Docket No. 50-443

SEABROOK STATION

UNIT NO. 1

STARTUP TEST REPORT

CYCLE 4

INDEX

1.0 CHRONOLOGICAL SUMMARY

Cycle 4 Fuel Load was completed July 9, 1994. Subsequent operation/testing milestones were completed as follows:

INITIAL CRITICALITY	07/29/94
LPPT COMPLETED	07/31/94
ON LINE	07/31/94
30% PAT COMPLETED	08/02/94
50% PAT COMPLETED	08/03/94
75% PAT COMPLETED	08/04/94
90% PAT COMPLETED	08/04/94
FULL POWER	08/05/94
100% PAT COMPLETED	08/10/94

2.0 CORE DESIGN SUMMARY

Cycle 4 will be Seabrook Station's second 18-month fuel cycle. The Cycle 4 core is designed to operate for 16820 MWD/MTU (441 Effective Full Power Days). 72 fresh fuel assemblies were loaded into the Cycle 4 core with 36 having an enrichment of 3.6 w/o and 36 having an enrichment of 4.0 w/o. By comparison, Cycle 3 utilized 76 fresh fuel assemblies with enrichments of 4.0 and 4.4 w/o.

The reload fuel mechanical design is identical to that used in Cycle 3. The operating features of these fuel assemblies are a removable top nozzle, debris filter bottom nozzle, integral fuel burnable absorber, extended burnup capability and anti-snag grids.

3.0 LOW POWER PHYSICS TESTING SUMMARY

Testing was performed in accordance with the following general sequence:

1. Initial Criticality: Criticality was achieved using a controlled dilution once shutdown and control banks had been withdrawn.

2. Zero Power Test Range Determination: This was determined after the point of adding heat had been demonstrated. Additional emphasis was placed on this measurement to prevent testing too low in the test range, thus minimizing gamma contribution to the excore signal.

3. On-line Verification of the Reactivity Computer: This was determined using stable startup rates during flux doubling measurements.

4. Boron endpoint measurements: Data was obtained with all rods out and control banks inserted.

5. Isothermal Temperature Coefficient Measurement (ITC): ITC was based on the reactivity change resulting from an RCS temperature change. The Moderator Temperature Coefficient (MTC) was calculated from the ITC Data.

6. Rod Worth Measurements: Individual Control Bank worths were measured during rod insertion. Total Control Bank worth was measured during withdrawal in overlap.

4.0 POWER ASCENSION TESTING SUMMARY

Testing was performed at specified power plateaus of 30%, 50%, 75%, 90% and 100% Rated Thermal Power (RTP). Power changes were governed by operating procedures and Fuel Preconditioning Guidelines specified by the fuel vendor, Westinghouse.

In order to determine the core power distribution, flux mapping was performed at 30%, 50% and 100% using the Fixed Incore Detector System. The resultant peaking factors were compared to Technical Specification limits, to verify that the core was operating within its design limits.

Thermal-hydraulic parameters, nuclear parameters and related instrumentation were monitored throughout the Power Ascension. Data was compared to previous cycles' power ascension data to identify any calibration or system problems. The major areas analyzed were:

1. Nuclear Instrumentation Indication: Overlap data was obtained between Intermediate Range and Power Range channels. Secondary plant heat balance calculations were performed to verify the Nuclear Instrumentation indications.

2. RCS Delta-T Indication: The initial scaling of RCS ΔT was left the same as Cycle 3. At the 75% power plateau, actual full power ΔT was extrapolated out using data from 30%, 50% and 75% power and ΔT rescaled accordingly. Final adjustments were performed at 100% power and the values provided in Table 3.

3. Upper Plenum Anomaly: In early 1992, Westinghouse notified North Atlantic that Seabrook Station may be susceptible to a phenomenon known as the Upper Plenum Anomaly (UPA). The UPA is primarily characterized by aperiodic step changes of 1°F to 2°F in hot leg temperature. A Design Document was written to implement a number of operating contingencies should the UPA be present. No Upper Plenum Anomaly was identified.

