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	BWR PSB	1	1	BWR RSB	1	1
INTERNAL:	ACRS 09	6	6	ADM/LFMB	1	0
	ELD/HDS3	1	0	NRR/ORAS	1	0
	REG FILE 04	1	1	RGN5	1	1
EXTERNAL:	EG&G BRUSKE,S	1	1	LPDR 03	1	1
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WNP-2 STARTUP REPORT

This report is submitted in compliance with the WNP-2 Technical Specification requirement in Section 6.9.1.1 that "a report of plant startup and power escalation testing shall be submitted following installation of fuel that has a different design or has been manufactured by a different fuel supplier." Requests were approved for Amendment to the WNP-2 Technical Specifications and the Reload License Application for the 128 bundle reload batch for core Cycle 2. The new fuel was supplied by Exxon Nuclear Company (ENC). The WNP-2 first refuel outage (RF86A) began on March 31, 1986. Major projects completed were refueling; repair of the B loop recirculation pump; and inspection, modification and repair of the No. 3 low pressure turbine. The outage ended on June 10, 1986, and 100% power level was reached on July 4, 1986.

In addition to routine outage surveillances, the refueling process required that several tests be performed before, during and after the outage, i.e., Powerplex Installation Acceptance Test, Shutdown Margin Verification and Determination, Reactivity Anomaly Evaluation, Control Rod Drive Functional Testing, and a Core Power Symmetry Analysis.

Refueling

WNP-2 is a BWR-5 utilizing 764 fuel assemblies. Cycle 2 energy requirements required a batch size of 128 Exxon 8x8 fuel assemblies. The refueling was accomplished by the application of fuel "shuffle strings". A shuffle string is defined as the fuel movement that starts with a discharged bundle move to the spent fuel pool, followed by several intermediate bundle movements and concluded with a fresh bundle insertion in the core. Prior to the performance of a given shuffle string, a designated control rod is withdrawn to demonstrate adequate shutdown margin to perform the shuffle string. During the insertion of a bundle, the SRM count rate was observed with the insertion to be stopped if the average SRM count rate exceeded that obtained during control rod withdrawal. The refueling of the core was completed in eight days.

When the refueling had been completed, 77 fuel assemblies from the core were temporarily placed in the spent fuel pool; twenty-eight (28) were placed there to facilitate the removal of the seven startup sources and 49 required new channels. The original core load contained several fuel assemblies with 'mismatched' channels. The mismatched channels were manufactured by General Electric with zirconium halves from different heat treat batches. Because industry experience has shown a higher tendency for bowing in mismatched channels, this type assembly was placed in core locations with a high probability for being discharged at the end of Cycle 1. In the final reload plan, 49 fuel assemblies remaining in the core for Cycle 2 had mismatched channels and were rechanneled. All 77 assemblies were then returned to their proper core locations. Once core alterations had been completed, a full core verification was performed. This process was used to visually verify fuel bundle identification numbers, location and orientation. This examination was video taped to be saved as part of the permanent plant record until core configuration is changed. The video tape of the full core verification was reviewed prior to the installation of the steam separator. During this review, a small piece of rubber hose was seen lying on the top guide and subsequently removed. The source of the piece was the grapple air supply hose. The mast on the refuel

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bridge was used to verify each bundle height was acceptable. If any new bundle was 0.25" higher or any exposed bundle was 0.50" higher than the others, the bundle was to be evaluated to determine the cause of the deviation. This measurement process helps to assure that the bundles are properly seated in the fuel support pieces. There were no abnormally high bundles in the core.

Powerplex Installation Acceptance Test

A new computer program was installed to support fuel and core surveillance during Cycle 2. The installation of Powerplex and the successful completion of the Powerplex Installation Acceptance Test Procedure (IATP) were completed prior to the beginning of RF86A. The Powerplex IATP was divided into four major sections. The first section was the verification of initial conditions. During the review of the reactor specific data at the beginning of the test, two problems were discovered. One of the arrays to be used in the heat balance process had 'hard' coded values when cycle specific data is required. The program was changed in order to read a file. This file can be changed as required. The core thermal power and the cleanup loop A flow limit arrays had to be changed to meet WNP-2 specifications. In both cases, the limits originally within Powerplex were too restrictive and would interpret real values as bad or unacceptable data. As part of the verification of initial conditions, array sizes and dimensions of the input deck were checked. A typographical error was found and corrected on the description on one input card. The Specification limits on the input deck were then checked. The linear heat generation limit array had to be extended from 30,000 MWD/ST to 40,000 MWD/ST.

