DRESDEN UNIT 3

CYCLE 7

Startup Testing Summary

Dresden Unit 3 resumed commercial operation for Cycle 7 on May 3, 1980 following a refueling and maintenance outage which included the reloading of 200 P8DRB265L fuel assemblies (pre-pressurized, 8 x 8 retrofit fuel). Since this is a new fuel design for Dresden 3, a comprehensive startup testing program was performed as required by Technical Specification 6.6.A.1 (Appendix A to DPR-25, Docket No. 50-249). The following is a summary of the startup testing results.

The major new design feature of the pre-pressurized, 8 x 8 retrofit fuel is that the helium backfill pressure has been increased from 1 atmosphere to 3 atmospheres, resulting in improved pellet-to-clad heat transfer. As stated in NEDE-23786-1-P (Fuel Rod Pre-pressurization Amendment 1), the pre-pressurization is a relatively simple design improvement expected to enhance fuel reliability. Evaluations of LOCA, transient and stability analyses (see above referenced LTR) indicated that fuel rod pre-pressurization had only minor effects on core safety parameters. In light of these considerations, no significant changes in core response or operation are anticipated.

The startup test program performed was similar to that performed for previous reloads at Dresden 2 and 3. The program consisted of various physics tests (shutdown margin, critical eigenvalue comparison, moderator temperature coefficient, etc.), instrument calibrations (LPRM, TIP's, flow instrumentation), and determination of baseline recirculation flow data as addressed by the Technical Specifications, Final Safety Analysis Report, and previous commitments to the Nuclear Regulatory Commission. No unusual conditions were noted, and test results were similar to previous cycles. This was expected due to the minimal changes in the fuel design.

Summaries of the startup tests identified in the Draft Regulatory Guide on refueling and startup tests for LWR reloads are attached. Additional test results are available at the site.

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Startup Test No. 1
Core Verification and Audit

PURPOSE

The purpose of this test is to visually verify that the core is loaded as intended.

CRITERIA

The as-loaded core must conform with the reference core loading upon which the licensing analysis was performed. At least one independent person must either participate in performing the verification or review a videotape of the verification prior to a startup. Any discrepancies discovered in the loading will be promptly corrected and the affected areas re-verified to be properly loaded prior to startup.

Conformance to the reference loading will be documented by a permanent core serial number map signed by the verifiers.

RESULTS AND DISCUSSION

The Cycle 7 core verification consisted of a core height check performed by the Fuel Handlers and two videotaped passes over the core by Nuclear Engineering personnel during which assembly orientations and locations were verified. Two independent CECo. auditors participated in the verification of the reactor core. No discrepancies were discovered.

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Startup Test No. 2
Control Rod Functional and Friction Test During Core Reload

PURPOSE

The purpose of this test is to assure that all control rods are functioning properly.

CRITERIA

A. Each control rod will be withdrawn after the four fuel bundles surrounding the given control rod are loaded. This will insure that the mobility of the control rod is not impaired.

B. During the control rod movement, the process computer is used to time the travel of the rod between even notches to verify proper withdrawal and insertion times. Drive times are to be adjusted to 48 seconds ±10% under normal drive pressures.

RESULTS AND DISCUSSION

Each control rod was withdrawn and reinserted after the four fuel bundles surrounding the given control rod were loaded. Control rod mobility was assured. During friction testing, control rod F14 was found to have a withdrawal time faster than the 43.2 seconds that is procedurally allowed. To allow oreration in this condition, Operating Order #26-80 requires that rod F14 must be notched out whenever it is withdrawn until the problem is corrected. All other control rods were friction tested successfully.

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Startup Test No. 3
Control Rod Subcritical and Overtravel Checks After Core Loading

PURPOSE

The purpose of this test is to assure that no gross local reactivity irregularities exist and that each control blade is latched to its control rod drive.

CRITERIA

After the core is fully loaded, each control rod will be withdrawn and inserted one at a time to assure that criticality will not occur due to the withdrawal of a single rod. Nuclear instrumentation will be monitored during the movement of each control rod to verify subcriticality. Once a control rod is fully withdrawn, it is tested for overtravel by trying to withdraw the rod further. A control rod fails the overtravel check if rod position indication is lost or if the overtravel alarm is received.

RESULTS AND DISCUSSION

After the core was loaded, each control rod was withdrawn and inserted one at a time. The Source Range Monitors were observed during the movement of each rod and subcriticality was verified. All of the control rods successfully completed the overtravel checks.

DRESDEN UNIT 3

Startup Test No. 4

Initial Criticality Comparison

PURPOSE

The purpose of this procedure is to perform a critical eigenvalue comparison. This is done by comparing the predicted critical control rod pattern to the actual critical control rod pattern and accounting for period and temperature coefficient corrections.

CRITERIA

The actual cold critical rod pattern should be within 1% ΔK of the predicted control rod pattern. If the difference is greater than $\pm 1\%$ ΔK, General Electric and Commonwealth Edison Company core management engineers will be promptly contacted to investigate the anomaly.

