. Group Rod Worth Measurements
H. Power Coefficient Measurements
I. Power Distribution Measurements

II. The results of these tests and compar[illegible] predictions are as follows:

A. The proper functioning of the CEDM's and CEA position indication was verifed through insertion and withdrawal of CEA's. All CEA's reached a 90% insertion in less than 3.1 seconds at hot, full-flow conditions. The slowest CEA (59) reached 90% insertion in 2.94 seconds.
B. Reactor Coolant System flow was verified to be consistent with previous testing.
C. Initial Criticality was achieved at 1316 ppm Boron with CEA Group-5 at 45.0" withdrawn. Predicted value was 1329 ppm.
D. The CEA Symmetry Check verified that all CEA's were attached to their extension shafts. An evaluation of the quantitative reactivity change for dual CEA's yielded an azimuthal tilt estimate of $< 6\%$. Acceptance Limit was $\leq 10\%$.
E. Critical Boron Measurements - Table 1.
F. Isothermal Temperature Coefficients - Table 2.
G. CEA Group Worth Measurements - Table 3.
H. Power Coefficient Measurements - Table 2.
I. Power Distribution Measurements - Table 4.

III. All test results were within acceptance limits except for the Power Coefficient Measurement at 50% power. This measurement was repeated at 85% power with similar but slightly improved results and the full power measurement satisfied the acceptance criteria. Other measurements failed to confirm the existence of fuel temperatures which are sufficient to account for the disparity. Both BG&E and CE have carefully reviewed the test results and the differences between measurement and prediction are felt to be due to the measurement technique which cycles the center CEA in the highly depleted center fuel assembly. Alternate measurement techniques are being evaluated to improve the measurement.

The disparity in agreement between predicted and measured Power Coefficient does not obviate the validity of the safety analysis.

TABLE 1

CRITICAL BORON MEASUREMENTS

	Measured	Predicted
All Rods Out, 532°F	1334 ppm	1347 ± 100 ppm
CEA Group 5, 4, 3, 2, 1	1078 ppm	1075 ± 100 ppm

TABLE 2

ISOTHERMAL TEMPERATURE COEFFICIENTS AND POWER COEFFICIENTS

ITC

	Measured	Predicted
Zero Power, CEA Group 5 at 102" Withdrawn	$+ .132 \times 10^{-4}$ $\Delta\rho/^{\circ}F$	$+ .113 \pm .3 \times 10^{-4} \Delta\rho/^{\circ}F$
50% Power, CEA Group 5 at 102" Withdrawn	$-.189 \times 10^{-4}$ $\Delta\rho/^{\circ}F$	$-.148 \pm .3 \times 10^{-4} \Delta\rho/^{\circ}F$
85% Power, CEA Group 5 at 102" Withdrawn	$-.479 \times 10^{4}$ $\Delta\rho/^{\circ}F$	$-.349 \pm .3 \times 10^{-4} \Delta\rho/^{\circ}F$
100% Power, CEA Group 5 at 102" Withdrawn	$-.577 \times 10^{-4} \Delta\rho/^{\circ}F$	$-.451 \pm .3 \times 10^{-4} \Delta\rho/^{\circ}F$

POWER COEFFICIENT

50% Power, CEA Group 5 at 102" Withdrawn	-1.331×10^{-4} $\Delta\rho$/% power	$-1.006 \pm .3 \times 10^{-4}$ $\Delta\rho$/% power
85% Power, CEA Group 5 at 102" Withdrawn	-1.212×10^{-4} $\Delta\rho$/% power	$-.907 \pm .3 \times 10^{-4} \Delta\rho$/% power
100% Power, CEA Group 5 at 102" Withdrawn	$-1.147 \times 10^{-4} \Delta\rho$/% power	$-.875 \pm .3 \times 10^{-4} \Delta\rho$/% power

TABLE 3

CEA GROUP WORTH MEASUREMENTS

	Measured (%)	Predicted (%)
Group 5.	.440	.452 ± .068
Group 4	.170	.181 ± .027
Group 3	.678	.700 ± .105
Group 2	.492	.491 ± .074
Group 1	.836	.889 ± .133
TOTAL	2.616	2.713 ± .271

TABLE 4

POWER DISTRIBUTION MEASUREMENTS

	Measured		Acceptance Limits	
	50%	100%	50%	100%
F_{xy}^T	1.680	1.596	≤1.73	≤1.65
F_r^T	1.594	1.516	≤1.73	≤1.65
T_q	.0130	.0116	≤.030	≤.030
Radial Box Power Distributions	See Figure 1	See Figure 2	Measurement varies from prediction by less than ±10% (± 15% for fuel assemblies on core periphery).	

