FPL Energy
Seabrook Station

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SBK-L-07009

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Seabrook Station
Cycle 12 Startup Report

In accordance with the requirements of Technical Specification 6.8.1.1, enclosed is the Cycle 12 Startup Report for Seabrook Station.

Should you require further information regarding this matter, please contact Mr. Paul V. Gurney, Reactor Engineering Supervisor, at (603) 773-7776.

Very truly yours,

FPL Energy Seabrook, LLC

Gene F. St. Pierre
Site Vice President

cc: S. J. Collins, NRC Region I Administrator
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ENCLOSURE TO SBK-L-07009

SEABROOK STATION

UNIT NO. 1

STARTUP TEST REPORT

CYCLE 12

INDEX

1.0 EXECUTIVE SUMMARY

This report summarizes the cycle 12 startup testing performed following the completion of the Fall 2006 refueling outage. Preparations for both the refueling outage and cycle 12 operation included a measurement uncertainty recapture (MUR) power uprate to allow operation at 3648 MWt. The planning for the MUR included the following:

- On September 22, 2005, the station submitted License Amendment Request 05-04, Application for Measurement Uncertainty Recapture Power Uprate, requesting approval to operate at the higher power level starting in cycle 12.

- Secondary plant modifications were planned to support the cycle 12 power uprate. The modifications included items such as the following:

  - Ultrasonic based feed water flow instrumentation
  - High Pressure Turbine Modifications
  - Steam Generator Feed Pump Turbine Upgrade
  - Turbine Generator Rewind and Maintenance
  - Replacement of Turbine Generator Alterex Exciter with a Static Exciter

  The above modifications were implemented during the October 2006 refueling outage with required modification retests performed during plant heatup or power ascension.

- On May 22, 2006 License Amendment 110, Seabrook Station Unit No. 1 – Issuance of Amendment RE: Measurement Uncertainty Recapture Power Uprate (TAC NO. MC8434), was issued to support operation at the higher power level in cycle 12.

Operation/testing milestones were completed as follows:

CYCLE 12 FUEL LOAD COMPLETED	10/18/06
INITIAL CRITICALITY	11/03/06
LPPT COMPLETED	11/03/06
ON LINE	11/10/06
30% PAT COMPLETED	11/10/06
50% PAT COMPLETED	11/11/06
80% PAT COMPLETED	11/12/06
94% PAT COMPLETED	11/12/06
98% PAT COMPLETED	11/13/06
FULL POWER	11/13/06

2.0 CORE DESIGN SUMMARY

The Cycle 12 core is designed to operate for 21,240 MWD/MTU with a coastdown to 22,240 MWD/MTU. Eighty-four fresh fuel assemblies were loaded into the Cycle 12 core. Twenty-eight have an enrichment of 4.5 w/o and fifty-six have an enrichment of 4.95 w/o. In addition, the top and bottom 6 inches have an enrichment of 2.6 w/o creating an axial annular blanket. By comparison, Cycle 11 utilized 88 fresh fuel assemblies, 48 with an enrichment of 4.0 w/o and the remaining 40 at 4.8 w/o, both with a similar 2.6 w/o axial annular blanket configuration.

The following mechanical design is used in the Cycle 12 core:

- The fresh region 14 and reload regions 11, 12 and 13 fuel are of the Robust Fuel Assembly (RFA) design, which includes slightly thicker RCC guide and thimble tubes as well as a different mid-grid design when compared to the previous Vantage 5H (V5H) design.

- All fuel utilizes ZIRLO for fuel clad, control rod guide tubes and instrument thimbles. The top and bottom grids are Inconel-718. The six low-pressure drop mid-zone and three intermediate flow mixer grids are ZIRLO with ZIRLO sleeves. In addition, all fuel contains a Performance$^+$ debris mitigation grid located at the bottom end plug of the fuel rod

The Cycle 12 core was designed for an uprated rated thermal power (RTP) condition of 3648 MWt. The previous RTP for cycle 11 was 3587 MWt.

3.0 LOW POWER PHYSICS TESTING SUMMARY

Testing was performed in accordance with the following general sequence:

1. Initial Criticality: Criticality was achieved by withdrawing all shutdown and control banks and diluting to critical.

2. Zero Power Test Range Determination: This was determined after the point of adding heat had been demonstrated.

3. On-line Verification of the Reactivity Computer: This was determined by examining the output of the Advanced Digital Reactivity Computer (ADRC) during rod withdrawal and the determination of the point of adding heat.

4. Boron Endpoint Measurement: This was determined with all the Control and Shutdown banks withdrawn using the ADRC.

5. Rod Worth Measurement: Individual control bank and shutdown bank worths were measured using the Dynamic Rod Worth Measurement (DRWM) technique with the ADRC.

