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 SIX

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SUMMARY OF STARTUP TESTING FOR CALVERT CLIFFS UNIT TWO CYCLE SIX

I. The following tests were conducted for the startup of Calvert Cliffs Unit Two 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 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 (56) reached 90% insertion in 2.54 seconds.

B. Reactor Coolant Flow was verified to be consistent with previous testing.

C. Initial criticality was achieved at 1615 ppm Boron with CEA Group 5 at 87.7" withdrawn. Predicted value was 1576 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 2.75%, well within the 10% acceptance limit.

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.

The ARO zero power Moderator Temperature Coefficient (MTC) was determined to be $+.54 \times 10^{-4}$ delta rho/^{o}F. Although this was well within the acceptance criteria (±.3 of prediction), it exceeded the Technical Specification limit of $+.5 \times 10^{-4}$ delta rho/^{o}F. Special test exception 3.10.2 was invoked until Low Power Testing was complete, at which time CEAs were inserted to reduce MTC. Operational restrictions were placed on boron concentration to ensure that MTC remained within limits during power escalation and early in the cycle until excess core reactivity was reduced. These actions were taken with concurrence from the fuel vendor and the Plant Safety Committee.

TABLE 1

CRITICAL BORON MEASUREMENTS

	Measured	Predicted
All Rods Out, 532°F	1629 ppm	1590 ± 50 ppm
CEA Group's Inserted 5,4,3,2,1	1366 ppm	1336 ± 50 ppm

TABLE 2

ISOTHERMAL TEMPERATURE COEFFICIENTS AND POWER COEFFICIENTS

ITC

	Measured	Predicted
Zero Power, CEA Group 5 at All Rods Out	$+.389 \times 10^{-4}$ delta Rho/°F	$+0.30 \pm 0.3 \times 10^{-4}$ delta Rho/°F
50% Power, CEA Group 5 at 105" Withdrawn	$-.020 \times 10^{-4}$ delta Rho/°F	$0.03 \pm 0.3 \times 10^{-4}$ delta Rho/°F
100% Power, CEA Group 5 at 105" Withdrawn	-0.319×10^{-4} delta Rho/°F	$-0.27 \pm 0.3 \times 10^{-4}$ delta Rho/°F

POWER COEFFICIENT

50% Power, CEA Group 5 at 105" Withdrawn	-1.012×10^{-4} delta Rho/% Power	$-1.00 \pm 0.2 \times 10^{-4}$ delta Rho/% Power
100% Power, CEA Group 5 at 105" Withdrawn	-0.933×10^{-4} delta Rho/% Power	$-0.88 \pm 0.2 \times 10^{-4}$ delta Rho/% Power

TABLE 3
CEA GROUP WORTH MEASUREMENTS

	Measured (% delta Rho)	Predicted (% delta Rho)
Group 5	0.396	0.420 ± .063
Group 4	0.215	0.233 ± .035
Group 3	0.585	0.615 ± .092
Group 2	0.378	0.403 ± .060
Group 1	0.700	0.754 ± .113
TOTAL	2.274	2.425 ± .242

TABLE 4
POWER DISTRIBUTION MEASUREMENTS

	50% Power		100% Power	
	Measured	Acceptance Limits	Measured	Acceptance Limits
F_{xy}^{T}	1.6804	1.785	1.5994	1.700
F_{r}^{T}	1.5972	1.720	1.5197	1.650
T_q	0.0109	0.030	0.0036	0.030