RESULTS

The Unit 3 critical occurred on April 24, 1980 at 1:48 p.m. on the A sequence. The moderator temperature was 164° F and the period was 185 seconds. The General Electric predictions and rod worths were performed using the PANACEA code, which assumed a 68° F moderator.

When corrected for temperature and period, the actual critical was within 1% ΔK of the predicted critical. Table 4-1 summarizes the results.

TABLE 4-1

CRITICAL EIGENVALUE CALCULATIONS

	K	Data Source
Keff with all rods in	0.9542	#1
ρ inserted by Group 1 rods	0.0398 ΔKeff	#1
ρ inserted by Group 2 rods withdrawn at criticality	0.0135 ΔKeff	#1
Panacea Keff at Critical Rod Pattern at 68°	1.0075	
Temperature Correction between 68° F and 164°	−0.0032 ΔKeff	#2
MTC of $\frac{-3.3 \times 10^{-5}}{°F} \frac{\Delta K}{K}$		
Panacea Keff at critical Rod Pattern corrected for Temperature	1.0043	
Keff at time of Critical with ∞ period	1.000	
Period correction for 185 sec. period	+ .0003 ΔKeff	#3
Actual Keff with 185 sec. period	1.0003	
Difference (Panacea Keff − Actual Keff)	.0040 ΔKeff .40% ΔKeff	

Data Sources Used in Calculations

#1. GE letter, B. G. Hopkins to R. E. Parr/C. S. Heller, dated April 18, 1980

#2. Actual Moderator Temp. Coeff. determined BOC 7 on site.

#3. ρ vs. τ tables.

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Startup Test No. 5
TIP System Symmetry, Reproducibility, and Total Uncertainty

PURPOSE

The primary purpose of this test is to determine the Traversing In-Core Probe (TIP) system total uncertainty (using a detailed statistical analysis) which consists of geometric and random noise components. A gross TIP symmetry check, which involves comparing integrated symmetrical TIP string readings is also performed.

CRITERIA

A. TIP Uncertainty-Gross Check

The maximum deviation between symmetrically located TIP pairs of LPRM strings should be less than 25%.

B. Total TIP Uncertainty-Statistical Check

The TIP geometric-random noise uncertainty obtained by averaging the uncertainties for all data sets must be less than 9%.

NOTE: A minimum of two and up to six data sets may be used to meet the above criteria. If either criterion is not met and the calculations have been rechecked, the calibration of the TIP system (e.g. axial alignment) shall be checked. For the statistical check, it may be necessary to omit data pairs from the analysis if exact octant symmetry is not attainable in fuel loading or control rod patterns. In such cases, offline code predictions of exposure or control rod induced asymmetry may prove useful in explaining the uncertainty.

RESULTS AND DISCUSSION

Two complete sets of data required for evaluating TIP uncertainty were obtained during the D3 BOC7 Startup Testing Program. Data was obtained at steady state power levels greater than 95% of rated power. The results for each method of analysis are summarized below:

A. TIP Uncertainty (Gross Check)

To determine the symmetry component of TIP uncertainty, machine normalized, full power adjusted TIP readings were obtained and averaged for each symmetric TIP pair. The percent deviation between each symmetrical TIP pair and their average was calculated and is given in Table 5.1. The average deviation over all symmetric TIP pairs was 6.37% with a maximum deviation of 15.24% (occurring in a TIP pair near the periphery). The worst-case pair is less than the 25% criterion on maximum deviation.

RESULTS AND DISCUSSION (Continued)

B. Total TIP Uncertainty (Statistical Check)

The total TIP uncertainty was calculated using the method recommended by General Electric. Individual nodal values of BASE (from the process computer) in the upper left-hand quadrant of the core were divided by their symmetric counterpart and used to find an average ratio $\bar{R}$. This $\bar{R}$ was then used to calculate the random noise-geometric uncertainty. The first data set gave a value for random noise-geometric TIP Uncertainty of 5.99% (5-13-80) and the second of 6.07% (5-15-80). This yields an average of 6.03% which is less than the 9% criterion.

TIP SYMMETRY - GROSS CHECK

Table 5.1

TIP Pair	% Deviation on 5-13-80
1	12.39
2	15.24
3	0.26
4	7.72
5	2.76
6	8.54
7	10.20
8	3.57
9	11.64
10	7.59
11	3.76
12	7.94
13	1.97
14	5.36
15	4.43
16	7.88
17	2.89
18	0.53
Average:	6.37

SYMMETRIC TIP LOCATIONS

TIP PAIR	LPRM
1	08-17 16-09
2	08-25 24-09
3	08-33 32-09
4	08-41 40-09
5	08-49 48-09
6	16-25 24-17
7	16-33 32-17
8	16-41 40-17
9	16-49 48-17

TIP PAIR	LPRM
10	24-33 32-25
11	24-41 40-25
12	24-49 48-25
13	24-57 56-25
14	32-41 40-33
15	32-49 48-33
16	32-57 56-33
17	40-49 48-41
18	40-57 56-41