6. Isothermal Temperature Coefficient Measurement (ITC): This was determined using the ADRC during a Reactor Coolant temperature change. The Moderator Temperature Coefficient (MTC) was calculated from the ITC Data.

All acceptance criteria were met and the results are presented in Table 1.

4.0 POWER ASCENSION TESTING SUMMARY

Since the power ascension for cycle 12 included first time operation at an uprated rated thermal power level of 3648 MWt, the standard post-refuel power ascension test program was augmented to include additional testing/evaluations. The scope of the additional testing/evaluations was determined as follows:

- As part of the preparations for rated thermal power increase from 3587 MWt to 3648 MWt, an applicability assessment of initial plant startup tests (as discussed in Chapter 14 of the Updated Final Safety Analysis Report) was performed. The assessment results are summarized below:

    - A number of the Chapter 14 tests now exist as routine operating and surveillance procedures that are performed as part of each refueling and post-refueling startup. The scope of these procedures was determined to be acceptable for use in the uprated power condition and as such are not reported in this startup report. Examples of these procedures are Core Loading, Rod Drop Testing, and Water Chemistry Control.

    - The dynamic tests described in Chapter 14 were not re-performed. The assessment determined that these tests were not necessary based on analysis and the experience of other plants with similar uprates. Examples of these procedures are Reactor Trip and Load Swing.

    - Chapter 14 tests were not re-performed on systems or equipment that have been removed from service since initial startup.

    - Chapter 14 tests that are re-performed during each post-refueling startup were re-performed for the cycle 12 startup. Examples of these procedures include Control Rod Worth Measurement and RCS Flow Rate Measurement.

    - A limited number of Chapter 14 tests were re-performed to accommodate uprate specific modifications and/or conditions. These procedures include the Steam Generator Moisture Carryover Test and the Turbine Generator Performance Test.

- Secondary side modifications were completed as part of the uprate to improve plant performance and efficiency. These included high-pressure turbine modifications, steam generator feed pump turbine upgrade, turbine generator rewind, and installation of turbine generator static exciter. Specific performance tests for these modifications were developed and included in the scope of the power ascension test program.

4.0 POWER ASCENSION TESTING SUMMARY (Continued)

A specific station procedure was written for the power ascension to the uprated power level of 3648 MWt. This procedure directed the performance of required testing/evaluations. This power ascension procedure provided the overall sequence of required activities as well as the types of management reviews and approvals needed to continue the power ascension to the next power plateau.

Testing was performed at specified power plateaus of 30%, 50%, 80%, 94%, 98%, and 100% Rated Thermal Power (RTP). Power changes were governed by operating procedures and fuel preconditioning guidelines.

Test activities 1 through 10 described below are standard power ascension activities performed following all refueling outages. Items 11 through 16 describe the additional testing/evaluations performed to ensure a conservative, deliberate approach to the uprated power level of 3648 MWt.

Thermal-hydraulic parameters, nuclear parameters and related instrumentation were monitored throughout the Power Ascension. Data was compared to previous cycle power ascension data and engineering predictions, as required, at each test plateau to identify calibration or system problems. The major areas analyzed were:

1. Core Performance Evaluation: Flux mapping was performed at 30%, 50%, 80% and 100% RTP using the Fixed Incore Detector System. The resultant peaking factors and power distribution were compared to Technical Specification limits to verify that the core was operating within its design limits. All analysis limits were met and the results are summarized in Table 2.

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

3. RCS Delta-T Indication: All RCS ΔT loops were initially scaled using cycle 11 values (scaled conservatively for a rated thermal power condition of 3587 MWt). Data from 30%, 50%, and 80% RTP met prescribed acceptance criteria. Data was evaluated at 98% RTP and the ΔT loops were re-scaled for the new rated thermal power condition of 3648 MWt.

4.0 POWER ASCENSION TESTING SUMMARY (Continued)

4. Upper Plenum Anomaly Evaluation: In early 1992, Westinghouse notified Seabrook Station that it might be susceptible to a phenomenon known as the Upper Plenum Anomaly (UPA). The UPA is primarily characterized by a periodic step change of 1°F to 2°F in hot leg temperature and a corresponding change in steam flow. Cycle 12 data collected at 100% RTP identified the presence of UPA. The 100% RTP data confirmed that instrumentation changes to the delta-T loops implemented in early 2005 successfully mitigated the impact of UPA events on the delta-T instrumentation..

5. RCS Temperatures: Data was obtained for the Narrow Range Loop temperatures. Evaluations for Delta-T (°F) and T_{AVG} /T_{REF} Indication were performed. The data was as expected.

