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U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

LaSalle County Station, Unit 2
Facility Operating License No. NPF-18
NRC Docket No. 50-374

Subject: LaSalle 2 Cycle 16 Startup Test Report Summary

Enclosed for your information is the LaSalle County Station (LSCS) Unit 2 Cycle 16 Startup Test Report. This report is submitted in accordance with Technical Requirements Manual Section 5.0.b.

LSCS Unit 2 Cycle 16 began operation on February 27, 2015, following a refueling and maintenance outage. The Unit 2 Cycle 16 core loading consisted of 264 fresh Global Nuclear Fuel GNF-2 fuel bundles, 4 fresh Global Nuclear Fuel GNF-3 fuel bundles, 304 once-burned Global Nuclear Fuel GNF-2 fuel bundles, 190 twice-burned AREVA Atrium-10 fuel bundles, and 2 twice-burned AREVA Atrium-10XM fuel bundles. Also installed in the Unit 2 Cycle 16 reactor were 8 new GE/Reuter-Stokes NA-300 Local Power Range Monitors (LPRMs), and 9 new General Electric Ultra HD control rod blades.

Attached are the evaluation results from the following tests:

- Reactor Core Verification
- Single Rod Subcritical Check
- Control Rod Friction and Settle Testing
- Control Rod Drive Timing
- Shutdown Margin Test (In-sequence critical)
- Reactivity Anomaly Calculation (Critical and Full Power)
- Scram Insertion Times
- Core Power Distribution Symmetry Analysis
- Reactor Recirculation System Performance

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

Should you have any questions concerning this letter, please contact Mr. G. V. Ford, Jr., Regulatory Assurance Manager, at (815) 415-2800.

Respectfully,

Peter J. Karaba
Site Vice President
LaSalle County Station

Attachment

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – LaSalle County Station

Reactor Core Verification

Purpose

The purpose of this test is to visually verify that the core is loaded as intended for Unit 2 Cycle 16 operation.

Criteria

The as-loaded core must conform to the cycle core design used by the Core Management Organization (GNF & Nuclear Fuels) in the reload licensing analysis. Any discrepancies discovered in the loading will be promptly corrected and the affected areas re-verified to ensure proper core loading prior to unit startup.

Conformance to the cycle core design will be documented by a permanent core serial number map signed by the audit participants.

Results and Discussion

Core verification was performed concurrently with core load and shuffle per NF-AA-330-1001, "Core Verification Guideline." The Unit 2 Cycle 16 core verification consisted of a core height, assembly orientation, assembly location, and assembly seating check. Bundle serial numbers and orientations were recorded during the videotaped scans for comparison to the appropriate core loading map and Cycle Management documentation. On February 18, 2015, the core was verified as being properly loaded and consistent with the LSCS 2 Cycle 16 Core Loading Plan, Revision 4. This was documented in WO# 01629633-01.

Single Rod Subcritical Check

Purpose

The purpose of this test is to demonstrate that the Unit 2 Cycle 16 core will remain subcritical upon the withdrawal of the analytically determined strongest control rod.

Criteria

In accordance with LTP-1600-30, the core must remain subcritical, with no significant increase in source range monitor (SRM) readings, with the analytically determined strongest rod fully withdrawn.

Results and Discussion

The analytically determined strongest rod for the Beginning of Cycle 16 for Unit 2 was determined by Nuclear Fuels to be control rod 18-11 per the LSCS Unit 2 Cycle 16 Cycle Management Report, Revision 4. On February 18, 2015, with a Unit 2 moderator temperature of 91°F, Control Rod 18-11 was withdrawn to the full out position (48) and the core remained subcritical with no significant increase in SRM readings. This information is documented in WO# 1736094-01.

Control Rod Friction and Settle Testing

Purpose

The purpose of this test is to demonstrate that excessive friction does not exist between the control rod blade and the fuel assemblies during operation of the control rod drive (CRD) following core alterations.

Criteria

LOS-RD-SR7, “Channel Interference Monitoring” requires beginning of cycle rod settle time in less than or equal to 3.0 seconds. The testing population consists of all control rods.

Results and Discussion

CRD Friction Testing commenced after the completion of the core load verification and single rod subcritical check. All 185 control rods met the appropriate acceptance criteria of less than or equal to 3.0 seconds. The testing was performed on February 25, 2015, and is documented in WO# 01629655-05.

Control Rod Drive Timing

Purpose

The purpose of this test is to check and set the insert and withdrawal speeds of the control rod drives (CRDs).

Criteria

LOS-RD-SR5, "Control Rod Drive Timing," preferred beginning of cycle acceptance criteria for the withdraw times (full-in to full-out) is between 45 and 60 seconds, and insert times (full-out to full-in) is between 40 and 55 seconds.

Results and Discussion

Control rod timing per LOS-RD-SR5 was performed satisfactorily for all 185 CRDMs on February 23-25, 2015, and is documented in WO# 01629268-01. None of the rod withdrawal speeds were faster than the LOS-RD-SR5 preferred criteria.

Shutdown Margin Test

Purpose

The purpose of this test is to demonstrate, from a normal in-sequence critical, that the core loading has been limited such that the reactor will remain subcritical throughout the operating cycle with the strongest worth control rod in the full-out position and all other rods fully inserted.

Criteria

In accordance with Technical Specifications 3.1.1, "Shutdown Margin (SDM)," SDM shall be ≥ 0.38% Δk/k with the highest worth control rod fully withdrawn.

In accordance with LTS-1100-1, "Shutdown Margin Determination," if a shutdown margin (SDM) of 0.38% Δk/k + R cannot be demonstrated with the strongest worth control rod fully withdrawn, the core loading must be altered to restore SDM. R is the reactivity difference between the core's beginning-of-cycle SDM and the minimum SDM for the cycle. The R value for Cycle 16 is 0.00% Δk/k per the LSCS Unit 2 Cycle 16 Cycle Management Report, Revision 4, so an SDM of ≥ 0.38% Δk/k must be demonstrated.

