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Dresden Nuclear Power Station, Unit 3, No. DPR-25
NRC Docket No. 50-249

Subject: Dresden Nuclear Power Station
Unit 3 Cycle 16 Startup Test Report

Enclosed please find the Dresden Unit 3 Cycle 16 Startup Test Report. Technical Specifications Section 6.9.B requires a submittal of special reports to the Nuclear Regulatory Commission. On May 26, 1999, Dresden Unit 3 Cycle 16 will have completed 90 days of commercial operation.

Should you have any questions concerning this letter, please contact Dale Ambler, Regulatory Assurance Manager at (815) 942-2920 extension 3800.

Respectfully,

J. M. Heffley
Site Vice President
Dresden Nuclear Power Station

Attachment Dresden Unit 3 Cycle 16 Startup Test Report

cc: Regional Administrator, NRC Region III
NRC Senior Resident Inspector – Dresden Nuclear Power Station

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Attachment
Dresden Unit 3 Cycle 16
Startup Test Report

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Attachment
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Startup Test Report

Startup Testing Summary

Dresden Unit 3 resumed commercial operation for Cycle 16 on February 26, 1999, following a scheduled refueling and maintenance outage. The reload fuel for Cycle 16 is comprised of 176 Siemens Power Corporation (SPC) manufactured ATRIUM-9B fuel assemblies. The D3C16 reload is the second reload of ATRIUM fuel for Unit 3 and the first using the offset fuel bundle design.

The startup test program was similar to those performed for previous Unit 2 and Unit 3 beginning-of-cycle startups at Dresden. Various physics tests were performed (i.e., shutdown margin, critical eigenvalue comparison) as well as instrument calibrations (i.e., LPRM, TIP, flow instrumentation) as addressed by the Technical Specifications, the Updated Final Safety Analysis Report, and previous commitments to the Nuclear Regulatory Commission. No unusual conditions were noted during the performance of these tests and results were as expected.

Attachment
Dresden Unit 3 Cycle 16
Startup Test Report

Startup Test No. 1 - Core Verification and Audit

Purpose

The purpose of this test is to visually verify that the fuel is correctly positioned and oriented in the reactor core.

Acceptance Criteria

The as-loaded core must conform to the reference core design used in the licensing analyses. Any discrepancies discovered in the loading must be promptly corrected and the affected areas re-verified 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 16 core verification consisted of a core height check performed by the Fuel Handling Department and two passes over the core viewed by the Station Nuclear Group. The purpose of the height check was to verify proper seating of each fuel bundle in its fuel support piece. The passes over the core allowed verification of proper assembly orientation and location. On February 16, 1999, the final core verification was completed per procedure DTS 8474 "Core Verification". The core was verified as being properly loaded and consistent with the Unit 3 Cycle 16 core reload designed by the Nuclear Fuel Management Department of ComEd. Therefore, the as-loaded core configuration is consistent with that assumed in the evaluation of the Dresden Unit 3 Cycle 16 Reload Licensing Analyses.

Attachment
Dresden Unit 3 Cycle 16
Startup Test Report

Startup Test No. 2 - Control Rod Operability and Subcriticality Check

Purpose

The purpose of this test is three-fold. First, it insures that no gross local reactivity irregularities exist. Second, it allows verification that each control rod is latched to its control rod drive. Finally, it insures that all control rods and control rod drives are functioning properly.

Acceptance Criteria

The following conditions must be met:

1. After the core is fully loaded, the strongest worth control rod will be withdrawn to insure that criticality will not occur. As it is withdrawn, nuclear instrumentation will be monitored to verify subcriticality.

2. Each control rod drive will be withdrawn and then checked for overtravel to verify coupling. The control rod drive will then be reinserted. This check verifies that the mobility of the control rod drive is not impaired.

3. During control blade movement the process computer or an alternate method will be utilized to time the travel of each control rod drive between notch positions to verify proper withdrawal and insertion times.

Results and Discussion

The single control rod subcriticality demonstration using the strongest worth control rod was successfully completed per procedure DTS 8734 "Single Control Rod Subcriticality Demonstration" on February 16, 1999. All control rod drive functional tests to demonstrate mobility, coupling, and stroke times were completed successfully.

Startup Test No. 3 - TIP System Symmetry and Total Uncertainty

Purpose

This test performs a gross symmetry check and a detailed statistical uncertainty analysis on the Traversing In-core Probe (TIP) System.

