Scott A. Bauer
Department Leader
Regulatory Affairs
Palo Verde Nuclear
Generating Station

Tel: 623/393-5978
Fax: 623/393-5442
e-mail: sbauer@apsc.com

Mail Station 7636
P.O. Box 52034
Phoenix, AZ 85072-2034

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July 1, 2002

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

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 2
Docket No. STN 50-529
Unit 2, Cycle 11 Startup Report

Dear Sirs:

In accordance with Technical Requirements Manual requirement T5.0.600.2.a.(2), Arizona Public Service Company (APS) is submitting this startup report for PVNGS Unit 2, Cycle 11. ZIRLO cladded fuel manufactured by Westinghouse Electric Company was loaded into Unit 2 for Cycle 11. The manufacturing of the fuel by Westinghouse Electric Company in Columbia, South Carolina, is a change from the previous vender and location. The previous vender was Combustion Engineering (CE) and the previous fuel manufacturing location was Hematite, Missouri. PVNGS Technical Specification amendment 140 was issued by the NRC on March 12, 2002 that allowed for the use of ZIRLO cladded fuel. This startup report addresses the tests that were performed to demonstrate that the unit operating conditions affected by the addition of ZIRLO cladded fuel remain within design predictions and specifications.

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: E. W. Merschoff
D. G. Naujock
J. N. Donohew
N. L. Salgado

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ENCLOSURE

Unit 2, Cycle 11 Startup Report

Introduction

The Palo Verde Nuclear Generating Station (PVNGS) Unit 2 Cycle 11 core consists of 108 fresh assemblies (ZIRLO) intermixed with once and twice-burned irradiated assemblies. The predicted cycle length is 520 EFPD. Reload Analyses shows that this core is typical of the most recent reload cores designed at PVNGS.

Cycle 11 initial criticality occurred at 0559 on April 16, 2002. Low Power Physics Testing (LPPT) began immediately following criticality and was completed on April 16, 2002. Power Ascension Testing followed and was completed on April 25, 2002.

LPPT consisted of:

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

Critical Boron Concentration (HZP)	$\pm$ 50 ppm of predicted
ITC Measurement	$\pm$ 3 pcm/°F of predicted
CEA Testing	
Reference Group	$\pm$ 10% of predicted
Test Group(s)	$\pm$ 15% of predicted
Total Worth	$\pm$ 10% of predicted
Inverse Boron Worth	$\pm$ 15% of predicted
Radial Power Distribution ~20% RTP	$\pm$ 10% of predicted for locations with a Relative Power Density (RPD) > 1.0

Test Acceptance Criteria (continued)

Flux Symmetry ~ 20% RTP	$\leq$ 10% of symmetric group average for instrumented locations with a RPD $\geq$ 1.0 and $\pm$ 0.1 RPD units for locations with a RPD < 1.0.
Radial Power Distribution ~70% RTP	$\pm$ 0.1 RPD and Root Mean Square (RMS) $\leq$ 5%
Axial Power Distribution ~70% RTP	$\pm$ 0.1 RPD and RMS $\leq$ 5%
Peaking Factors	$\pm$ 10% of predicted
Radial Power Distribution ~100% RTP	$\pm$ 0.1 RPD and RMS $\leq$ 5%
Axial Power Distribution ~ 100% RTP	$\pm$ 0.1 RPD and RMS $\leq$ 5%
Peaking Factors	$\pm$ 10% of predicted
Critical Boron Concentration (HFP)	$\pm$ 50 ppm of predicted

Low Power Physics Testing

All Rods Out (ARO) Critical Boron Concentration (CBC)

This test is performed by obtaining a set of reactor coolant system (RCS) boron samples at equilibrium conditions near ARO (CEA Group 5 ~ 121.4" withdrawn) and adjusting this boron concentration for the Group 5 residual reactivity worth. The measured RCS boron concentration was 2091.3 ppm, which was adjusted for an ARO condition to 2097.7 ppm. The design HZP ARO CBC is 2115 ppm. The difference of 17.3 ppm is within the acceptance criteria.

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 0.634 pcm/^{o}F. The predicted ITC was 1.42 pcm/^{o}F and was corrected to test conditions. The corrected ITC was 1.18 pcm/^{o}F. The measured ITC met the acceptance criteria 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 Group (RG)3 + RG4) were 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 (RG3 + RG4)	-1179.2	-1176.6	-0.22	< 10%
Test Groups:				
SD 'B' #9 & 10	-1206.2	-1078.4	-10.59	< 15%
SD 'A' #2 & 20	-975.8	-964.8	-1.13	< 15%
SD 'B' #7 & 16	-1091.6	-1030.1	-5.64	< 15%
SD 'A' #3 & 19	-986.3	-965.6	-2.10	< 15%
RG1, RG2	-1033.0	-923.4	-10.61	< 15%
RG5 & SD 'B' #6	-896.6	-838.1	-6.52	< 15%
Total CEA Worth	-7368.7	-6977.0	-5.32	< 10%

All tests 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 lower electrical limit (LEL). The measured IBW was 134.2 ppm/% ΔK/K. The predicted IBW was 138.4 ppm/% ΔK/K. The acceptance criteria were 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 RPD units.

Radial Power Distribution and Flux Symmetry ~ 20% RTP

A comparison of predicted and measured RPDs 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 criteria of 10%. Measured powers in

symmetric, instrumented assemblies were within 10% of the symmetric group average for assemblies with RPDs greater than 1.0 and within 0.1 RPD units for assemblies with an RPD less than 1.0.

Radial and Axial Power Distributions ~ 70% RTP

A comparison of predicted and measured RPDs was made using data from ROCS and CECOR at ~ 70% RTP. Measured versus predicted RPDs were within the requirement of $\pm$ 0.1 RPD and an RMS of $\leq$ 5% for both the Radial and Axial comparisons.

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

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

Critical Boron Concentration (Hot Full Power)

The requirement for the measured versus predicted Critical Boron Concentration at HFP is $\pm$ 50 ppm. This acceptance criterion was met for the Power Ascension Testing, as the predicted HFP, equilibrium Xenon, CBC was 1567 ppm and the measured value was 1520 ppm.