North Atlantic

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The Northeast Utilities System

NYN-96008

February 16, 1996

United States Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

Reference: Facility Operating License No. NPF-86, Docket No. 50-443

Subject: Cycle 5 Startup Report

Gentlemen:

In accordance with the requirements of Technical Specification 6.8.1.1, enclosed is the Cycle 5 Startup Report for Seabrook Station.

Should you have any questions, please contact Mr. Anthony M. Callendrello, Licensing Manager, at (603) 474-9521, extension 2751.

Very truly yours,

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Enclosure

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ENCLOSURE 1 TO NYN-96008

Docket No. 50-443

SEABROOK STATION

UNIT NO. 1

STARTUP TEST REPORT

CYCLE 5

INDEX

1.0 CHRONOLOGICAL SUMMARY

Cycle 5 Fuel Load was completed November 26, 1995. Subsequent operation/testing milestones were completed as follows:

INITIAL CRITICALITY	12/09/95
LPPT COMPLETED	12/10/95
ON LINE	12/11/95
30% PAT COMPLETED	12/12/95
50% PAT COMPLETED	12/14/95
75% PAT COMPLETED	12/15/95
90% PAT COMPLETED	12/15/95
FULL POWER	12/16/95
100% PAT COMPLETED	01/12/96

2.0 CORE DESIGN SUMMARY

Cycle 5 is designed to be a transition core to longer 24 month cycle lengths. The Cycle 5 core is designed to operate for 20372 MWD/MTU (530 Effective Full Power Days). 80 fresh fuel assemblies were loaded into the Cycle 5 core with 24 having an enrichment of 4.4 w/o and 56 having an enrichment of 4.8 w/o. In addition, the top and bottom 6 inches of the 80 assemblies have an enrichment of 2.6 w/o creating an axial annular blanket. By comparison, Cycle 4 utilized 72 fresh fuel assemblies with enrichments of 3.6 and 4.0 w/o and no axial annular blanket.

Fresh assemblies for this cycle are Vantage 5H ZIRLO. This design utilizes ZIRLO for fuel clad, control rod guide tubes and instrument thimbles and Zircaloy-4 for the 6 low pressure drop mid grids. The mechanical design is similar to that used in previous cycles with the addition of an inconel protective bottom grid.

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Criticality: Criticality was achieved using a controlled withdrawal of control banks once shutdown banks had been withdrawn.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: Control Bank worths were measured during rod insertion and individual as well as total bank worths were calculated.

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% 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 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 4. At 75% RTP, actual full power ΔT was extrapolated out using data from 30%, 50% and 75% and ΔT rescaled accordingly. At 90% RTP, ΔT was again evaluated and no rescaling was required to support a power increase to 100% RTP. Final adjustments were performed at 100% RTP.

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 prepared at that time to implement a number of operating contingencies should the UPA be present. Cycle 5 data collected at 100% RTP identified the presence of UPA for RCS loops 2 and 3. As a result, Revised T_{HOT} Average Scaling (RTAS) was implemented for loop 2 T_{HOT} signal conditioning circuitry.

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

4.0 POWER ASCENSION TESTING SUMMARY (Continued)

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.

7. Turbine Impulse Pressure (T_{REF}): The initial scaling of impulse pressure was left the same as Cycle 4. Impulse pressure was evaluated at each plateau to determine if the existing scaling would support continued power increase. Final adjustments were performed at 100% RTP.

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 rescaled at 50% and 100% RTP.

9. RCS Flow: A primary heat balance was performed at 90% RTP to determine total RCS flow. The measured flow was corrected for the effects of RCS "hot leg temperature stratification" using Westinghouse methodology [WCAP-14541].

Other than procedure changes to accommodate initial criticality using control banks vice dilution and additional monitoring requirements for " Wide Band Operation" (License Amendment 33) the power ascension test program required no major changes from Cycle 4.

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. An Upper Plenum Anomaly was identified and RTAS was implemented for RCS loops 2 T_{HOT} signals. Total RCS flow was determined to be 100.8% of the allowable Technical Specification limit. See Table 3 for results.

TABLE 1

LOW POWER PHYSICS RESULTS: CYCLE 5

ITEM	MEASURED	PREDICTED	ERROR	CRITERIA
CBD POSITION AT CRITICALITY	99 steps	69 steps	87 pcm	±500 pcm
BORON END POINTS:				
• ALL RODS OUT	1938 ppm	1959 ppm	139 pcm	± 1000 pcm
• CONTROL BANKS INSERTED	1410 ppm	1424 ppm	98 pcm	± 500 pcm *
ARO ITC (pcm/°F)	-2.09	-1.34	0.75	± 2*
ARO MTC (pcm/°F)	-0.43	+0.32	N/A	< 1.95**
CONTROL BANK ROD WORTHS: (pcm)				
• D	621	586	35	± 100*
• C	953	949	4	± 142*
• B	810	800	10	± 120*
• A	1257	1232	25	± 185*
• TOTAL	3641	3567	74	≥3210 ± 357*

NOTE: * Review criteria, all others are acceptance criteria.
** COLR limit is 2.19 (the max over the entire cycle), 1.95 is the BOL surveillance limit.

TABLE 2

POWER ASCENSION FLUX MAP RESULTS: CYCLE 5

ITEM	MAP 1	MAP 2	MAP 3
DATE OF MAP	12/12/95	12/13/95	12/16/95
POWER LEVEL (%)	29.4	49.1	100.0
CBD POSITION (steps)	181	191	225
RCS BORON (ppm)	1682	1618	1395
F_Q	1.9750	1.8890	1.9182
$F_{\Delta H}$	1.5463	1.5095	1.4976
INCORE TILT	1.011	1.0106	1.0089

TABLE 3

FULL POWER THERMAL-HYDRAULIC DATA: CYCLE 5

ITEM	VALUE
RCS T_{AVG}	586.4 °F
RCS DELTA-T: • LOOP 1 • LOOP 2 • LOOP 3 • LOOP 4	 59.62 °F 58.49 °F 56.99 °F 58.64 °F
RCS FLOWS: • LOOP 1 • LOOP 2 • LOOP 3 • LOOP 4 • TOTAL	(corrected for hot leg streaming affects) 97303 GPM 99857 GPM 102823 GPM 98667 GPM 398650 GPM
AUCTIONEERED HIGH T_{AVG} T_{REF}	587.34 °F 586.79 °F
IMPULSE PRESSURE	665.8 PSIG
SG PRESSURES: • A • B • C • D	 971.6 PSIG 971.3 PSIG 970.3 PSIG 967.9 PSIG