U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Report No. 50-334/82-18

Docket No. 50-334

License No. DPR-66 Priority - Category C

Licensee: Duquesne Light Company

435 Sixth Avenue

Pittsburg, Pennsylvania 15219

Facility Name: Beaver Valley Unit No. 1

Inspection At: Shippingport, Pennsylvania

Inspection Conducted: July 19 - 22, 1982

Inspectors: Charles Petrone 8/23/82
C. D. Petrone, Reactor Inspector date

Approved by: L H Bettenhausen 8/23/82
L. H. Bettenhausen, Ph.D., Chief, date
Test Program Section

Inspection Summary:

Inspection on July 19 - 22, 1982 (Report 50-334/82-18)

Areas Inspected: Routine, unannounced inspection of refueling startup testing program, including core power distribution limits, incore/excore calibration, core thermal power evaluation, determination of reactor shutdown margin, isothermal temperature coefficient determination, control rod worth measurement, control rod drop tests, control rod position indication checks, and core load verification. The inspection involved 28 inspection hours onsite by one region based inspector.

Results: No violations were identified.

DETAILS

1.0 Persons Contacted

1.1 Duquesne Light Company

R. Collins, Test Engineer
* M. Coppula, Technical Services Superintendent
* K. Grada, Superintendent of Licensing
* F. Lipchick, Senior Compliance Engineer
L. Hendrickson, Test Engineer
* J. Malloy, QA Engineer
J. Mentzer, Nuclear Operations Engineer
* J. Sieber, Manager, Nuclear Safety and Licensing
* G. Zupsic, Coordinator, Station Study Projects

1.2 Nuclear Regulatory Commission

* W. Troskoski, Resident Inspector

The inspector also interviewed other members of the licensees staff during this inspection.

* identifies those present at the exit interview on July 22, 1982.

2.0 Post Refueling Core Verification

The licensee performed the core mapping verification on April 12, 1982 in accordance with FP-DLW-RC, BVPS Unit 1, Cycle II-III Refueling Procedure, dated February 25, 1982. The inspector reviewed the data sheets and noted that all entries and verification signatures were completed satisfactorily. The inspector also viewed the videotape taken during the performance of the core verification to determine if the fuel assemblies had been loaded in the intended core locations. Although no discrepancies

were identified between the videotape and the core map in the refueling procedure, the quality of the videotape was such that the serial numbers of approximately 20% of the fuel assemblies could not be verified by this inspector. The licensee personnel performed the verification by direct observation of the video monitors while videotaping the core top, and not by review of the completed videotape. The camera operator verified the serial number and location of each fuel assembly as it was videotaped, while an engineer and a QA inspector independently verified the fuel location on a separate monitor. At the exit interview, the licensee stated an attempt would be made to improve the quality of the tape made during the next refueling outage. They would do this by adjusting the lighting and focus over each fuel assembly, as needed.

No violations were identified.

3.0 Control Rod Drop Time Measurements

3.1 Control Rod Drop Time Measurements

BVT 1.1-1.1.1, Control Rod Drop Time Measurement was performed on June 14, 1982 with the reactor coolant system hot and operating at full flow. The inspector reviewed the procedure for technical adequacy and compliance to technical specifications. TS 3.1.3.3 requires that the drop times shall not exceed 2.2 seconds from the beginning of decay of the stationary gripper coil voltage to dashpot entry. The inspector reviewed the rod drop test results and verified that the drop times for all 48 rods were well within acceptance criteria. The inspector also reviewed several visicorder traces and verified that the drop times had been interpreted correctly from these selected traces.

3.2 Control Rod Position Indication System Tests

BVT 1.1-1.1.3, Control Rod Position Indication System Test was completed on July 17, 1982. This test is performed to calibrate the rod position indication system and to verify the system satisfactorily

performs the required indication and alarm functions for each individual rod at hot standby conditions. The licensee performed the first calibration with the reactor coolant system at 540° and 2,235 psig (mode 3). Using information obtained from this calibration, new (non-linear) scales (meter face overlays) were developed for each rod position indication meter. These new scales were attached to each meter face to custom calibrate each meter. This improved the accuracy to the point where all meters except one met the ±12 step accuracy requirement of Technical Specification 3.1.3.3. The licensee was granted temporary relief from the requirement for ±12 step accuracy in modes 3, 4, and 5. At a meeting with the NRC on July 13, 1982 in Bethesda, Maryland the licensee addressed the issue and explained the limitations of the rod position indication system. Representatives from the NRC agreed that the temporary relief provided in amendment 52 would be made permanent by relaxing the ±12 step accuracy requirement in modes 3, 4, and 5.

The inspector had no further questions at this time.

4.0 Nuclear Design and Core Management Report

The inspector reviewed WCAP 100037, The Nuclear Design and Core Management of the Beaver Valley Unit 1 Power Plant, Cycle 3, which includes information on fuel loading, power distribution, reactivity coefficients, control rod worth and operational limitations. This report presents the data necessary for startup and core physics testing.

During this review the inspector noted that discrepancies existed between the core map (figure 2.2) and the core map contained in the refueling procedure, FP-DLW-R2. The Nuclear Design and Core Management report indicates the fuel assemblies in positions L-38 and E-8 to be ZO1 and ZO2, respectively. The refueling procedure indicates these assemblies are actually ZD1 and ZD2. A review of the videotape taken during core verification confirmed that the fuel assembly serial numbers are actually ZD1 and ZD2, in agreement with the refueling procedure.