Acceptance Criteria

For the gross check, the maximum deviation between symmetrically located TIP pairs of Low Power Range Monitor (LPRM) strings should be less than 25%. For the statistical check, the calculated ^{2} of the integrated TIP responses should be less than 34.81.

Results and Discussion

One complete set of TIP data required for evaluating TIP uncertainty was obtained during the startup test program on March 4, 1999. The data was obtained at near full power steady state operating conditions. 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, power adjusted 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 the results are summarized in Table 3-2. The maximum absolute deviation was 11.19%, which is within the acceptance criteria of 25%.

2. TIP Symmetry - Statistical Check

   The TIP symmetry statistical analysis was performed using the standard ^{2} test. The machine-normalized, power adjusted 6-inch TIP readings were obtained and 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 with the results summarized in Table 3-3. The TIP data variance (S^2TIP_{ij}) was calculated to be 9.55 using equation 3-2 and ^{2} was calculated to be 4.78 using Equation 3-3. This value is within the acceptance criteria of 34.81.

Startup Test No. 3 - TIP System Symmetry and Total Uncertainty (continued)

Table 3-1 Symmetric TIP Locations

TIP Pair	LPRMs	TIP Pair	LPRMs
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

Startup Test No. 3 - TIP System Symmetry and Total Uncertainty (continued)

Table 3-2 TIP Symmetry - Gross Check

Symmetric TIP Pair	Absolute Percent Deviation
1	2.28
2	1.89
3	11.19
4	2.23
5	1.92
6	4.48
7	2.88
8	1.89
9	2.79
10	0.24
11	0.30
12	5.94
13	1.99
14	4.08
15	7.60
16	1.31
17	1.03
18	3.06

Maximum Absolute Percent Deviation: 11.19%

Startup Test No. 3 - TIP System Symmetry and Total Uncertainty (continued)

Table 3-3 TIP Symmetry - Statistical Check

Symmetric TIP Pair	Relative Difference, Dm
1	2.51
2	2.66
3	11.14
4	2.27
5	2.24
6	4.79
7	3.58
8	1.48
9	3.59
10	1.00
11	0.74
12	6.26
13	1.88
14	4.78
15	7.90
16	0.42
17	1.28
18	3.74

Startup Test No. 3 - TIP System Symmetry and Total Uncertainty (continued)

Equation 3-1

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

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, power adjusted, 6-inch TIP readings for the respective TIP pair locations.

Equation 3-2

$$S^2 TIP_{ij} = \frac{\sum_{m=1}^{18} Dm^2}{36} = 9.55$$

Equation 3-3

$$X^2 = \frac{18(S^2 TIP_{ij})}{36} = 4.78$$

Startup Test No. 4 - Initial Criticality Comparison

Purpose

This test is used to perform a critical eigenvalue comparison. This is accomplished by comparing the predicted critical control rod pattern to the actual control rod pattern at the point of initial criticality and adjusting for reactor period.

Acceptance Criteria

The actual cold critical rod pattern must be within 1.0% k/k of the predicted control rod pattern.

Results and Discussion

Unit 3 was initially brought critical on February 24, 1999 at 1228 hours utilizing an A-2 sequence. The moderator temperature was 187 F and reactor period was calculated to be 214 seconds. Estimated Critical Pattern (ECP) and rod worth were calculated by Nuclear Fuel Management utilizing MICROBURN with an assumed moderator temperature of 170 F. After correcting for reactor period, the actual critical was found to be within 1.0% k/k of the predicted critical as documented in procedure DTS 8141 "Initial Criticality Comparison". Table 4-1 summarizes the results.

Startup Test No. 4 - Initial Criticality Comparison (continued)

Table 4-1 Initial Criticality Comparison Calculations

Critical Information	Value
Predicted critical k_{eff}	1.0100 k/k[1]
k_{eff} at time of criticality with 214 second period	1.0117 k/k[2]
Correction to period from 214 second period	0.00031295 k/k[1]
Actual k_{eff} with period	1.0114 k/k
$\lvert$predicted k_{eff} - actual $k_{eff}\rvert$	0.0014 k/k
Percent difference	0.14 % k/k

Footnotes:

(1) NDIT NFM 9900029 Seq. 00 "D3C16 Zero Power Reactivity and Rod Worth Report (ZPR)"
(2) Calculated value from Powerplex core monitoring software predict case (Reference: DTS 8273 "Reactor Criticals")