UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30303

Report Nos.: 50-348/84-12 and 50-364/84-12

Licensee: Alabama Power Company
600 North 18th Street
Birmingham, AL 35291

Docket Nos.: 50-348 and 50-364 License Nos.: NPF-2 and NPF-8

Facility Name: Farley Units 1 and 2

Inspection on April 23-27, 1984

Inspection at Farley site near Dothan, Alabama

Inspector: for P. T. Burnett — 5/16/84 Date Signed

Approved by: for F. Jape, Section Chief, Engineering Branch, Division of Reactor Safety — 5/16/84 Date Signed

SUMMARY

Areas Inspected

This routine unannounced inspection involved thirty-four inspector-hours on site in the area of post-refueling, startup tests.

Results:

No violations or deviations were identified.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

W. G. Hairston, Plant Manager
*S. D. Woodard, Assistant Plant Manager
*D. N. Morey, Operations Superintendent
*W. B. Shipman, Maintenance Superintendent
*C. D. Nesbitt, Technical Superintendent
*R. Marlow, Technical Supervisor
*W. G. Ware, SAER Supervisor
*S. K. Osterholtz, Reactor Engineering Supervisor
W. MacDonald, Reactor Engineer

Other Organization

L. Grobmeyer, Westinghouse (by telephone)

NRC Resident Inspectors

*W. H. Bradford, Senior Resident Inspector
W. Ruland

*Attendend exit interview

2. Exit Interview

The inspection scope and findings were summarized on April 27, 1984 with those persons indicated in paragraph 1 above. The following followup items were identified:

348, 364/84-12-01: Negative period calibrations of the reactivity computer paragraph 5.a(3);

348, 364/84-12-02: Evaluate use of chi-squared test of SRNIs, paragraph 5.b.

3. Licensee Action on Previous Enforcement Matters

Not inspected.

4. Unresolved Items

Unresolved items were not identified during this inspection.

5. Post-Refueling Startup Tests

a. Pre-critical Tests (72700)

(1) FNP-0-IMP-2303 (Revision 1), Verification of Rod Control System Operability was performed at cold shutdown during the period April 19-20, 1984. The test confirmed that control banks and shutdown banks moved at the proper speeds or stepping rates. Electrical wave forms for the stationary and moveable grippers and lift coils were compared and found to be essentially identified among shutdown bank rods and among control bank rods. All associated systems functioned properly. Normal bank overlap was demonstrated. Trace comparison was performed using transparent overlaps. The inspector reviewed a few traces of each kind and observed no significant differences between the overlaps traced from the first rods moved and the traces for the rods reviewed.

(2) FNP-1-STP-112 (Revision 7), Rod Drop Time Measurement was performed in the period April 20-22, 1984. Review of the test data sheets confirmed that all rod drops were performed at temperatures in excess of 541°F and pressures in excess of 2000 psig. All reported rod drop times were significantly less than the maximum of 2.2 allowed by technical specification 3.1.3.4. The inspector independently analyzed ten of the rod-drop traces, selected at random, and obtained values in good agreement with those reported.

(3) FNP-0-IMP-108 (Revision 7) Westinghouse Solid-State Reactivity Computer Adjustment, Hookup, and Checkout (issued July 11, 1983) was completed prior to the start of zero power testing. Review confirmed that the delay neutron parameters specified in the core design report (WCAP-10525) were input to the computer. Part of the checkout of the computer includes input test exponential signals to confirm a proper computer response and output. Only positive exponential signals were used, inspite of the fact that the computer is used to measure negative exponentials (negative periods and reactivities) as well.

The vendor (Westinghouse) had developed a circuit modification for some models of reactivity computers to generate a negative exponential signal for calibrating the response of the computer to negative periods. A telephone conversation with a vendor representative revealed that the modification is not currently available for the reactivity computer of Farley. Nevertheless, the licensee did express an interest on such capability and will pursue the subject further (Inspector Followup Item 348/364/84-12-01: Negative period calibration of the reactivity computer).

b. Zero Power Physics Tests (61708, 61710)

This activity was controlled by FNP-1-ETP-3601 (General Revision 1), Zero Power Physics Test Procedures.