The next section was a comparison of Powerplex program outputs with fuel management calculations. The specifications met were:

a. Eigen values within 0.0010;
b. Bundle power differences within 2%;
c. Power peaking differences within 3%; and
d. Core thermal limits differences within 3% at full power with
   i) no Xenon or exposure
   ii) equilibrium Xenon, no exposure
   iii) equilibrium Xenon, 20 hour exposure

The system was then tested to verify that all the data required by Powerplex was properly collected, transmitted and processed. Since actual reactor data are limited in scope for a given time and dependent on the reactor operating conditions, all the various functions of the Powerplex system were then tested using simulated data. Hand entered Transverse Incore Probe (TIP) data generated an "overflow" condition in a subroutine. This routine was corrected, resolving the problem. Although some minor software problems were discovered and resolved during the testing, the Powerplex system successfully met the requirements established by the Supply System and ENC.*

*During power operations, two more problems have been discovered in the data transmission from the process computer to Powerplex. Currently, Powerplex will only allow one substitute value of control rod position rather than the specified 10. There is also a problem with Powerplex accepting the value of the cleanup B loop flow values. Temporary fixes are being used until ENC has prepared the permanent resolution.

Shutdown Margin Verification and Determination

An insequence Shutdown Margin Demonstration (SDM) was performed during the first startup following the outage. Technical Specifications require that this SDM be equal to or greater than 0.38% ΔK/K, if the highest worth rod is analytically determined. The SDM was demonstrated to be 2.21% ΔK/K. The examination of the calculations and the Cycle Management Report showed that an additional SDM demonstration at some greater exposure would not be required.

Reactivity Anomaly Evaluation

WNP-2 Technical Specifications require that the reactivity difference between the monitored and predicted core K_{eff} is verified not to exceed 1% ΔK/K during the first startup following core alterations. This testing was performed at approximately 300 MWD/MT of exposure and Xenon equilibrium. The predicted K_{eff} was 1.007 and the monitored K_{eff} was 0.999. As in Cycle 1, the graph of predicted K_{eff} versus exposure was normalized to the monitored K_{eff} at the beginning of cycle (BOC). The normalized graph will be used during the remainder of Cycle 2 for any subsequent reactivity anomaly surveillances.

Control Rod Drive Functional Testing

After fuel movement or control rod drive (CRD) maintenance, the timing of the insertion and withdrawal of each control rod is verified to be within a 40 to 60 second range. This was done during the RF86A outage after the CRD maintenance and fuel movements were completed in order to fine tune the CRD system and to discover any physical interference problems in the core.

In addition to this, each control rod scram timing was checked. The Technical Specification requirements that must be met and the results of the testing are as follows:

a. Maximum scram time to notch position 6 (in seconds):

Required	Slowest Actual (to N#5)
7	3.569

b. Maximum average scram time of all the operable rods to the 4 notch positions (in seconds):

Notch	Required	Slowest Actual
45	.430	.308
39	.868	.608
25	1.936	1.312
5	3.497	2.355

c. Maximum average scram time for four rods in an two-by-two array to the 4 notch position (in seconds):

Notch	Required	Slowest Actual
45	.430	.340
39	.920	.653
25	2.052	1.440
5	3.706	2.638

d. In order to operate under the normal Minimum Critical Power Ratio (MCPR) of 1.27 for ENC fuel and 1.28 for GE fuel, the slowest average scram time of four rods in a two-by-two array must be less than the following (in seconds):

Notch	Time
45	.404
39	.660
25	1.504
9	2.624

If the average scram time of any four rods in a two-by-two array exceed the times indicated above, the Plant must operate with an MCPR penalty. As a result of the scram time testing, WNP-2 operated with an MCPR limit of 1.32, until the slowest rods were vented and scram time measurements repeated. The new scram times met the criteria permitting the normal MCPR limits to be applied.

Core Power Symmetry Analysis

After the outage a core power symmetry analysis was performed to determine the degree of Transverse Incore Probes (TIP) asymmetry based on comparisons of symmetric TIP string traces. A statistical analysis of data obtained from TIP readings with reactor power stable at rated power and near equilibrium showed that the TIP system met the criteria* for symmetry as established by ENC.

*Criteria involved a chi squared (X^2) test at a 1% level of significance, requiring X^2 value of less than 36.19. Analysis of the data resulted in a X^2 value of 3.285.

WASHINGTON PUBLIC POWER SUPPLY SYSTEM

P.O. Box 968 • 3000 George Washington Way • Richland, Washington 99352

Docket No. 50-397

August 29, 1986

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: NUCLEAR PLANT NO. 2
STARTUP SUMMARY REPORT FOLLOWING RESUMPTION
OF COMMERCIAL POWER OPERATION

Reference: Technical Specification Sections 6.9.1.1, 6.9.1.2, and 6.9.1.3

Dear Sirs:

In accordance with the requirements of Plant 2 Technical Specification Sections 6.9.1.1, 6.9.1.2, and 6.9.1.3, the Supply System hereby submits the Startup Summary Report following the Spring 1986 Refueling Outage (RF86A).

Should you have any questions or comments, please contact Mr. M. R. Wuestefeld, WNP-2 Plant Engineering Supervisor-Reactor Systems, at (509) 377-2076.

Very truly yours,

CM Powers

C. M. Powers (927M)
WNP-2 Plant Manager

CMP:lp
Enclosure

cc: J. B. Martin (NRC-Region V)
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