FIGURE 1

Calvert Cliffs Unit 1, Cycle 6, 50% Power
Comparison of Measured Versus Predicted
Radial Box Power Distribution

Measured @ 50.5, 34.5 MWD/T, Bank 5 at 103.5"

Predicted @ 50%, 40 MWD/T, Bank 5 at 102"

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

			1 .7843 .7770 -.931%	2 1.0764 1.0399 -3.391%			
		3 .8563 .8496 -.782%	4 1.1359 1.0986 -3.284%	5 1.1286 1.0921 -3.234%	6 .8548 .8849 3.521%	7 1.1316 1.0963 -3.119%	
	8 .8701 .8374 -3.758%	9 1.1202 1.1195 -.062%	10 .9806 .9635 -1.744%	11 1.2229 1.2142 -.711%	12 1.0249 1.0088 -1.571%	13 .9530 .9501 -.304%	
14 .8720 .8374 -3.968%	15 1.0836 1.0642 -1.790%	16 .8202 .8502 3.658%	17 1.2224 1.2388 1.342%	18 .8774 .8711 -.718%	19 1.2171 1.2150 -.173%	20 .8231 .8330 +1.203%	
21 .8595 .8496 -1.152%	22 1.1245 1.1195 -.445%	23 .8258 .8502 2.955%	24 .9375 .9514 1.483%	25 .8769 .9360 6.740%	26 1.1749 1.1992 2.063%	27 .8644 .8857 2.464%	28 1.0396 1.0822 4.098%
29 1.1404 1.0986 -3.665%	30 .9853 .9635 -2.213%	31 1.2317 1.2388 .576%	32 .9004 .9360 3.954%	33 1.1564 1.1790 1.954%	34 1.0417 1.0044 -3.581%	35 .9352 .9698 3.700%	36 .9008 .9342 3.708%
37 1.1327 1.0921 -3.584%	38 1.2291 1.2142 -1.212%	39 .8824 .8711 -1.281%	40 1.1780 1.1992 1.800%	41 1.0354 1.0044 -2.994%	42 1.1395 1.1382 -.114%	43 .9377 .9382 .053%	44 .8796 .9115 3.627%
45 .7852 .7770 -1.044%	46 .8571 .8849 3.243%	47 1.0304 1.0088 -2.096%	48 1.2225 1.2150 -.613%	49 .8684 .8857 1.992%	50 .9343 .9698 3.800%	51 .9342 .9382 .428%	52 1.1163 1.1320 1.406%	53 .8386 .8824 5.223%
54 1.0757 1.0399 -3.328%	55 1.1269 1.0963 -2.715%	56 .9688 .9501 -1.930%	57 .8202 .8330 1.561%	58 1.0571 1.0822 2.374%	59 .9040 .9342 3.341%	60 .8813 .9115 3.427%	61 .8390 .8824 5.173%	62 .5497 .5677 3.275%

FIGURE 2

Calvert Cliffs Unit 1, Cycle 6, 100% Power
Comparison of Measured Versus Predicted
Radial Box Power Distribution

Measured @ 96.6%, 260.6 MWD/T, Bank 5 at 105.0"

Predicted @ 100%, 250 MWD/T, Banks at 102.0"

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

						1 .7434 .7366 -0.915%	2 1.0107 0.9766 -3.374%
			3 .8067 .7948 -1.475%	4 1.0709 1.0467 -2.260%	5 1.0776 1.0466 -2.877%	6 .8328 .8538 +2.522%	7 1.0927 1.0619 -2.819%
		8 .8264 .8013 -3.037%	9 1.0703 1.0753 +0.467%	10 .9528 .9307 -2.319%	11 1.1926 1.1889 -0.310%	12 1.0207 1.0030 -1.734%	13 .9566 .9513 -0.554%
	14 .8281 .8013 -3.236%	15 1.0416 1.0424 +0.077%	16 .8128 .8403 +3.383%	17 1.2095 1.2304 +1.728%	18 .8878 .8807 -0.800%	19 1.2263 1.2321 +0.473%	20 .8463 .8496 +0.390%
21 .8094 .7948 -1.804%	22 1.0741 1.0753 +0.112%	23 .8181 .8403 +2.714%	24 .9509 .9629 +1.262%	25 .8999 .9423 +4.712%	26 1.2033 1.2264 +1.920%	27 .9026 .9127 +1.119%	28 1.0819 1.1203 +3.549%
29 1.0747 1.0467 -2.605%	30 .9570 .9307 -2.748%	31 1.2180 1.2304 +1.018%	32 .9229 .9423 +2.102%	33 1.1914 1.2093 +1.502%	34 1.0915 1.0521 -3.610%	35 .9961 1.0242 +2.821%	36 .9640 .9941 +3.122%
37 1.0811 1.0466 -3.191%	38 1.1980 1.1889 -0.760%	39 .8923 .8807 -1.300%	40 1.2060 1.2264 +1.692%	41 1.0853 1.0521 -3.059%	42 1.1996 1.2034 +0.317%	43 1.0067 1.0053 -0.139%	44 .9527 .9777 +2.624%
45 .7442 .7366 -1.021%	46 .8348 .8538 +2.276%	47 1.0255 1.0030 -2.194%	48 1.2310 1.2321 +0.089%	49 .9062 .9127 +0.717%	50 .9950 1.0242 +2.935%	51 1.0032 1.0053 +0.209%	52 1.1909 1.2212 +2.544%	53 .9114 .9567 +4.970%
54 1.0101 0.4766 -3.317%	55 1.0882 1.0619 -2.417%	56 0.9714 .9513 -2.069%	57 0.8430 .8496 +0.783%	58 1.0988 1.1203 +1.957%	59 0.9669 .9941 +2.813%	60 .9543 .9777 +2.452%	61 .9118 .9567 +4.924%	62 .6073 .6242 +2.783%

REFERENCE

1. Calvert Cliffs Nuclear Power Plant Unit 1, Startup Test Report, August 29, 1975.