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TS 6.9.1

RA-11-017

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Oyster Creek Nuclear Generating Station
Renewed Facility Operating License No. DPR-16
Docket No. 50-219

Subject: Oyster Creek Nuclear Generating Station Unit 1 (OCNGS) Cycle 23 Startup Test Report

Enclosed for your information is the OCNGS Cycle 23 Startup Test Report. This report is submitted in accordance with Technical Specifications (TSs) Section 6.9.1 due to the introduction of a new fuel design GNF-2 at OCNGS.

OCNGS achieved initial cycle criticality on November 30, 2010, and reached steady state full power for the first time in Cycle 23 on December 30, 2010. Startup testing was completed on January 14, 2011, with the exception of the first sequence exchange. A supplementary report will be submitted following the completion of the first sequence exchange.

The refueling and maintenance activities performed during the 1R23 refuel outage which may have impacted the fuel design change include: Core offload of 160 GE11 spent fuel bundles, Core reload of 160 new GNF-2 fuel bundles, replacement of 4 GE Marathon Control Rod Blades, and replacement of 27 control rod drives.

The 30 tests listed in FSAR Appendix 14.2A, and the two additional tests listed in FSAR Table 14.2A-1, were reviewed to determine their applicability given the scope of the fuel design change. Attached are the evaluation results from the applicable tests:

- Control Rod Drives
- Fuel Loading
- Shutdown Margin Testing
- Control Rod Sequence
- LPRM Calibration
- Core Performance Testing
- Calibration of Rods
- Axial Power Distribution
- Rod Pattern Exchange

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All test data was reviewed in accordance with implementing test procedures, and exceptions to any result was evaluated to verify compliance with applicable TS limits and to ensure the acceptability of subsequent test results.

Should you have any questions concerning this letter, please contact Declan Doran at 609-971-4367.

Sincerely,

Michael J. Massaro
Site Vice President
Oyster Creek Nuclear Generating Station

Enclosure:

Cycle 23 Startup Report

cc: USNRC, Regional Administrator, Region I
USNRC, Senior Project Manager, NRR
USNRC, Senior Resident Inspector

Control Rod Drives

Purpose

The purpose of this test is to demonstrate that the control rod scram insertion times are within the operating limits set forth by Technical Specifications (TSs).

Criteria

The maximum scram time averages are described in TS 3.2.B.3. The average of the scram insertion times for the three fastest control rods of all groups of four control rods in a two-by-two array are compared, along with the full core average scram times. The time requirements are below.

Percent Inserted (%)	Core Avg (sec)	2x2 Array (sec)
5	0.375	0.398
20	0.900	0.954
50	2.00	2.120
90	5.00	5.300

Results and Discussions

All control rods were exercised to demonstrate normal notching capability prior to plant startup, and all control rods that underwent maintenance were scram time tested prior to startup.

All control rods were scram time tested while reactor pressure was greater than 800 psig and were well within required TS limits. There are no scram time testing requirements for individual control rods, only 2x2 arrays, and full core averages. The results from scram time testing show that the 2x2 arrays and full core averages are satisfactory. The full core average times are listed below.

Percent Inserted (%)	Core Avg (sec)
5	0.326
20	0.696
50	1.509
90	2.586

Based upon the review of the scram times, there is no notable trend in scram times since last cycle. Therefore, there is no indication of system or configuration degradation.

Fuel Loading

Purpose

The purpose of this test is to load new fuel and to shuffle the existing fuel safely to the final loading pattern as intended for Cycle 23.

Criteria

The as-loaded conditions for the core must conform to the cycle core design used by the Core Management Organization (Global Nuclear Fuels and Nuclear Fuels) in the reload analysis.

During fuel movement, shutdown margin and Source Range Monitor (SRM) connectivity is to be maintained within TS limits.

Results and Discussions

During fuel movement activities, at least two SRMs were operable, one in the quadrant where the core alteration was being performed and one in the adjacent quadrant (TS Section 3.9). Each fuel bundle remained neutronically coupled to an operable SRM at all times as verified by SHUFFLEWORKS, and Shutdown Margin was verified by Exelon Core Manager (ECM) throughout the shuffle. SRM count rates were recorded after each core component move.

The final loading pattern includes 160 new GNF-2 fuel bundles, 180 once burned GE11 bundles, 184 twice burned GE11 bundles, and 36 thrice burned GE11 bundles. The complete Cycle 23 core consists of all barrier fuel.

