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October 14, 1996

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Unit 1, Cycle 13, Startup Report; Technical Specification 6.9.1.1

REFERENCE: (a) Calvert Cliffs Nuclear Power Plant Technical Specification 6.9.1.1

In accordance with Reference (a), attached is the Calvert Cliffs Unit 1, Cycle 13, Startup Report. This report must be submitted within 90 days of completion of the testing or resumption of commercial power operation, whichever comes first. Unit 1 resumed commercial power operation on July 29, 1996.

Should you have questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,

Peter Katz

PEK/DWM/bjd

Attachment

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BALTIMORE GAS AND ELECTRIC COMPANY
CALVERT CLIFFS NUCLEAR POWER PLANT
UNIT 1

Docket Number 50-317

License Number DPR-53

Unit 1 Cycle 13

Summary of Startup Testing

INTRODUCTION

The Unit 1 Cycle 13 core is designed for Full Power Operation Burnup of 20,012 MWD/MTU. The core loading is listed in Table 1, and the core loading pattern is shown in Figure 1. The initial startup of Cycle 13 began with Control Element Assembly (CEA) and Control Element Drive Mechanism Testing (CEDM) on June 23, 1996. CEA and CEDM testing along with the Reactor Coolant System (RCS) flow measurement were completed on June 24, 1996. Reactor Coolant Pump inspections delayed the remainder of startup testing until late July. On July 28, 1996 startup testing resumed with a second RCS flow measurement. Initial Criticality was declared at 16:52 on July 29, 1996. Startup testing concluded with the Variable Tavg test to determine the Moderator Temperature Coefficient (MTC) on August 10, 1996.

The startup testing evolution was controlled under four Post Startup Test Procedures (PSTP). Each is listed below with a description of the tests contained in the procedure.

PSTP-2, Initial Approach to Criticality and Low Power Physics Testing:

- Dual CEA Symmetry Check
- Critical Boron Concentration (CBC) Measurements
- Isothermal Temperature Coefficient (ITC) Measurement
- CEA Group Worth Measurements

PSTP-13, CEDM Performance Testing:

- CEA and CEDM Testing
- CEA Drop Time Testing

PSTP-3, Power Escalation Testing

- Radial Power Distribution Comparisons at 30, 60, 85, and 97% Rated Thermal Power (RTP).
- Core Symmetry Power Distribution Measurements at 30, 60, 85, and 97% RTP.
- ITC and Power Coefficient (PC) Measurement at 97% RTP

PSTP-301, RCS Flow Measurement:

- RCS Flow Measurement
- Core Differential Pressure Comparison

TEST CRITERIA

The following review and acceptance criteria were applied to the individual tests during the startup evolution

Parameter	Review Criteria	Acceptance Criteria
RCS Flow		
1. 0% RTP	390,600-398,400 gpm	384,900-410,350 gpm
2. 0% RTP after impeller change	390,600-398,400 gpm	382,725-409,525 gpm
3. 85% RTP	388,455-396,255 gpm	383,249-409,525 gpm
Core ΔP	11.61 ± 0.75 psid	≤ 14.26 psid
CEA Drop Time (90% inserted)	≤ 2.75 seconds	≤ 2.95 seconds
CEA Symmetry	Less than 10% tilt	None
CBC	± 50 ppm of predicted	± 100 ppm of predicted
CEA Worth		
1. Group	Greater of ± 15% or ± 0.1% Δρ of predicted	Greater of ± 15% or ± 0.1% Δρ of predicted
2. Total	± 10% of predicted	± 10% of predicted
ITC (0% and 97% RTP)	± 0.3 x 10^{-4} Δρ of predicted	Per the MTC Technical Specification (TS)
PC (97% RTP)	± 0.2 x 10^{-4} Δρ/% RTP	± 0.3 x 10^{-4} Δρ/% RTP
Power Distributions		
1. 30% RTP (Interior/Peripheral)	± 15% / 20% of predicted	FxyT and FrT within TS Limits
2. 60, 85, and 97% RTP (Interior/Peripheral)	± 10% / 15% of predicted	FxyT, FrT, and Tq within TS Limits
Core Symmetry		
1. Box Powers	Same as Power Distribution	Same as Power Distribution
2. Tilt		
a. 30% RTP	≤ 5%	None
b. 60, 85, and 97% RTP	≤ 2%	≤ 3%
3. Symmetric ICI Box powers	± 10%	None

TEST RESULTS

Table 2 summarizes the test results, individual tests are discussed below

CEA and CEDM Testing

CEA and CEDM testing was performed prior to initial Cycle 13 criticality with all four Reactor Coolant Pumps running and the RCS temperature at nominal Hot Zero Power (HZP) conditions (532 °F). The operability of the CEDMs was verified by checking the associated light operations for each CEDM. This was accomplished with only a few minor problems noted. These minor problems were corrected and each CEDM was subsequently re-verified to be operable.

The CEA drop times were measured from the full out position to 90% and 100% insertion. All CEAs met both the listed Acceptance and Review criteria. The slowest CEA to 90% insertion was Group 1 CEA # 65, with a 90% insertion time of 2.46 seconds.

