Commonwealth Edison
72 West Adams Street, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690 - 0767

May 22, 1989

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Dresden Nuclear Power Station Unit 3
Summary Startup Report - Cycle 12
NRC Docket No. 50-249

Dr. Murley:

Enclosed for your information and use is the Dresden Station Unit 3 Cycle 12 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.

Very truly yours,

J. A. Silady
Nuclear Licensing Administrator

lm

Attachment

cc: A.B. Davis - Regional Administrator, Region III
S.G. DuPont - Senior Resident Inspector - Dresden
B.L. Siegel - Project Manager, NRR

0150T

8905310188 890522
PDR ADOCK 05000237
P PDC

IE26

DRESDEN UNIT 2

CYCLE 12

STARTUP TEST REPORT

TABLE OF CONTENTS

DRESDEN UNIT 2

CYCLE 12

STARTUP TESTING SUMMARY

Dresden Unit 2 resumed commercial operation for Cycle 12 on February 21, 1989, following a refueling and maintenance outage. During the outage, the fourth reload of Advanced Nuclear Fuels Corporation (formerly Exxon Nuclear Company) fuel was installed. The reload consisted of 200 9x9 fuel assemblies. This was the second reload of 9x9 fuel for Unit 2. An operating license amendment was submitted for NRC review on August 25, 1988 to facilitate CECo reviews of this and subsequent reloads per 10 CFR 50.59. The amendment was approved by letter from B.L. Siegel to H.E. Bliss dated January 6, 1989. CECo notified the NRC Staff of completion of the CECo review of the Cycle 12 reload licensing analyses and applicability of 10 CFR 50.59 by letter from J.A. Silady to T.E. Murley dated February 8, 1989.

The startup test program 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, etc.), and instrument calibrations (LPRM, TIP's, flow instrumentation) as addressed by the Technical Specifications, Final Safety Analysis Report, and previous commitments to the Nuclear Regulatory Commission. No unusual conditions were noted and the test results were as expected.

Summaries of the startup tests identified in the Draft Regulatory Guide SC 521-4 on refueling and startup tests for LWR reloads are attached per DPR-19 Technical Specification 6.6.A.1. Additional test results are available at the site.

DRESDEN UNIT 2

CYCLE 12

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 ensure proper core loading 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 12 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 Janury 19, 1989, the core was verified as being properly loaded and consistent with the Advanced Nuclear Fuels Cycle 12 core reload design. Therefore, the as-loaded core configuration is consistent with that assumed in the evaluation of the Dresden Unit 2 Cycle 12 Reload Licensing Analyses.

CYCLE 12

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. Following the core reload, each control blade will be withdrawn and reinserted. This will guarantee that the mobility of the control blade is not impaired.
2. During control blade movement, the process computer or an alternate method is utilized to time the travel of the blade between notch positions in order to 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

All control rod drive functional tests were completed by January 18, 1989. After performing these tests, all control blades demonstrated acceptable mobility, proper withdrawal and insertion times, and subcriticality. In addition, all blades but one passed their overtravel checks.

On January 17, control rod N-7 was found to be uncoupled when it was fully withdrawn for an overtravel check. The control rod drive was replaced on February 17. Subsequent overtravel testing showed rod N-7 to be properly coupled to its drive.

DRESDEN UNIT 2

CYCLE 12

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 χ^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 AND DISCUSSION

One complete set of data required for evaluating TIP uncertainty was obtained during the D2 BOC12 Startup Testing Program on March 3, 1989. Data were obtained at a steady state power level, 97% of rated. The control rod pattern maintained mirror symmetry across the axis that defines the line of symmetry for the TIP system. 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 9.78%, with a maximum absolute deviation of 20.55% which is below the 25% criteria.

2) TIP Symmetry - Statistical Check.

The TIP symmetry statistical analysis was performed using the standard χ^2 -test as recommended by Advanced Nuclear Fuels. The machine-normalized, 6-inch TIP readings obtained from a TIP set performed on March 3, 1989 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 ($S^2 TIP_{ij}$) was calculated to be 60.55 using equation 3.2 and χ^2 was calculated to be 30.27 using equation 3.3. Note that the value for χ^2 is within the limit of 34.81 established by Advanced Nuclear Fuels.

Dresden is aware that, although we are still within limits, this value of χ^2 is significantly higher than that obtained during start-up testing for the previous cycle ($\chi^2 = 9.02$ for Dresden 2 Cycle 11). Dresden is continuing to investigate this phenomenon.

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	12.90
2	9.77
3	7.75
4	5.39
5	12.97
6	8.38
7	9.94
8	8.10
9	7.79
10	4.37
11	0.66
12	17.46
13	8.58
14	5.79
15	7.43
16	16.31
17	11.91
18	20.55

Average Absolute Percent Deviation: 9.78

Maximum Absolute Percent Deviation: 20.55

TABLE 3.3. TIP Symmetry - Statistical Check

Symmetric TIP Pair	Relative Difference Dm
1	13.277
2	10.297
3	7.700
4	5.611
5	13.482
6	8.123
7	9.636
8	8.162
9	8.464
10	3.739
11	0.870
12	17.321
13	8.610
14	5.642
15	7.033
16	16.565
17	11.987
18	20.963

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)

$$S^2_{TIP_{ij}} = \frac{\sum_{m=1}^{18} Dm^2}{36} = 60.55$$

Equation 3.3

$$\chi^2 = \frac{18(S^2_{TIP_{ij}})}{36} = 30.27$$

DRESDEN UNIT 2

CYCLE 12

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, Advanced Nuclear Fuels and Commonwealth Edison Company Core Management Engineers will be promptly notified to investigate the discrepancy. The Nuclear Regulatory Commission will be notified within 24 hours.

RESULTS AND DISCUSSION

Unit 2 went critical on February 19, 1989 at 18:20 hours utilizing an A-2 sequence. The moderator temperature was 155°F and the period was 79.8 seconds. Advanced Nuclear Fuels 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 0.1913% ΔK/K of the predicted critical. This is well within 1.0% ΔK/K of the predicted critical. Table 4-1 summarizes the results.

TABLE 4-1

INITIAL CRITICALITY COMPARISON CALCULATIONS

ITEM	k/k
k_{eff} with all rods in adjusted to 170°F	= 0.9518
ρ inserted by group 1 rods	= 0.0337 *
ρ inserted by group 2 rods at criticality	= 0.01636 *
Predicted k_{eff} at critical rod pattern (170°F)	= 1.00186*
Moderator temperature coefficient	= -5.0×10^{-5} (Δ k/k)/°F *
Temperature correction between 155°F and 170°F	= +0.00075
Predicted k_{eff} with temperature correction at critical rod pattern	= 1.00261
k_{eff} at time of criticality with ∞ period	= 1.000
Period correction for 79.8 second period	= +0.000697**
Actual k_{eff} with 79.8 second period	= 1.000697
(Predicted k_{eff} - actual k_{eff})	= 0.001913 Δ k/k
Percent Difference	= 0.1913% Δ k/k

SOURCES

* Letter, D. F. Kelter to E. D. Eenigenburg, dated January 12, 1989 Supplemented by letter dated February 7, 1989.

** ρ vs. τ tables

0150T