The licensee's representative contacted the authors of the Nuclear Design and Core Management (Westinghouse) report and received confirmation that the core map, figure 2.2, contained typographical errors and that the correct fuel assembly serial numbers were ZD1 and ZD2, not ZO1 and ZO2. The authors also stated that they reviewed the core loading plan and figure 2.2 and found no additional typographical errors.

The inspector identified no other discrepancies.

5.0 Pre-Critical Tests

BVT 1.3-2.2.1, Initial Approach to Criticality After Refueling, Category I, Issue I, dated May 3, 1982 was used to achieve initial criticality after refueling, to determine the upper limit of the neutron flux (doppler limit) for all zero power physics measurements (HZP Physics Testing Decade), and to verify proper calibration of the reactivity computer.

The inspector reviewed this procedure to verify that prerequisites were signed off, data entries were recorded correctly, verification signoffs were made, and results were within procedure requirements and technical specifications. It was noted that:

- The checkout of the reactivity computer was performed satisfactorily on July 6 and July 7, 1982 in accordance with Appendix A.

- Initial criticality was achieved on July 7, 1982 and the HZP ARO boron concentration, was measured to be 1,496 ppm. This is in acceptable agreement with the predicted value of 1,467 ± 50 ppm boron.

- The determination of the upper limit of the neutron flux (Doppler limit) for zero power physics testing decade was performed on July 7, 1982. The zero power physics testing decade was determined to be 3×10^{-8} amps full scale.

No deficiencies were identified.

6.0 Post-Critical Tests

BVT 1.3-2.2.2, Core Design Check List is used to verify design data at 0% and 100% power and to obtain calibration data for the excore instrumentation.

6.1 Section VII.A covers the zero power physics tests. The inspector reviewed the results of the following zero power physics tests.

- Boron Endpoint

  Appendix A was used to obtain the All Rods Out (ARO) boron endpoint while withdrawing control bank "D" (CBD) to 221 steps.

- Isothermal Temperature Coefficient

  Appendix B was performed on July 7, 1982 to determine the ARO Isothermal Temperature Coefficient (ITC). The reactivity computer was used to plot the change in reactivity versus reactor coolant system temperature (Tave). The following results were obtained:

Rod Position	Measured ITC pcm/°F	Acceptance Criteria
ARO	-1.745	-3.0 ± 3 pcm/°F
CBD at 0, All Other Rods Out	-4.37	-5.9 ± 3 pcm/°F

- Low Power Incore Moveable Detector Flux Maps

  Two incore flux maps were run to check for core power anomalies at 0% power. The results of the HZP ARO flux map showed a major axis quadrant power tilt of 4.8%. The measured peaking

factors ($F_{\Delta H}$, F_Q) were well within technical specification limits. Based on these results, Westinghouse recommended that the licensee increase power to 40±5% and take another flux map with the plant stabilized at equilibrium conditions. A flux map was run at 45% power; the following results were calculated from the data obtained:

		Actual	Acceptance Criteria
Quadrant Tilt		1.013 (maximum)	less than 1.02
$F_{\Delta H}$		1.4582	less than 1.7208
F_{xy}	upper	1.5305	less than 1.8318
	middle	1.5720	1.8651
	lower	1.5500	1.8651
F_Q		2.0092	less than 4.5045

6.2 Section VII.B is used to obtain the data required to calibrate the excore instrumentation. This is done by running a series of four flux maps at different axial offsets. At the time of this inspection, the licensee was performing these flux map runs. The inspector observed flux mapping activities in the control room on July 21, 1982 and noted that these tests were being performed in accordance with an approved written procedure by qualified personnel using calibrated instruments.

No discrepancies were observed.

7.0 Core Thermal Power Evaluation

The licensee performs a daily check of reactor thermal power by calculating daily heat balance using the C1-3 log sheet. The inspector reviewed the log sheets for tests performed on July 12, 13, and 14.

No discrepancies were identified.

8.0 Shutdown Margin Calculation

The licensee performs shutdown margin calculations in accordance with OST 1.49.1 when the reactor is critical (modes 1 & 2) and in accordance with OST 1.49.2 when shut down (modes 3, 4 and 5). The inspector reviewed the data sheets associated with the tests performed on July 13, 14 and 15 in accordance with OST 1.49.1, and on July 6, 7, 16 and 17 in accordance with OST 1.49.2. The inspector observed that an error had been made on one of the OST 1.49.1 data sheets. Figure 2 of OST 1.49.1 is a graph of Integral Rod Worth versus Rod Bank Position Steps Withdrawn. The operator is required to use figure 2 to determine rod bank worth from the known rod bank position. In this case, the operator misinterpreted the units on the rod bank position axis and came up with an incorrect integral rod worth. The error was apparently due to the unwieldly units (10 divisions equals 40 rod bank steps) used on the figure. The error was conservative in that the actual shutdown margin was greater than the calculated shutdown margin. The inspector determined this to be a minor error.

During the exit interview, the licensee's representatives committed to correct the data sheet and to brief each shift of operations personnel on the importance of accurate shutdown margin calculations. The licensee also committed to clarify OST 1.49.1 by re-drawing figure 2.

The inspector had no further questions in this area.

9.0 Exit Interview

At the conclusion of this inspection the inspector met with those persons identified in paragraph 1.0 and presented the scope and findings of this inspection.