Core verification was completed on 11/22/10 in accordance with procedure NF-AA-330-1001. To ensure proper fuel loading into the core, the following steps were performed:

- Proper fuel bundle serial number, location and orientation
- Seating verification
- Debris inspection

The verified core loading map was compared with the Core Loading Plan and no discrepancies were found.

Shutdown Margin Testing

Purpose

The purpose of this test is to demonstrate that the reactor will be subcritical throughout the fuel cycle with any single control rod fully withdrawn and all other rods fully inserted.

Criteria

TS 3.A.1 requires that Shutdown Margin (SDM) under all operational conditions shall be equal to or greater than 0.38% delta k/k with the highest worth control rod analytically determined.

OCNGS calculates shutdown margin using an in sequence critical with the strongest control rod analytically determined.

Results and Discussion

Shutdown Margin Measurement test was performed by using the in-sequence critical method using Procedure 1001.27. This in-sequence test satisfies the requirement of the FSAR test by measuring the actual SDM value to verify the TS SDM requirements are met.

The Beginning of Cycle (BOC) SDM was calculated by taking the predicted cycle minimum shutdown margin and then subtracting the difference between the predicted critical eigenvalue and the actual critical eigenvalue. This calculated SDM value based upon plant conditions at criticality was equal to 2.21% $\Delta k/k$. This value was verified to be greater than the required 0.38% $\Delta k/k$ as defined in TS 3.2.A

Control Rod Sequence

Purpose

This test is intended to demonstrate acceptable rod worth's result from the sequence being used.

Criteria

There are no TSs associated with this test, as this test predates the development of the Bank Position Withdraw Sequence (BPWS).

Results and Discussion

The plant uses a BPWS compliant sequence enforced by the Rod Worth Minimizer (RWM) up to 10 % power as allowed by TSs. In-sequence rod worths vary more as a function of the loading than the nuclear fuel type.

BOC criticality was achieved on 11/30/10. The reactor was declared critical at 2022 with RWM Group 4 Control Rod 18-23 at position 20, RWM sequence step 6. Reactor water temperature was 186 degrees F. There were no inoperable control rods and the reactor period was 144 seconds. The actual critical eigenvalue was within .5 mk of the predicted critical eigenvalue.

Final Full power rod pattern was achieved on 1/1/11. All thermal limits remained within their required values.

LPRM Calibration

Purpose

The Purpose of this test is to calibrate the local power distribution monitoring system.

Criteria

All operable detectors are to be calibrated, and the gain adjustment factors (GAF) for each Local Power Range Monitor (LPRM) are within procedural requirements (0.80 – 1.20) to be operable.

Results and Discussion

A full LPRM calibration using Traversing In-core Probes (TIPs) was performed at 100% power. The LPRMs were within their TS Calibration interval and therefore the LPRMs were not re-calibrated from the full set of TIP set obtained at 75% Core Thermal Power (CTP). TIPs were obtained so that a GAF file could be created and used for LPRM adaption in 3D MONICORE. A LPRM Calibration was performed on 1/13/11 and 1/14/11 at 100% power and at equilibrium xenon conditions in accordance with OCNGS Procedures 1001.39 and 620.3.009. All operable LPRMs were successfully calibrated during this surveillance.

Core Performance Testing

Purpose

The purpose of this test is to determine thermal limits, bundle powers, core power, and core flow at various points in the power ascension.

Criteria

All core conditions are to remain within the acceptance criteria for normal operations.

Results and Discussion

Throughout power ascension, 3D MONICORE cases were manually triggered to provide current core conditions. No thermal limits or core parameters were exceeded during these maneuvers.

Calibration of Rods

Purpose

The purpose of this test is to obtain reference relationships between rod motion and reactor power in a standard sequence.

Criteria

Predicted core conditions (power, recirculation flow, thermal limits, etc) are compared to actual core conditions, and anomalies are to be accounted for prior to raising power.

Results and Discussion

During power ascension, 3D MONICORE predictors were routinely performed prior to significant rod or flow maneuvers to provide the operators with the size of expected power change. No anomalies were noted.