6. Steam, feedwater venturi, and feedwater ultrasonic flows: Data was obtained for the steam, feedwater venturi, and feedwater ultrasonic flows. Evaluations for deviations were performed. The data was as expected.

7. Steam Generator Pressures: Data was obtained for the steam generator pressures. Evaluations for deviations between redundant channels on individual steam generators were performed. The data was as expected.

8. Turbine Impulse Pressure (T_{REF}): The initial scaling of impulse pressure was set during refueling outage 11 based on engineering calculations for expected full power turbine impulse pressure. The scaling of T_{REF} was evaluated during the power ascension and found acceptable for continued power increase to 100%. Once steady state 100% RTP conditions were reached, the turbine impulse pressure was evaluated and determined to be acceptable.

9. Incore/Excore Calibration: Scaling factors were calculated from flux map data using the single point calibration methodology. The nuclear instrumentation power range channels were re-scaled at 50% and 100% RTP.

10. RCS Flow: The RCS flow was measured at the 94% RTP plateau using elbow tap measurements to minimize the effects of observed hot leg streaming. The calculated RCS flow value met the Technical Specification requirements.

4.0 POWER ASCENSION TESTING SUMMARY (Continued)

11. Plant Walkdowns: At the 94% and 98% testing plateaus, walkdowns of selected secondary plant systems/components were performed to evaluate the overall response/stability of these systems/components. Acceptable results from these walkdowns were documented as part of the approval process to continue to increase power to the next plateau.

12. Augmented Data Collection/Evaluations: For the areas of NSSS, Balance of Plant, and Key Control Systems, selected additional monitoring points were evaluated against expected values at the testing plateaus. Acceptable results from these evaluations were documented as part of the approval process to continue to increase power to the next plateau.

13. Main Turbine Performance Testing: Due to the modifications to the high pressure turbine, testing to measure the turbine-generator performance was performed once steady state 100% RTP conditions were reached.

14. Steam Generator Moisture Carryover Measurement: Once steady state 100% RTP conditions were reached, testing was performed (using radiotracer soduim-24) to measure/determine the steam generator moisture carryover for the uprated rated thermal power condition of 3648 MWt.

15. Radiation Surveys: Containment radiation surveys were completed at the uprated power level. The results were evaluated and found acceptable and consistent with expectations for the uprated power condition.

16. Area Temperature Monitoring: Selected area temperatures and process stream measurements were obtained during plant operation at the uprated power level. The results were evaluated and found acceptable and consistent with expectations for the uprated power condition.

TABLE 1

LOW POWER PHYSICS RESULTS: CYCLE 12

ITEM	MEASURED	PREDICTED	ERROR	CRITERIA
BORON END POINT:				
HZP ALL RODS OUT	2084 ppm	2093 ppm	55.9 pcm	± 1000 pcm ± 500 pcm *
ALL RODS OUT ITC (pcm/°F)	-2.23	-1.94	0.29	± 2*
ALL RODS OUT MTC (pcm/°F)	-0.50	N/A	N/A	<+ 4.201**
CONTROL BANK ROD WORTHS: (pcm)				
A	786.9	781.2	- 5.7	
B	713.1	645.0	- 68.1	
C	860.8	817.8	- 43.0	
D	387.3	388.6	+ 1.3	
SA	213.2	210.1	- 3.1	100 pcm * or
SB	1012.8	926.1	- 86.7	15% *
SC	323.4	313.7	- 9.7	
SD	327.3	316.8	- 10.5	
SE	460.8	456.6	- 4.2	
TOTAL	5085.6	4855.9	- 229.7	± 8%* >90%

NOTE: * Review criteria, all others are acceptance criteria.
** COLR limit is 4.201 BOC.

TABLE 2

POWER ASCENSION FLUX MAP RESULTS: CYCLE 12

ITEM	MAP 1	MAP 2	MAP 3	MAP 3
DATE OF MAP	11/10/06	11/11/06	11/11/06	11/13/06
POWER LEVEL (%)	30.5	48.6	80.3	100.0
CONTROL BANK D POSITION (steps)	160	191	211	226
F_Q	2.2338	2.2049	1.9025	1.8312
$F_{\Delta H}$	1.5926	1.5407	1.4941	1.4650
MAXIMUM INCORE TILT	1.0213	1.0194	1.0153	1.0138
MAXIMUM MEASURED TO PREDICTED POWER DISTRIBUTION ERROR (%)	-11.806	-10.754	-9.330	-8.491
ABSOLUTE AVERAGE MEASURED TO PREDICTED POWER DISTRIBUTION ERROR (%)	3.143	2.859	2.561	2.393