Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

July 8, 1985

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Dresden Station Unit 2
Summary Startup Test
Report - Cycle 10
NRC Docket No. 50-237

Dear Mr. Denton:

Enclosed for your information and use is the Dresden Station Unit 2, Cycle 10 Startup Test Report Summary. This report is submitted in accordance with previous requests from the NRC Staff and our Technical Specifications.

Please address any questions concerning this matter to this office.

One signed original and forty (40) copies of this letter and the enclosure are provided for your use.

Very truly yours,

J. R. Wojnarowski
Nuclear Licensing Administrator

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Enclosure

cc: R. Gilbert - NRR
NRC Resident Inspector - Dresden

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DRESDEN UNIT 2
CYCLE 10
STARTUP TEST SUMMARY

Dresden Unit 2 began Cycle 10 commercial operation on April 14, 1985 following a refueling and maintenance outage. The Dresden 2 Cycle 10 reload is the second Exxon Nuclear Company fabricated fuel reload for Dresden 2 and consists of 196 Pre-Pressurized 8x8 Fuel Assemblies. A comprehensive Startup Testing program was performed in accordance with previous programs and Technical Specification Section 6.6.A.1.

The program consisted of various tests including Shutdown Margin, Moderator Temperature Coefficient, Instrument Calibrations (APRM, LPRM, TIP, Core Flow), and Recirculation Baseline Data Acquisition required by Technical Specification Section 3.6.G. In addition, extensive tests were performed to verify the accuracy of the Core Monitoring Software System. No unusual conditions were noted and test results were similar to previous cycles. This was expected due to the minimal changes in 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.

DRESDEN UNIT 2

CYCLE 10

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 to the reference core design used in the various licensing analyses. At least one independent party must either participate in performing the core verification or review a videotaped version prior to unit startup. Any discrepancies discovered in the loading will be promptly corrected and the affected areas reverified to be properly loaded prior to unit startup.

Conformance to the reference core design will be documented by a permanent core serial number map signed by the audit participants.

RESULTS AND DISCUSSION

The Cycle 10 core verification consisted of a core height check performed by the fuel handlers and two videotaped passes over the core by the nuclear group. The height check verifies the proper seating of an assembly in the fuel support piece while the video-tapes verify proper assembly orientation and location. On February 22, 1985, the core was verified as being properly loaded and consistent with Exxon Nuclear Cycle 10 core design. Therefore, the as-loaded core configuration is consistent with what Exxon Nuclear used in their evaluation of Dresden Unit 2 Cycle 10 Reload Licensing Analyses.

DRESDEN UNIT 2

CYCLE 10

STARTUP TEST NO. 2

CONTROL ROD OPERABILITY AND SUBCRITICALITY CHECK

PURPOSE

The purpose of this test is to ensure that no gross local reactivity irregularities exist, that each control blade is latched to its control rod drive, and that all control blades are functioning properly.

CRITERIA

The following must be met:

1. Each control blade will be withdrawn and reinserted after the four fuel assemblies in the given control cell are loaded. This will guarantee that the mobility of the control blade is not impaired.

2. During control blade movement, the process computer is utilized to time the travel of the blade between notch positions and verify proper withdrawal and insertion times.

3. After the core is fully loaded, each control blade will be withdrawn and inserted individually to assure that criticality will not occur. As it is withdrawn, nuclear instrumentation will be monitored to verify subcriticality. Once withdrawn, each control blade is tested for overtravel by continually applying a withdrawal signal. A blade fails this check if rod position indication is not evident or if an overtravel alarm is received.

RESULTS AND DISCUSSION

After performing this test, all control blades demonstrated acceptable mobility and proper withdrawal and insertion times. In addition, all blades passed their overtravel and subcriticality checks.

DRESDEN UNIT 2
STARTUP TEST NO. 3
TIP SYSTEM SYMMETRY - UNCERTAINTY

PURPOSE

The purpose of this test is to perform a gross symmetry check and a detailed statistical uncertainty analysis on the Transversing In-Core Probe (TIP) System.

CRITERIA

1) TIP Symmetry - Gross Check

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

2) TIP Symmetry - Statistical Check

The calculated X^2 of the integrated TIP responses should be less than 34.81.

NOTE: One data set may be used to meet the above criteria. If either criteria is not met, the instrumentation and data processing system should be checked for any problems that could lead to asymmetries. If the problem persists, the fuel vendor should be consulted to assure that the larger than expected TIP asymmetries do not significantly affect core monitoring calculations.

RESULTS

One complete set of data required for evaluating TIP uncertainty was obtained during the D2 BOC10 Startup Testing Program on May 15, 1985. Data were obtained at a steady state power level, 98% of rated power. The results for each method of analysis are summarized below.

1) TIP Symmetry - Gross Check

In order to determine the overall symmetry of the TIP system, the machine-normalized, 6-inch TIP readings were obtained and averaged over nodes 1 through 24 for each symmetric TIP pair (the symmetric locations are given in Table 3.1). The absolute percent deviation for each symmetric TIP pair was calculated and is summarized in Table 3.2. The average absolute deviation for all symmetric TIP pairs was 5.02%, with a maximum absolute deviation of 15.1% which is well below the 25% criteria.

