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TRM T5.0.600.2

102-05209-SAB/TNW/JAP
February 4, 2005

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Station P1-37
Washington, DC 20555-0001

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 3
Docket No. STN 50-530
Unit 3, Cycle 12 Startup Report

In accordance with Technical Requirements Manual (TRM) section T5.0.600.2.a.(2), Arizona Public Service Company (APS) is submitting this startup report for PVNGS Unit 3, Cycle 12.

The Unit 3 Cycle 12 core consists of 100 fresh assemblies (Improved Lattice) intermixed with 104 once and 37 twice-burned irradiated assemblies. The fresh assemblies were designed utilizing a new three-enrichment assembly split. The utilization of a new three-enrichment assembly meets criteria (2) of TRM T5.0.600.2.a, requiring a startup report. Using three different fresh assembly enrichments versus only using two enrichments enhances the PVNGS Unit 3 core design by providing both improved power peaking control and lower predicted crud deposition.

No commitments are being made to the NRC by this letter.

If you have any questions, please contact Thomas N. Weber at (623) 393-5764.

Sincerely,

SAB/TNW/JAP/kg

Enclosure

cc: B. S. Mallett — NRC Region IV Regional Administrator
M. B. Fields — NRC NRR Project Manager
G. G. Warnick — NRC Senior Resident Inspector for PVNGS

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ENCLOSURE

Unit 3, Cycle 12 Startup Report

Introduction

The Palo Verde Nuclear Generating Station (PVNGS) Unit 3 Cycle 12 core consists of 100 fresh assemblies (Improved Lattice) intermixed with 104 once and 37 twice-burned irradiated assemblies. The predicted cycle length is 496 EFPD. Reload analyses show that this core is typical of the most recent reload cores designed at PVNGS.

Cycle 12 initial criticality occurred at 2052 hours on December 5, 2004. Low Power Physics Testing (LPPT) began immediately following criticality. Additionally, the resumption of commercial operations occurred on December 7, 2004. Power Ascension Testing followed and was completed without issues and the unit reached full power on December 12, 2004.

LPPT consisted of:

All Rods Out (ARO), Hot Zero Power (HZP), Critical Boron Concentration
Isothermal Temperature Coefficient (ITC) Measurement
Control Element Assembly (CEA) Worth Measurement
Inverse Boron Worth Measurement

Power Ascension Testing, for model verification, consisted of:

Radial Power Distribution ~ 20% Rated Thermal Power (RTP)
Radial Power Distribution ~ 70% RTP
Axial Power Distribution ~ 70% RTP
Radial Power Distribution ~ 100% RTP
Axial Power Distribution ~ 100% RTP
Verification of the Cycle Independent Shape Annealing Matrix (CISAM)
Hot Full Power (HFP), ARO, Critical Boron Concentration.

Test Acceptance Criteria

The following acceptance criteria apply to each of the tests performed during LPPT and Power Ascension Testing:

Critical Boron Concentration (HZP)	± 50 ppm of predicted
ITC Measurement	
LPPT	± 3 pcm/°F of predicted
CEA Testing	
Reference Group	± 10% of predicted
Test Group(s)	± 15% of predicted
Total Worth	± 10% of predicted
Inverse Boron Worth (IBW)	± 15 ppm/% ΔK/K of predicted

Test Acceptance Criteria (continued)

Radial Power Distribution ~20% RTP	± 10% of predicted for locations with a Relative Power Density (RPD) > 1.0
Flux Symmetry ~ 20% RTP	≤ 10% of symmetric group average for instrumented locations with an RPD ≥ 1.0 and ± 0.1 RPD units for locations with an RPD < 1.0.
Radial Power Distribution ~70% RTP	± 0.1 RPD and Root Mean Square (RMS) ≤ 5%
Axial Power Distribution ~70% RTP	± 0.1 RPD and RMS ≤ 5%
Peaking Factors ~70% RTP	± 10% of predicted
Radial Power Distribution ~100% RTP	± 0.1 RPD and RMS ≤ 5%
Axial Power Distribution ~ 100% RTP	± 0.1 RPD and RMS ≤ 5%
Peaking Factors ~100% RTP	± 10% of predicted
CISAM Verification	
Axial Shape RMS Error	≤ 7.5%
Core Average Axial Shape Index (ASI) Error (absolute value)	≤ 0.075
Axial Form Index Error (absolute value)	≤ 0.10
Critical Boron Concentration (HFP)	± 50 ppm of predicted

Low Power Physics Testing

<u>All Rods Out (ARO) Critical Boron Concentration (CBC)</u>

This test is performed by obtaining a set of reactor coolant system (RCS) boron samples at equilibrium conditions near ARO (CEA Group 5 ~ 122 inches withdrawn) and adjusting this concentration for the Group 5 residual reactivity worth. The measured RCS concentration was 1973 ppm, which was adjusted for an ARO condition to 1979 ppm. The design HZP ARO CBC is 1979 ppm. The difference of 0 ppm is within the acceptance criterion.