Results and Discussion

The beginning-of-cycle SDM was successfully determined from the initial critical data. The initial Cycle 16 critical occurred on February 26, 2015, on control rod 30-35 at position 10, using an A2 sequence. The moderator temperature was 171 °F, and the reactor period was 288 seconds. Using LTS-1100-1 and the LSCS Unit 2 Cycle 16 Cycle Management Report, Revision 4, the SDM was determined to be 1.503% Δk/k. This was documented in LTS-1100-1, Attachment A and WO# 01629617-01. The SDM was greater than the minimum 0.38% Δk/k that is required to satisfy the Technical Specifications.

Reactivity Anomaly Calculation (Critical and Full Power)

Purpose

The purpose of this test is to compare the actual and predicted critical rod configurations to detect any unexpected reactivity trends.

Criteria

In accordance with NF-LA-715, "Critical Predictions with 3D Monicore," NF-AB-760, "Reactivity Anomaly Determination," and Technical Specifications 3.1.2, "Reactivity Anomalies," the reactivity equivalence of the difference between the actual critical control rod configuration and the predicted critical control rod configuration and the difference between the actual and predicted reactivity of the control rod configuration at full power steady state conditions shall not exceed 1% Δk/k. If the difference exceeds 1% Δk/k, the cause of the anomaly must be determined, explained, and corrected for continued operation of the unit.

Results and Discussion

Two reactivity anomaly calculations were successfully performed during the Unit 2 Cycle 16 Startup Test Program. One reactivity anomaly calculation is from the in-sequence critical and the other is from steady state, equilibrium conditions at approximately 100% full power.

The initial Cycle 16 critical occurred on February 26, 2015, on control rod 30-35 at position 10, using an A2 sequence. The moderator temperature was 171 °F and the reactor period was 288 seconds. The expected k_{eff} supplied by Nuclear Fuels was 1.00200. The actual k_{eff} was 1.00213. The resulting anomaly was 0.013% Δk/k. The anomaly determined is within the 1% Δk/k required for BOC conditions as stated in NF-LA-715. This was documented in NF-LA-715, Attachment 3 and WO# 01629634-01.

The reactivity anomaly calculation for full power steady state operation was performed on March 26, 2015. The data used was from 99.4% power at a cycle exposure of 218.9 MWD/ST at equilibrium conditions. The expected k_{eff} supplied by Nuclear Fuels was 1.0070. The actual k_{eff} was 1.0057. The resulting anomaly was 0.13% Δk/k. This value is within the 1% Δk/k criteria of Technical Specifications. This was documented in NF-AB-760, Attachment 1, and WO# 01629632-01.

Scram Insertion Times

Purpose

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

Criteria

In accordance with LOS-RD-SR12, "Scram Insertion Times," and Technical Specifications 3.1.3, "Control Rod OPERABILITY," the maximum scram insertion time of each control rod from the fully withdrawn position (48) to notch position 05, based on de-energization of the scram pilot valve solenoids as time zero, shall not exceed 7.0 seconds. Also, no more than 12 OPERABLE control rods shall be "slow" in accordance with the below table. In addition, no more than 2 OPERABLE control rods that are "slow" shall occupy adjacent locations.

When the scram insertion time of an operable control rod from the fully withdrawn position (48), based on de-energization of the scram pilot valve solenoids at time zero, exceeds any of the following, that control rod is considered "slow":

Notch Position	Scram Time to Notch Indicated (seconds)
45	0.52
39	0.80
25	1.77
05	3.20

Results and Discussion

Scram testing was completed on February 23, 2015, per WO# 01629520-01. Results of testing are given below.

Notch Position	Core Average Scram Times of all CRDs (secs)
45	0.297
39	0.578
25	1.254
05	2.275

These results also meet the "Option B" Scram Speeds referenced in the Unit 2 Cycle 16 Core Operating Limits Report (TRM Appendix J).

Core Power Distribution Symmetry Analysis

Purpose

The purpose of this test is to verify the core power symmetry.

Criteria

In accordance with NF-AB-707, "3D Monicore – Operation and Maintenance," the Transversing Incore Probe (TIP) uncertainty value must be less than 6%.

Results and Discussion

Core power symmetry calculations were obtained on March 31, 2015, based upon data obtained from a full core TIP set (OD-1) at approximately 100% power. The TIP uncertainty value was 2.69%. This was documented in WO# 1790742-01.

Reactor Recirculation System Performance

Purpose

The purpose of this test is to collect sufficient baseline data at the beginning of cycle to establish the following relationships:

- core thermal power vs. total core flow
- recirculation total drive flow vs. total core flow
- core plate flow vs. total core flow
- recirculation flow control valve position vs. loop drive flow
- jet pump readings vs. loop drive flow

Criteria

In accordance with LTP-1600-13, "Recirculation System Performance" and Technical Specifications 3.4.1 "Recirculation Loops Operating," and 3.4.3, "Jet Pumps,", the performance curves used in conjunction with reactor recirculation (RR) system flow and differential pressure data will establish baseline data to determine if possible jet pump or recirculation pump degradation exists.

The established baseline performance curves will also be used to verify jet pump operability to determine if jet pump anomalies exist.

Results and Discussion

RR data was collected during the L2C16 startup. Data was obtained from computer points for all the points of interest to evaluate the RR System performance. The RR performance curves were updated for L2C16; no significant changes from L2C15 were noted in the curves. This was completed on April 17, 2015, and is documented in WO#1627372-01.