2) TIP Symmetry - Statistical Check.

The TIP symmetry statistical analysis was performed using the standard X^2-test as recommended by Exxon Nuclear Company. The machine-normalized, 6-inch TIP readings obtained from a TIP set performed on May 15, 1985 were used for the analysis. These TIP readings were summed over nodes 3 through 22 for each TIP tube location. The percent relative difference (Dm) for each symmetric TIP pair was then calculated using equation 3.1 - the results are summarized in Table 3.3. The TIP data variance (S^2TIP_{ij}) was calculated to be 22.306 using equation 3.2 and X^2 was calculated to be 11.153 using equation 3.3. Note that the value for X^2 is well within the limit of 34.81 established by Exxon.

TABLE 3.1. Symmetric TIP Locations

TIP PAIR	LPRM	TIP PAIR	LPRM
1	08-17 16-09	10	24-33 32-25
2	08-25 24-09	11	24-41 40-25
3	08-33 32-09	12	24-49 48-25
4	08-41 40-09	13	24-57 56-25
5	08-49 48-09	14	32-41 40-33
6	16-25 24-17	15	32-49 48-33
7	16-33 32-17	16	32-57 56-33
8	16-41 40-17	17	40-49 48-41
9	16-49 48-17	18	40-57 56-41

TABLE 3.2. TIP Symmetry - Gross Check

Symmetric TIP Pair	Absolute Percent Deviation
1	.094
2	11.7
3	2.8
4	3.4
5	7.5
6	15.1
7	4.3
8	1.9
9	2.3
10	1.0
11	9.1
12	.443
13	1.7
14	2.0
15	2.8
16	8.7
17	7.7
18	7.8

Average Absolute Percent Deviation: 5.02

Maximum Absolute Percent Deviation: 15.1

TABLE 3.3. TIP Symmetry - Statistical Check

Symmetric TIP Pair	Relative Difference Dm
1	0.34
2	12.2
3	3.01
4	3.60
5	7.69
6	15.79
7	0.083
8	2.05
9	2.52
10	1.22
11	9.56
12	0.566
13	1.91
14	1.61
15	2.82
16	8.99
17	7.84
18	8.03

Equation 3.1

$$Dm = \frac{100\,(Tm_1 - Tm_2)}{\left(\frac{Tm_1 + Tm_2}{2}\right)}$$

Note: $Tm_1 = \sum_{k=3}^{22} T_1(k)$ for TIP_1 and $TM_2 = \sum_{k=3}^{22} T_2(k)$ for TIP_2

Where TIP_1 and TIP_2 are symmetric TIP pairs, and $T_1(k)$ and $T_2(k)$ are the machine normalized, 6-inch TIP readings for the respective TIP pair locations.

Equation 3.2 (Variance)

$$S^2_{TIP_{ij}} = \frac{\sum_{m=1}^{18} Dm^2}{36} = 22.306$$

Equation 3.3

$$\chi^2 = \frac{18(S^2_{TIP_{ij}})}{36} = 11.153$$

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DRESDEN UNIT 2

CYCLE 10

START-UP TEST NO. 4

INITIAL CRITICALITY COMPARISON

PURPOSE

The intent of this procedure is to perform a critical Eigenvalue comparison. This is done by comparing the predicted control rod pattern to the actual control rod pattern at criticality taking into account period and temperature coefficient corrections.

CRITERIA

The actual cold critical rod pattern shall be within 1.0% ΔK/K of the predicted control rod pattern. If the difference is greater than ± 1.0% ΔK/K, Exxon Nuclear Company and Commonwealth Edison Company Core Management Engineers will be promptly notified to investigate the anomaly.

RESULTS AND DISCUSSION

Unit 2 went critical on April 10, 1985 at 4:31 p.m. utilizing an A-1 sequence. The moderator temperature was 159°F and the period was 563 seconds. Exxon Nuclear predictions and rod worths were calculated using the XTGBWR Code, which assumed a moderator temperature of 170°F.

After corrections were made for temperature and period, the actual critical was within 1.0% ΔK/K of the predicted critical. Table 4-1 summarizes the results.

TABLE 4-1

INITIAL CRITICALITY COMPARISON CALCULATIONS

ITEM	Δ k/k
k_{eff} with all rods in adjusted to 170°F	= 0.9433
ρ inserted by group 1 rods	= 0.0382 *
ρ inserted by group 2 rods	= 0.0180 *
ρ inserted by additional rods at criticality	= 0.0008 *
XTGBWR k_{eff} at critical rod pattern (170°F)	= 1.0003 *
Temperature correction between 159°F and 170°F	= +.000517
Moderator temperature coefficient = -4.7×10^{-5} (Δ k/k)/°F *	
XTGBWR k_{eff} at critical rod pattern	= 1.0008
k_{eff} at time of criticality with ∞ period	= 1.000
Period correction for 563 second period	= +0.0001**
Actual k_{eff} with 563 second period	= 1.0001
(XTGBWR k_{eff} - actual k_{eff})	= 0.0007 Δ k/k
Percent Difference	= 0.07% Δ k/k

SOURCES

* Letter, L. J. Bridges to D. J. Scott, dated December 18, 1984

** ρ vs. τ tables