4. RCS Temperatures: Data was obtained for all Narrow Range Loop temperatures. Evaluations of Delta-T (°F) and Tavg/Tref Indication were performed.

5. Steam and Feedwater Flows: Data was obtained to evaluate flows for individual loop agreement between transmitters and loop steam flow/feed flow deviations.

6. Steam Pressures: Data was obtained to evaluate steam generator pressures for individual loop agreement between transmitters as well as individual turbine impulse pressures.

7. Incore/Excore Calibration: The core was operated at its natural axial power shape during flux mapping at 50% and 100% RTP. Scaling factors were calculated using the single point methodology and then used to recalibrate the Nuclear Instrumentation System.

8. RCS Flow: A primary heat balance was performed at 90% and 100% RTP to determine total RCS flow.

Other than procedure changes to accommodate the new fixed incore detector system and single point incore/excore calibration, the power ascension test program required no changes from Cycle 3.

5.0 RESULTS

1. Low Power Physics Testing: Both acceptance and review criteria were revised per Westinghouse letter 94 NA#-G-0030, recommended Westinghouse physics test results. All acceptance criteria were met. All review criteria were met. See Table 1 for results.

2. Flux Mapping: No problems were identified during the flux maps at 30%, 50% and 100% RTP. See Table 2 for results.

3. Full Power Thermal/Hydraulic Evaluation: No problems were encountered with any instrumentation. No Upper Plenum Anomaly was identified. Total RCS flow was determined to be 100.9% of the allowable Technical Specification limit. See Table 3 for results.

TABLE 1

LOW POWER PHYSICS RESULTS: CYCLE 4

ITEM	MEASURED	PREDICTED	ERROR	CRITERIA
RCS BORON AT CRITICALITY (ppm) CBD @ 163 STEPS)	1686	1707	21	± 70
BORON END POINTS: (ppm)				
ALL RODS OUT	1730	1707	23	± 139
CONTROL BANKS INSERTED	1230	1241	11	± 68*
ARO ITC (pcm/°F)	-3.07	-3.16	0.09	± 2*
ARO MTC (pcm/°F)	-1.50	-1.39	N/A	< 0
CONTROL BANK ROD WORTHS: (pcm)				
D	553	541	12	± 100*
C	899	966	67	± 134*
B	926	921	5	± 138*
A	1080	1119	39	± 162*
OVERLAP	3458	3547	11	≥3192 ± 354*

NOTE: * Review criteria, all others are acceptance criteria.

TABLE 2

POWER ASCENSION FLUX MAP RESULTS: CYCLE 4

ITEM	MAP 1	MAP 2	MAP 3
DATE OF MAP	08/01/94	08/02/94	08/05/94
POWER LEVEL (%)	29.4	48.2	99.8
CBD POSITION (STEPS)	178	194	226
RCS BORON (ppm)	1634	1455	1182
F_{XY} (UNRODDED/RODDED)	1.6978/1.7084	1.6389	1.5943
$F_{\Delta H}$	1.5452	1.4808	1.4165
INCORE TILT	1.0034	1.0042	1.0064

TABLE 3

FULL POWER THERMAL-HYDRAULIC DATA: CYCLE 4

ITEM	VALUE
RCS T_{AVG}	586.5°F
RCS DELTA-T	
Loop 1	57.02°F
2	58.19°F
3	57.08°F
4	57.55°F
RCS FLOWS	
Loop 1	99126 GPM
2	98022 GPM
3	101537 GPM
4	98703 GPM
TOTAL	397388 GPM
AUCTIONEERED HIGH T_{AVG}	587.56°F
T_{REF}	586.90°F
IMPULSE PRESSURE	665.8 PSIG
SG PRESSURES	
A	976.4 PSIG
B	975.6 PSIG
C	975.7 PSIG
D	973.5 PSIG