Low Power Physics Testing (continued)

Isothermal Temperature Coefficient (ITC)

Raising and lowering the RCS Temperature and measuring the associated changes in core reactivity performs this test. The measured ITC with Group 5 at ~ 122" withdrawn was -1.887 pcm/°F. The predicted ITC was -1.560 pcm/°F and was corrected to test conditions. The corrected ITC was -1.622 pcm/°F. The measured ITC met the acceptance criterion and satisfied the surveillance requirement of Technical Specification 3.1.4.1.

CEA Rod Worth Measurements

Rod worth was measured using the Rod Swap method. The Reference Group (regulating groups (RGs) 2 + 3) was diluted into the core. The worth of the reference group was swapped with the worth of the test group. The results are summarized in the following Table:

CEA Group	Measured Worth (pcm)	Predicted Worth (pcm)	% Difference	Acceptance Criteria
Reference Group (RG2 & RG3)	-1295.9	-1318.5	1.74	≤ 10%
Test Groups:				
SD (B6 & B16)	-1202.1	-1203.7	0.13	≤ 15%
RG1 & RG4	-1041.4	-1052.3	1.05	≤ 15%
SD (B7 & B10)	-1159.1	-1178.9	1.71	≤ 15%
RG5 & SD (A2 & A20)	-1050.1	-1082.5	3.08	≤ 15%
RG5 & SD (B9 & B16)	-1242.2	-1235.8	-0.51	≤ 15%
RG5 & SD (A3 & A19)	-1064.0	-1085.6	2.03	≤ 15%
Total CEA Worth	-8054.8	-8157.3	1.27	≤ 10%

All test results met the acceptance criteria.

Inverse Boron Worth (IBW)

The IBW was determined by obtaining the measured worth of the CEA Reference Group and the change in the CBC from the dilution of the Reference Group to the control element assembly (CEA) lower electrical limit (LEL). The measured IBW was 136.0 ppm/% ΔK/K. The predicted IBW was 136.0 ppm/% ΔK/K. The acceptance criterion was met.

Power Ascension Testing

Flux Symmetry Verification ~ 20% RTP

Obtaining a flux map, by processing a CECOR snapshot and comparing symmetrical Relative Power Densities (RPD) performs this test. All deviations from the average of the instrumented powers were well within 10% or 0.1 relative power density (RPD) units.

Radial Power Distribution and Flux Symmetry ~ 20% RTP

A comparison of predicted and measured RPD's was made using data from ROCS and CECOR at ~ 20% RTP. The maximum difference for assemblies with an RPD greater than or equal to 1.0 was less than the acceptance criterion of 10%. Measured powers in symmetric, instrumented assemblies were within 10% of the symmetric group average for assemblies with RPD's greater than 1.0 and within 0.1 RPD units for assemblies with an RPD less than 1.0.

Radial and Axial Power Distributions and Peaking Factor Comparisons ~ 70% RTP

A comparison of predicted and measured RPD's was made using data from ROCS and CECOR at ~ 70% RTP. Measured versus predicted RPD's were within the requirement of ± 0.1 RPD and a root mean square (RMS) of ≤ 5% for both the radial and axial comparisons. Additionally, CECOR and ROCS comparisons of the Peaking Factors were made. The acceptance criterion of ± 10% was also met.

Radial and Axial Power Distributions and Peaking Factor Comparisons ~ 100% RTP

A comparison of predicted and measured RPD's was made using data from ROCS and CECOR at ~ 100% RTP. Measured versus predicted RPD's were within the requirement of ± 0.1 RPD and an RMS of ≤ 5% for both the Radial and Axial comparisons. Additionally, CECOR and ROCS comparisons of the Peaking Factors were made. The acceptance criterion of ± 10% was also met.

Verification of the Cycle Independent Shape Annealing Matrix (CISAM)

Evaluation of the CEFAST output data was performed to validate the use of the CISAM in the plant Core Protection Calculator (CPC). The requirement that the axial shape index (ASI) RMS error be ≤ 7.5% for each CPC channel was met. Additionally, the absolute values of the Core Average ASI Error and the Axial Form AFM Error were ≤ 0.075 and ≤ 0.10, respectively.

Critical Boron Concentration (Hot Full Power)

The requirement for the measured versus predicted CBC at HFP is ± 50 ppm. This acceptance criterion was met for the Power Ascension Testing. The predicted HFP, equilibrium Xenon, CBC was 1393 ppm and the measured value was 1402 ppm.