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

LaSalle County Station, Unit 1
Facility Operating License No. NPF-11
NRC Docket No. 50-373

Subject: LaSalle Unit 1 Cycle 17 Startup Test Report Summary

Enclosed for your information is the LaSalle County Station (LSCS) Unit 1 Cycle 17 Startup Test Report. This report is submitted in accordance with Technical Requirements Manual Section 5.0.b.

LaSalle County Station Unit 1 Cycle 17 (L1C17) began operation on March 10, 2016, following a refueling and maintenance outage. The Unit 1 Cycle 17 core loading consisted of 276 fresh Global Nuclear Fuel GNF-2 fuel bundles, 288 once-burned Global Nuclear Fuel GNF-2 fuel bundles, and 200 twice-burned Global Nuclear Fuel GNF-2 fuel bundles. Also installed in the Unit 1 Cycle 17 reactor were 8 new GE/Reuter-Stokes NA-300 Local Power Range Monitors (LPRMs) and 2 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 Specifications limits and to ensure the acceptability of subsequent test results.

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

Respectfully,

William J. Trafton
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 1 Cycle 17 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 in accordance with NF-AA-330-1001, "Core Verification Guideline." The Unit 1 Cycle 17 core verification consisted of a core height, assembly orientation, assembly location, and assembly seating check. Bundle serial numbers and orientations were recorded during the video recorded scans for comparison to the appropriate core loading map and Cycle Management documentation. The core was verified as being properly loaded and consistent with the LaSalle Unit 1 Cycle 17 Core Loading Plan, Revision 5. This was documented in Work Order (WO) 1727936-01.

Single Rod Subcritical Check

Purpose

The purpose of this test is to demonstrate that the Unit 1 Cycle 17 core will remain subcritical upon the withdrawal of the analytically determined strongest control rod.

Criteria

In accordance with LTP-1600-30, "Single Rod Subcritical Check," 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 17 for Unit 1 was determined by Nuclear Fuels to be Control Rod 54-31 in accordance with the LaSalle Unit 1 Cycle 17 Cycle Management Report, Revision 3. With a Unit 1 moderator temperature of 95°F, Control Rod 54-31 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 1727931-01.

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

Appropriate acceptance criteria are provided in LOS-RD-SR7, "Channel Interference Monitoring," and include limits on rod settle time. The control rod settle test acceptance criterion is less than or equal to 7 seconds.

Results and Discussion

CRD Friction Testing commenced after the completion of the core load verification and single rod subcritical check. All 185 control rods settled in less than 4.4 seconds, which is documented in WO 1727920-05 and WO 1727856-01.

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 in accordance with LOS-RD-SR5 was performed satisfactorily for all 185 CRD mechanisms on March 8, 2016 and is documented in WO 1782448-01. 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 analytically determined.

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 17 is 0.00% Δk/k in accordance with the LaSalle Unit 1 Cycle 17 Cycle Management Report, Revision 3; therefore, a 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 17 critical occurred on March 8, 2016, on Control Rod 38-35 at position 38, using an A2 sequence. The moderator temperature was 177.8 °F and the reactor period was 400 seconds. Using LTS-1100-1 and the LaSalle Unit 1 Cycle 17 Cycle Management Report, Revision 3, the SDM was determined to be 1.594% Δk/k. This was documented in LTS-1100-1, Attachment A and WO 1727862-01. The SDM was greater than the minimum 0.38% Δk/k that is required to satisfy the Technical Specifications.

Reactivity Anomaly Determination

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 LaSalle Unit 1 Cycle 17 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 17 critical occurred on March 8, 2016, on Control Rod 38-35 at position 38, using an A2 sequence. The moderator temperature was 177.8 °F and the reactor period was 400 seconds. The expected k_{eff} supplied by Nuclear Fuels was 1.0020. The actual k_{eff} was 1.00264. The resulting anomaly was 0.064% Δk/k. The anomaly determined is within the 1% Δk/k required for beginning-of-cycle conditions as stated in NF-LA-715. This was documented in NF-LA-715, Attachment 3 and WO 1727939-01.

The reactivity anomaly calculation for full power steady state operation was performed. The data used was from 99.8% power at a cycle exposure of 31.5 MWD/sT at equilibrium conditions. The expected k_{eff} supplied by Nuclear Fuels was 1.0070. The actual k_{eff} was 1.0085. The resulting anomaly was 0.15% Δk/k. This value is within the 1% Δk/k criteria of the Technical Specifications. This was documented in NF-AB-760, Attachment 1, and WO 1727932-01.

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 Technical Specifications 3.1.4, "Control Rod Scram Times."

Criteria

In accordance with LOS-RD-SR12, "Scram Insertion Times," and Technical Specifications 3.1.4, "Control Rod Scram Times," 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 as 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 performed in accordance with WO 1727920-06, 1727947-01, and 1879186-01. Results of testing are given below.

Notch Position	Core Average Scram Times of all CRDs (sec)
45	0.299
39	0.587
25	1.277
05	2.314

These results also meet the "Option B" Scram Speeds referenced in the LaSalle Unit 1 Cycle 17 Core Operating Limits Report (TRM Appendix I).

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 Traversing Incore Probe (TIP) uncertainty value must be less than 6%.

Results and Discussion

Core power symmetry calculations were obtained based upon data obtained from a full core TIP set (OD-1) at approximately 100% power. The TIP uncertainty value was 3.52%. This was documented in WO 1880287-01.

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 3.4.3, "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 L1C17 startup from computer points for all the points of interest to evaluate the RR system performance. The RR performance curves were updated for L1C17, and no significant changes from L1C16 were noted in the curves. This is documented in WO 1724356-01.