Dual CEA Symmetry Checks

The Partial Symmetry Check was performed by individually inserting each dual CEA in Shutdown Group C. For each insertion, the reactivity change was calculated. For each symmetric set, the magnitude of the reactivity change for each dual CEA was consistent. In addition tilt was calculated using the measured reactivity changes. The largest calculated tilt was 5.36%, which was within the Review Criteria of ± 10%.

RCS Flow

The RCS Flow was initially measured in June at Hot Standby conditions with all four RCPs running. The measured flow was 395,216 gpm, which was within the Review and Acceptance Criteria. The RCP differential pressures were slightly higher than previous cycles as expected because of the significant number of steam generator U-tubes that were plugged. The core differential pressure was consistent with previous cycles.

Near the end of July, RCS flow was again measured because the 11B RCP rotating assembly was replaced after the initial measurement in June. Test conditions were Hot Standby with all four RCPs running. The measured flow was 394,198 gpm, which was again within the Review and Acceptance Criteria. RCP and core differential pressures were consistent with the previously measured values.

Critical Boron Concentration (CBC), HZP, All Rods Out (ARO)

The CBC was determined by obtaining from Chemistry the results of a RCS boron grab sample taken at conditions near ARO and adjusting it to an ARO condition. The ARO CBC was determined to be 2016 ppm, compared to a predicted value of 1992 ppm. This value was within both Review and Acceptance Criteria.

Isothermal Temperature Coefficient

The ITC was determined by decreasing and increasing RCS temperature while measuring the associated reactivity change. The measured reactivity was divided by the temperature change to arrive at a value for the ITC. The calculated ITC with Group 5 CEAs at approximately 105 inches withdrawn was 0.2495×10^{-4} $\Delta\rho/°F$. The measured value met both Review and Acceptance Criteria.

CEA Group Worth Measurement

The worth of each Regulating CEA was determined using the dilution method. Each individual measured group worth met the Review and Acceptance Criteria, as did the total measured group worth for all the Regulating CEAs.

Radial Power Distribution Comparison

The Radial Power Distribution comparisons were performed at 30, 60, 85, and 97% RTP. The power distribution calculated by CECOR was compared to the ROCS predicted values for each power level. At each power plateau, the peaking factors (FrT and FxyT) and the azimuthal tilt (Tq) were compared to their TS limits. In all cases, the FrT, FxyT, and Tq were within their respective TS limits. In addition, all comparisons of box powers, both interior and peripheral, to predicted values from ROCS fell within Review and Acceptance Criteria.

Core Symmetry Power Distribution Measurements

The Core Symmetry Evaluation for the Box Powers met both Review and Acceptance Criteria as described above for the Radial Power Distribution Comparisons. The evaluation of core tilt at each power level indicated that the Review and Acceptance Criteria were met.

The final evaluation of core symmetry involved comparison of symmetric Incore Instrumentation (ICI) Box Powers. This evaluation was performed by comparing symmetric ICI Box Powers, summed over all axial detector levels, to predicted values as well as determining a tilt based on only that set of symmetric detectors. In all cases, the Review Criteria of ± 10% was met.

ITC and Power Coefficient (PC) Measurement

The ITC and PC were measured at 97% RTP with the Regulating Group 5 CEAs at approximately 105 inches withdrawn. These parameters were determined by adjusting either moderator temperature or reactor power while adjusting turbine load to maintain the unaffected parameter approximately constant. The measured values for the ITC and the PC met both Review and Acceptance Criteria

REFERENCES

1. J. E. Baum (ABB) to W. J. Lippold (BGE), " Calvert Cliffs Unit 1 Cycle 13 - Reload Design Report," B-96-001, dated January 3, 1996.

2. PSTP-2, Initial Approach to Criticality and Low Power Physics Testing, Revision 16.

3. PSTP-13, CEDM Performance Testing, Revision 5.

4. PSTP-3, Escalation to Power Test Procedure, Revision 18

5. PSTP-301, RCS Flow Measurement, Revision 0

6. PSTP-4, Variable Tavg Testing, Revision 31

6. NEOP-13, Unit 1 Technical Data Book, Revision 3

Written by: _____ Date: 9/30/96

Reviewed by: _____ Date: 10/1/96

Table 1: Unit 1 Cycle 13 Core Loading

Batch	Number of Shim Rods	Number of Assemblies	Enrichment
1R0	20	24	4.48 w/o
1R1	44	28	4.48 w/o
1R2	68	32	4.48 w/o
1RT	44	4	4.00 w/o
1P0	0	16	4.28 w/o
1P1	20	12	4.28 w/o
1P2	44	8	4.28 w/o
1P3	60	52	4.28 w/o
1N	0	8	4.20 w/o
1N1	4[a]	16	4.18 w/o
1N2	8[a]	16	4.19 w/o
2J1	0	1	3.40 w/o

Note: Shim rods refers to Erbium (Er_2O_3) except for [a] which refers to B_4C bearing shim rods.