ASSEMBLY RELATIVE POWER DENSITY FOR 50% POWER

UNIT 2 CYCLE 6

PREDICTED: 50% POWER, EQUILIBRIUM XENON, BANK 5 @ 105 IN. WITHDRAWN, 40 MWD/T

MEASURED: 47.4% POWER, EQUILIBRIUM XENON, BANK 5 @ 105 IN. WITHDRAWN, 34 MWD/T

FIGURE 1

MEASURED										HO 1	HO 2					
PREDICTED										0.7382	0.9189					
% DIFF.										0.7700	1.0400					Y
										-4.13	-11.64					
DIFF. = MEASURED-PREDICTED / PREDICTED X100						HO 3	HO 4	HO 5	FO 6	GO 7						
						0.8342	1.1106	1.1968	0.8444	1.0967						
						0.8300	1.1300	1.2100	0.8700	1.1000						X
						0.51	-1.72	-1.09	-2.94	-0.30						
					HO 8	GO 9	G1 10	GO 11	E1 12	G1 13						
					0.8863	1.1795	1.1154	1.0110	0.6687	0.6447						
					0.9100	1.1700	1.1300	1.0100	0.6700	0.8400						W
					-2.60	0.81	-1.29	0.10	-0.19	0.56						
				HO 14	GO 15	G1 16	GO 17	FO 18	H1 19	E1 20						
				0.8863	1.1503	1.1359	1.2512	0.8749	1.1947	0.7460						
				0.9100	1.1700	1.1600	1.2400	0.8800	1.1800	0.7300						V
				-2.60	-1.68	-2.08	0.90	-0.58	1.25	2.19						
			HO 21	GO 22	G1 23	GO 24	D1 25	GO 26	FO 27	GO 28						
			0.8342	1.1795	1.1359	1.2123	0.7798	1.0939	0.9698	1.2218						
			0.8300	1.1700	1.1600	1.1900	0.8000	1.0800	0.9600	1.1700						T
			0.51	0.81	-2.08	1.87	-2.53	1.29	1.02	4.43						
			HO 29	G1 30	GO 31	D1 32	H1 33	FO 34	H1 35	D1 36						
			1.1106	1.1154	1.2512	0.7798	1.2236	0.9033	1.2723	0.8047						
			1.1100	1.1200	1.2300	0.8000	1.2400	0.9100	1.2700	0.8100						S
			0.05	-0.41	1.72	-2.53	-1.31	-0.74	0.18	-0.65						
			HO 37	G1 38	FO 39	GO 40	FO 41	GO 42	FO 43	GO 44						
			1.1968	1.0110	0.8749	1.0939	0.9033	1.1837	0.9069	1.0775						
		HO 45	1.1800	0.9900	0.8800	1.0800	0.9100	1.1600	0.8900	1.0400						R
		0.7382	1.42	2.12	-0.58	1.29	-0.74	2.04	1.90	3.61						
P*		0.7300														
		1.12	FO 46	E1 47	H1 48	FO 49	H1 50	FO 51	H1 52	D1 53						
			0.8444	0.6687	1.1947	0.9698	1.2723	0.9069	1.1385	0.6512						
		HO 54	0.8200	0.6500	1.1700	0.9500	1.2300	0.8800	1.1100	0.6500						N
		0.9189	2.98	2.88	2.11	2.08	-0.60	3.06	2.57	0.18						
M		0.9700														
		-5.27	GO 55	G1 56	D1 57	GO 58	D1 59	GO 60	D1 61	D0 62						
			1.0967	0.8447	0.7460	1.2218	0.8047	1.0775	0.6512	0.5673						
			1.1000	0.8400	0.7300	1.1700	0.8100	1.0400	0.6500	0.5600						L
			-0.30	0.56	2.19	4.43	-0.65	3.61	0.18	1.30						
	1		2		3		4		5		6		7		8	9	10	11