Axial Power Distribution

Purpose

The purpose of this test is to compare axial power distributions between online LPRM adapted conditions, and offline PANACEA conditions

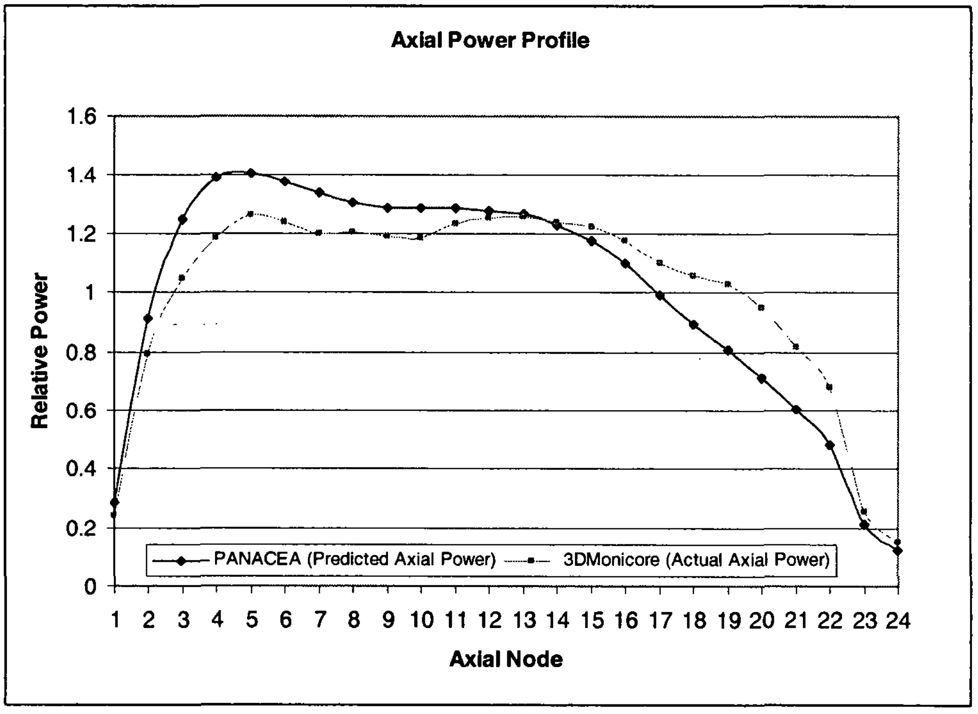
Criteria

Online LPRM adapted conditions are to be comparable to Offline PANACEA conditions to ensure that the core axial power distribution is accurately modeled. Any deviations are to be analyzed.

Results and Discussion

The Axial Power Distribution test was performed comparing Online LPRM adapted 3D MONICORE (3DM) axial power shape to Offline PANACEA axial power shape. Discrepancies were noted in the power shapes, and are discussed below. All results are within TS thermal limits.

Due to a difference in eigenvalue between the actual core reactivity (keff = 1.0071) compared to predicted conditions (keff = 1.0051), the full power steady state rod patterns were different. More deep control rod notches were withdrawn than originally predicted. This results in more power being generated higher in the core, and conversely less power in the bottom of the core, which is reflected in comparison between predicted vs actual relative power as shown below.



AXIAL NODE	PANACEA RELATIVE POWER	3D MONICORE RELATIVE POWER	POWER DIFF
24	0.125	0.153	0.028
23	0.211	0.258	0.047
22	0.478	0.679	0.201
21	0.603	0.817	0.214
20	0.713	0.951	0.238
19	0.807	1.028	0.221
18	0.891	1.061	0.170
17	0.994	1.103	0.109
16	1.103	1.178	0.075
15	1.177	1.223	0.046
14	1.232	1.240	0.008
13	1.266	1.260	-0.006
12	1.277	1.255	-0.022
11	1.285	1.233	-0.052
10	1.286	1.189	-0.097
9	1.287	1.192	-0.095
8	1.305	1.206	-0.099
7	1.337	1.200	-0.137
6	1.376	1.241	-0.135
5	1.407	1.265	-0.142
4	1.392	1.185	-0.207
3	1.249	1.050	-0.199
2	0.914	0.791	-0.123
1	0.285	0.244	-0.041

This difference in the axial power shape did not result in any significant adverse impact to thermal limits compared to predicted plant conditions as shown below.

Thermal Limit	PANACEA Projected Thermal Limits	3D MONICORE Actual Thermal Limits
MFLCPR	0.723	0.751
MFLPD	0.866	0.825
MAPRAT	0.806	0.781

Rod Pattern Exchange

Purpose

The purpose of this test is to determine the representative change in basic rod pattern at a high reactor power level

Criteria

Compare actual core conditions to predicted core conditions to determine correlation between predicted and actual core conditions. Any deviations are to be analyzed.

Results and Discussion

The first Control Rod Sequence Exchange is scheduled at ~3000 MWD/ST (May 2011). A supplementary report will be submitted following the completion of this exchange.