For post-refueling operation Appendix A, of this procedure guided the approach to and achievement of initial criticality using the inverse count rate ratio (ICRR) method to monitor the changing reactivity of the core. Reactivity changes were first made by incremental withdrawal of safety and control rods in normal operational order and then by dilution the reactor coolant system (RCS) boron concentration. Dilution rates were reduced as ICRR decreased.

Following criticality the procedure was used to demonstrate adequate overlap between source range and intermediate range nuclear instruments and the minimum level at which nuclear heating effects were observed. The upper power limit for zero power test program was then made a fraction of the minimum power to avoid doppler interference with reactivity measurements.

The operability of the reactivity computer was then verified over the range -13.6 pcm to + 30.6 pcm, by comparing computer solutions of reactor periods with those obtained from stop-watch period measurements and the inhour equation. Acceptable agreement was obtained.

In reviewing the approach to criticality it was observed that the licensee did not make use of the chi-squared test to gain assurance that the source range nuclear instruments (SRNI) (pulse counters) were responding primarily and properly to neutrons. After discussion of the test, the licensee agreed to review the benefits of using the test during times when safe operation is dependent on properly functioning SRNIs. These times include refueling, initial criticality of a new core, and periods of reduced vessel water level to facilitate maintenance and inspection (Inspector Followup Item 348/364/84-12-02: Evaluate use of chi-squared test of SRNIs).

(1) Appendix B, Boron End Point Measurements, was used to obtain precise boron concentrations for specified rod-boron configurations. The measured critical boron concentration for the all-rods-out (ARO) configuration was 1804 ppmB, which was in good agreement with the predicted value of 1792 ppmB.

(2) Appendix C, Isothermal Temperature Coefficient Measurements, was performed for the ARO configuration. The inspector's evaluation of the slopes of the x-y recorder traces yielded values in good agreement with those determined by the licensee. The licensee's derived, average value of the moderator temperature coefficient was 0.455 x10-4 delta k/k degree F, which is less positive then that allowed by Technical Specification 3.1.1.3.

(3) Appendix E, Control Bank Worth Measurement, was used to measure to the worth of a reference rod bank (control B) by boron dilution and the worth of each other rod bank by interchange with control B.

The chart recorder record of the reactivity computers output was reviewed for the measurement of control bank B. For about 70% of group span, the inspector independently determined the values of the reactivity increments. No significant differences from values recorded by the licensee were observed. In a few cases the negative reactivity swing had been more negative than the -13.6 pcm for which the computer was qualified. (See discussion under Appendix A.)

Using the observations recorded by the licensee the inspector independently calculated the reactivity worth of each remaining rod bank using the procedure and formula for rod interchange. Closely comparable results were obtained.

The inspector's questions on the methodology were answered in a conference call with a licensee and a Westinghouse representative.

6. Independent Inspection (92706)

The return of Unit 1 to criticality following a brief (about one day) maintenance outage was observed in the control room. The first attempt did not lead to criticality with all rods out. Licensee personnel reviewed the estimated critical position (ECP) calculation and identified three errors totaling 189 pcm reactivity error:

(1) Power history was incorrectly entered into the xenon reactivity calculation (-109 pcm).

(2) The program for calculating xenon concentration had not had parameters updated for the new core (-20 pcm).

(3) The RCS boron concentration was calculated to be 1675 ppm, but subsequent measurements showed it to be 1702 ppm (-60 pcm).

Individually and collectively these errors are not significant and are well within the +500 pcm and -1000 pcm tolerance allowed by procedures. After making the corrections indicated and reducing boron concentration, criticality was achieved within a few pcm of the new prediction. The licensee's further corrective action included scheduling a meeting of the reactor engineering group to discuss the lessons learned.