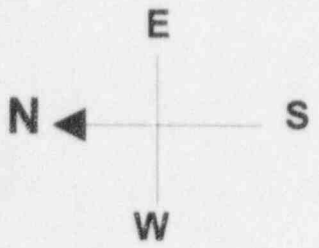

FIGURE 1: Unit 1 Cycle 13 Core Loading

	Y	X	W	V	T	S	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A
21								1N238	1N106			1N107		1N209							
20					1N203	1N005	1P014	1R001	1R005	1R023	1P012	1N009	1N219								
19				1N117	1R009	1P008	1R101	1P205	1P106	1P203	1R119	1P002	1R019	1N104							
18			1N102	1R013	1P112	1R105	1P320	1R109	1P349	1R127	1P314	1R116	1P102	1R015	1N118						
1		1N231	1R017	1P103	1R201	1P311	1R205	1P348	1R209	1P308	1R223	1P301	1R203	1P109	1R011	1N211					
16		1N008	1P003	1R113	1P304	1R213	1P339	1R228	1P341	1R219	1P333	1R215	1P310	1R107	1P005	1N004					
15		1P010	1R117	1P315	1R221	1P336	1R225	1P328	1R121	1P322	1R227	1P338	1R207	1P317	1R103	1P016					
14	1N210																				1N227
13		1R021	1P201	1R125	1P306	1R217	1P323	1RT1	1P331	1RT4	1P325	1R230	1P345	1R111	1P207	1R003					
12	1N116																				1N106
11		1R008	1P107	1P352	1R212	1P344	1R124	1P329	2J118	1P330	1R123	1P343	1R211	1P351	1P108	1R007					
10	1N112																				1N101
9		1R004	1P208	1R112	1P346	1R231	1P326	1RT3	1P332	1RT2	1P324	1R218	1P305	1R126	1P202	1R022					
8	1N252																				1N202
7		1P015	1R104	1P318	1R208	1P337	1R229	1P321	1R122	1P327	1R226	1P335	1R222	1P316	1R118	1P009					
6		1N011	1P006	1R108	1P309	1R216	1P334	1R220	1P342	1R232	1P340	1R214	1P303	1R114	1P104	1N006					
5		1N208	1R012	1P110	1R204	1P302	1R224	1P307	1R210	1P347	1R206	1P312	1R202	1P104	1R018	1N206					
4			1N105	1R016	1P101	1R116	1P313	1R128	1P350	1R110	1P319	1R106	1P111	1R014	1N120						
3				1N119	1R020	1P001	1R120	1P204	1P105	1P206	1R102	1P007	1R010	1N103							
2					1N207	1N007	1P011	1R024	1R006	1R002	1P013	1N010	1N201								
1								1N205	1N109			1N110		1N232							

TABLE 2: SUMMARY OF UNIT 1 CYCLE 13 TEST RESULTS

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Test Description	Predicted	Measured
RCS Flow		
1. 0% RTP	394,494 gpm	395,216 gpm
2. 0% RTP after impeller change	394,494 gpm	394,198 gpm
3. 85% RTP	392,284 gpm	393,203 gpm
Core ΔP		
1. 0% RTP	11.61 psid	11.71 psid
2. 0% RTP after impeller change	11.61 psid	11.88 psid
CEA Drop Time (Slowest to 90% inserted)	None	2.46 seconds
Critical Boron Concentration		
1. ARO	2016 ppm	1992 ppm
2. All Regulating Groups inserted	1593 ppm	1573 ppm
CEA Worth		
1. Group 1	0.420 %Δρ	0.421 %Δρ
2. Group 2	1.060 %Δρ	0.971 %Δρ
3. Group 3	0.903 %Δρ	0.863 %Δρ
4. Group 4	0.667 %Δρ	0.635 %Δρ
5. Group 5	0.327 %Δρ	0.346 %Δρ
6. Total	3.377 %Δρ	3.236 %Δρ
Isothermal Temperature Coefficient		
1. HZP, Group 5 @ 105" withdrawn	0.22×10^{-4} Δρ/°F	0.2495×10^{-4} Δρ/°F
2. HZP, corrected for test conditions	0.194×10^{-4} Δρ/°F	N/A
3. 97%, Group 5 @ 105" withdrawn	-0.53×10^{-4} Δρ/°F	-0.494×10^{-4} Δρ/°F
Power Coefficient (97%, Group 5 @ 105" withdrawn)	-0.99×10^{-4} Δρ/% RTP	-1.04×10^{-4} Δρ/% RTP

TABLE 2: SUMMARY OF UNIT 1 CYCLE 13 TEST RESULTS

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Power Distributions

Peaking Factors	30% RTP	60% RTP	85% RTP	97% RTP
FxyT	1.6984	1.6803	1.6830	1.6624
FrT	1.6092	1.5974	1.6022	1.5162
Tq	0.0193	0.0180	0.0171	0.0151
Box Powers	30% RTP	60% RTP	85% RTP	97% RTP
Interior	7.66%	-5.37%	5.5%	-6.69%
Peripheral	17.79%	14.78%	13.8%	11.89%
Core Symmetry	30% RTP	60% RTP	85% RTP	97% RTP
Tilt	1.93%	1.80%	1.71%	1.51%
Symmetric Box Powers	7.03%	6.12%	6.37%	5.87%