QUAD-CITIES NUCLEAR POWER STATION

UNIT ONE CYCLE 15

STARTUP TEST RESULTS

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1. Core Verification

Purpose

To verify proper core location and orientation for each fuel assembly.

Criteria

Prior to reactor startup the actual core configuration shall be verified to be identical to the planned core configuration.

Results and Discussion

Verification of the Cycle 15 core was completed on April 25, 1996. The orientation, seating, and serial number (bundle ID) were verified for each assembly. The first inspection was made to verify orientation and seating of assemblies. A second pass was subsequently made to verify bundle serial numbers.

2. Shutdown Margin Demonstration and Control Rod Functional Checks

Purpose

The purpose of this test is to demonstrate for this core loading in the most reactive condition during the operating cycle, that the reactor will remain subcritical with the strongest control rod fully withdrawn and all other rods fully inserted.

Criteria

The shutdown margin (SDM) shall be greater than 0.38% Δk with the highest worth control rod analytically determined.

Results and Discussion

On April 26,1996 control rod H-14 was fully withdrawn to demonstrate that the reactor would remain subcritical with the strongest rod out. This rod was calculated by Nuclear Fuel Services (NFS) to have the highest worth with the core fully loaded. The strongest rod out maneuver was performed to allow single control rod withdrawals for CRD testing.

Control rod functional checks were performed as part of control rod friction testing. No unexpected reactivity insertions were observed when any of the 177 control rods were withdrawn.

Prior to the initial critical, NFS calculated the shutdown margin to be 1.123% Δk at 0 MWd/ST, which is the point of minimum shutdown margin for Cycle 15 (R = 0). The critical rod pattern eigenvalue (from NFS data) was 1.0100 and the SRO eigenvalue was 0.9908. Corrections for moderator temperature and reactor period were -0.357% Δk and 0.0445% Δk, respectively. Adding the corrections to the critical eigenvalue less the SRO eigenvalue, the shutdown margin for Cycle 15 was determined to be 1.5185% Δk. This value was further corrected (for uncertainty in GE local critical calculations of 0.3% Δk) to 1.22% Δk.

3. Initial Critical Prediction

Purpose

The purpose of this test is to calculate the reactivity difference (%Δk) between the predicted and actual critical eigenvalues.

Criteria

The reactivity equivalence of the difference between the actual rod density and the predicted rod density shall not exceed 1% Δk.

Results and Discussion

The reactor was brought critical on August 24, 1996 at 2140 hours with reactor water temperature 160°F. The Δk difference between the expected critical rod pattern and the actual critical rod pattern (at 68°F) was 0.008 from rod worth tables supplied by NFS. The temperature effect was -0.00357 Δk from NFS supplied corrections. The excess reactivity from the 148 second period was 0.000445 Δk. These reactivities sum to a 0.00399 Δk difference (0.399% Δk) between the expected critical rod pattern and the actual rod pattern, which is within the 1% Δk criteria of this test.

4. Core Power Distribution Symmetry Analysis

Purpose

The purpose of this test is to determine the magnitude of core power distribution asymmetries using data (TIP traces and OD-1) collected in conjunction with the LPRM calibration.

Criteria

The total TIP uncertainty shall be less than 9% and the maximum difference between symmetric TIP pairs shall be less than 25%.

Results and Discussion

Core power symmetry calculations were performed based on OD-1 data from September 13 and September 26, 1996. The average total TIP uncertainty from these data sets was 4.308%, which satisfies the 9% limit. The random noise uncertainty was 1.253%, and the geometrical uncertainty was 4.112%. The maximum deviation between symmetric TIP pairs was 13.997% for pair 16-28, which meets the 25% limit.