North Atlantic

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The Northeast Utilities System

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Docket No. 50-443

NYN-02075

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

Seabrook Station
Cycle 9 Startup Report

In accordance with the requirements of Technical Specification 6.8.1.1, enclosed is the Cycle 9 Startup Report for Seabrook Station.

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

Very truly yours,

NORTH ATLANTIC ENERGY SERVICE CORP.

G.F. St. Pierre
Station Director

cc: H. J. Miller, NRC Region I Administrator
R. D. Starkey, NRC Project Manager, Project Directorate I-2
G.T. Dentel, NRC Senior Resident Inspector

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ENCLOSURE TO NYN-02075

SEABROOK STATION

UNIT NO. 1

STARTUP TEST REPORT

CYCLE 9

INDEX

1.0 CHRONOLOGICAL SUMMARY

Cycle 9 Fuel Load was completed May 16, 2002. Subsequent operation/testing milestones were completed as follows:

INITIAL CRITICALITY	05/30/02
LPPT COMPLETED	05/30/02
ON LINE	05/31/05
30% PAT COMPLETED	06/01/02
50% PAT COMPLETED	06/02/02
80% PAT COMPLETED	06/03/02
94% PAT COMPLETED	06/04/02
FULL POWER	06/04/02

2.0 CORE DESIGN SUMMARY

The Cycle 9 core is designed to operate for 17,940 MWD/MTU with a coastdown to 19,400 MWD/MTU. Eighty-four (84) fresh fuel assemblies were loaded into the Cycle 9 core. Seventy-two have an enrichment of 3.6 w/o and twelve have an enrichment of 4.0 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 8 utilized 88 fresh fuel assemblies, 64 with enrichments of 3.8 w/o with a similar 2.6 w/o axial annular blanket configuration and the remaining 24 at 4.2 w/o with a similar 2.6 w/o axial annular blanket configuration.

Two mechanical designs are used in the Cycle 9 core:

- The fresh region 11 fuel is of the Robust Fuel Assembly (RFA) design, which includes slightly thicker RCC guide and thimble tubes as well as a different mid-grid design. The mid-grid design is expected to mitigate grid-to-rod fretting seen in V5H assemblies.

- The remaining reload regions 8, 9 and 10 are Vantage 5H.

- All fuel utilizes ZIRLO for fuel clad, control rod guide tubes and instrument thimbles. The top and bottom grids are Inconel-718. In addition, all fuel contains a Performance^{+} debris mitigation grid located at the bottom end plug of the fuel rod

- Region 8 and 9 low-pressure drop mid-zone grids are Zircaloy-4 with Zircaloy sleeves.

- Region 10 and 11 low-pressure drop mid-zone grids are ZIRLO with ZIRLO sleeves.

- Region 10 and 11 fuel assemblies also have three ZIRLO intermediate flow mixers grids.

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. 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.

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

4.0 POWER ASCENSION TESTING SUMMARY

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

In order to determine the core power distribution, flux mapping was performed at 30%, 50% and 100% RTP 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 cycle power ascension data at each test plateau to identify calibration or system problems. The major areas analyzed were:

1. 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.

2. RCS Delta-T Indication: All RCS ΔT loops were initially scaled using Cycle 8 values. Data from 30%, 50%, 80%, and 94% RTP met prescribed acceptance criteria. Data was evaluated at 100% RTP and the ΔT loops were re-scaled.

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 a periodic step change of 1°F to 2°F in hot leg temperature. Cycle 9 data collected at 100% RTP identified an UPA. The data suggest the UPA is not as aggressive as it was at the start of Cycle 8, however it is still present.

4. RCS Temperatures: Data was obtained for the Narrow Range Loop temperatures. Evaluations for Delta-T (°F), T_{AVG} Deviation Alarm Setpoint and T_{AVG} / T_{REF} Indication were performed.

4.0 POWER ASCENSION TESTING SUMMARY (Continued)

5. Steam and Feedwater Flows: Data was obtained for the steam and feedwater flows. Evaluations for deviations between redundant channels on individual steam generators were performed.

6. Steam Generator Pressures: Data was obtained for the steam generator pressures. Evaluations for deviations between redundant channels on individual steam generators were performed.

7. Turbine Impulse Pressure (T_{REF}): The initial scaling of impulse pressure was left the same as Cycle 8. The full power value was slightly higher than the current scaling value and is within the allowed deviation criteria.

8. 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.

9. 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 power ascension test program is essentially unchanged from Cycle 8.

5.0 RESULTS

1. Low Power Physics Testing: Acceptance criteria and 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 the instrumentation. Data collected at 100% RTP suggest the UPA is not as aggressive as it was at the start of Cycle 8. See Table 3 for results.

TABLE 1
LOW POWER PHYSICS RESULTS: CYCLE 9

ITEM	MEASURED	PREDICTED	ERROR	CRITERIA
BORON END POINTS:				
• HZP ALL RODS OUT	1823 ppm	1820 ppm	22 pcm	± 1000 pcm ± 500 pcm *
ALL RODS OUT ITC (pcm/°F)	-1.29	-2.17	0.88	± 2*
ALL RODS OUT MTC (pcm/°F)	0.47	-0.41	N/A	<+ 2.92**
CONTROL BANK ROD WORTHS: (pcm)				
• A	910.6	845.2	- 65.4	100 pcm or 15% *
• B	636.3	601.6	- 34.7	
• C	917.4	847.4	- 70.0	
• D	603.6	562.8	- 40.8	
• SA	271.7	269.2	- 2.5	
• SB	751.0	728.1	- 22.9	
• SC	370.3	368.6	- 1.7	
• SD	381.7	369.5	- 12.2	
• SE	491.2	478.7	- 12.5	
• TOTAL	5333.8	5071.1	- 262.7	8%* >90%

NOTE: * Review criteria, all others are acceptance criteria.
** COLR limit is 2.92 BOC.

TABLE 2

POWER ASCENSION FLUX MAP RESULTS: CYCLE 9

ITEM	MAP 1	MAP 2	MAP 3
DATE OF MAP	06/01/02	06/02/02	06/04/02
POWER LEVEL (%)	29.4	48.8	99.64
CONTROL BANK D POSITION (steps)	149	198	226
RCS BORON (ppm)	1602	1558	1307
F_Q	2.0379	2.3020	1.8854
$F\Delta_H$	1.5175	1.4965	1.4421
INCORE TILT	1.0094	1.0089	1.0057

TABLE 3

FULL POWER THERMAL-HYDRAULIC DATA: CYCLE 9

ITEM	VALUE
REACTOR COOLANT T_{AVG}	586.60 °F
REACTOR COOLANT DELTA-T: • LOOP 1 • LOOP 2 • LOOP 3 • LOOP 4	 58.68 °F 59.09 °F 57.52 °F 58.04 °F
REACTOR COOLANT FLOW: TOTAL	(Based on elbow tap measurements) 406355 GPM
AUCTIONEERED HIGH T_{AVG} T_{REF}	587.34 °F 587.39 °F
TURBINE IMPULSE PRESSURE	667.28 PSIG
STEAM GENERATOR PRESSURES: • A • B • C • D	 966.37 PSIG 968.10 PSIG 968.64 PSIG 968.59 PSIG