ASSEMBLY RELATIVE POWER DENSITY FOR 100% POWER

UNIT 2 CYCLE 6

PREDICTED: 100% POWER, EQUILIBRIUM XENON, BANK 5 @ 105 IN. WITHDRAWN, 250 MWD/T

MEASURED: 97.0% POWER, EQUILIBRIUM XENON, BANK 5 @ 105 IN. WITHDRAWN, 302.4 MWD/T

FIGURE 2

MEASURED								HO 1	HO 2		
PREDICTED								0.7135	0.8828		
% DIFF.								0.7300	0.9700		Y
								-2.26	-8.99		
DIFF = MEASURED-PREDICTED / PREDICTED X100				HO 3	HO 4	HO 5	FO 6	GO 7			
				0.7951	1.0644	1.1414	0.8229	1.0714			
				0.8000	1.0700	1.1500	0.8400	1.0600			X
				-0.61	-0.52	-0.75	-2.04	1.08			
			HO 8	GO 9	G1 10	GO 11	E1 12	G1 13			
			0.8518	1.1393	1.0321	0.9973	0.6924	0.8559			
			0.8800	1.1300	1.1100	1.0100	0.6900	0.8600			W
			-3.20	0.82	-7.02	-1.26	0.3	-0.48			
		HO 14	GO 15	G1 16	GO 17	FO 18	H1 19	E1 20			
		0.8518	1.1135	1.1128	1.2444	0.8863	1.2220	0.7641			
		0.8800	1.1400	1.1500	1.2300	0.9000	1.1900	0.7600			V
		-3.20	-2.32	-3.23	1.17	-1.52	2.69	0.54			
	HO 21	GO 22	G1 23	GO 24	D1 25	GO 26	FO 27	GO 28			
	0.7951	1.1393	1.1128	1.1995	0.8067	1.1215	0.9934	1.2552			
	0.7900	1.1300	1.1500	1.1900	0.8700	1.1000	0.9900	1.2000			T
	0.65	0.82	-3.23	0.80	-1.62	1.95	0.34	4.60			
	HO 29	G1 30	GO 31	D1 32	H1 33	FO 34	H1 35	D1 36			
	1.0644	1.0321	1.2444	0.8067	1.2634	0.9323	1.3071	0.8388			
	1.0600	1.1000	1.2300	0.8300	1.2600	0.9400	1.3000	0.8400			S
	0.42	-6.17	1.17	-2.81	0.27	-0.82	0.55	-0.14			
	HO 37	G1 38	FO 39	GO 40	FO 41	GO 42	FO 43	GO 44			
	1.1414	0.9973	0.8863	1.1215	0.9322	1.2220	0.9376	1.1257			
HO 45	1.1300	0.9900	0.9000	1.1000	0.9500	1.2000	0.9300	1.0800			R
0.7135	1.01	0.74	-1.52	1.95	-1.86	1.83	0.82	4.23			
P 0.7000											
1.93	FO 46	E1 47	H1 48	FO 49	H1 50	FO 51	H1 52	D1 53			
	0.8229	0.6924	1.2220	0.9934	1.3071	0.9376	1.1987	0.7035			
HO 54	0.8100	0.6700	1.1900	0.9800	1.3100	0.9200	1.1600	0.6900			N
0.8828	1.59	3.34	2.69	1.37	-0.22	1.91	3.34	1.96			
M 0.9200											
-4.04	GO 55	G1 56	D1 57	GO 58	D1 59	GO 60	D1 61	DO 62			
	1.0714	0.8559	0.7641	1.2552	0.8088	1.1257	0.7035	0.6133			
	1.0600	0.8600	0.7600	1.2000	0.8400	1.0800	0.6900	0.6100			L
	1.08	-0.48	0.54	4.60	-0.14	4.23	1.96	0.54			
1	2	3	4	5	6	7	8	9	10	11	

REFERENCES

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

BALTIMORE
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ARTHUR E. LUNDVALL, JR.
VICE PRESIDENT
SUPPLY

October 8, 1984

Dr. Thomas E. Murley
Regional Administrator
U.S. Nuclear Regulatory Commission
Region 1
631 Park Avenue
King of Prussia, PA 19406

SUBJECT: Calvert Cliffs Nuclear Power Plant Unit No. 2,
Docket No. 50-318 Report of Startup Testing for
Cycle 6

Gentlemen:

Startup testing for Calvert Cliffs Unit 2, Cycle 6 was completed on July 23, 1984. A summary of the results from those tests is enclosed.

Very truly yours,

Arthur E. Lundvall Jr.

AEL/JFW/jcs

Enclosure

cc: Director Inspection and Enforcement
U.S. Nuclear Regulatory Commission
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