TXU Energy
Comanche Peak Steam
Electric Station
P.O Box 1002 (E01)
Glen Rose, TX 76043
Tel 254 897 8920
Fax 254 897 6652
lance terry@txu com

C. Lance Terry
Senior Vice President &
Principal Nuclear Officer

CPSES-200300290
Log # TXX-03034

February 5, 2003

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES)
DOCKET NO. 50-445
UNIT 1 CYCLE 10 STARTUP REPORT

Gentlemen:

TXU Generation Company LP (TXU Energy) loaded 88 Westinghouse fuel assemblies into the Unit 1 Cycle 10 reactor core. Integral Fuel Burnable Absorbers were used in 72 of the 88 Westinghouse fuel assemblies. These assemblies were loaded as the beginning of CPSES Unit 1 transition to Westinghouse fuel from Framatome.

In accordance with the FSAR Section 4.6.6, enclosed is a summary report of the unit startup and power escalation testing following installation of fuel that has a different design or has been manufactured by a different fuel supplier.

IE26

This communication contains no new licensing basis commitments regarding CPSES Unit 1.

Sincerely,

TXU Generation Company LP
By: TXU Generation Management Company LLC,
Its General Partner

C. L. Terry
Senior Vice President and Principal Nuclear Officer

By: Roger D. Walker
Roger D. Walker
Regulatory Affairs Manager

JDS/js

Enclosure

c - E. W. Merschoff, Region IV
W. D. Johnson, Region IV
D. H. Jaffe, NRR
Resident Inspectors, CPSES

TXU Generation Company LP
COMANCHE PEAK STEAM ELECTRIC STATION

ENGINEERING REPORT

Unit 1 Cycle 10
STARTUP REPORT

ERX-03-001
Revision 0

1/8/03

Prepared By: ______________________ Date: 1-8-2003
Cody M. Lemons
Core Performance Engineering

Reviewed By: Norman L Terrel Date: 1-10-03
Norman L. Terrel
Core Performance Supervisor

Approved By: Mickey R. Killgore Date: 1-14-03
Mickey R. Killgore
Reactor Engineering Manager

DISCLAIMER

This information contained in this report was prepared for the specific requirements of TXU Generation Company LP and may not be appropriate for use in situations other than those for which it was specifically prepared. TXU Generation Company LP PROVIDES NO WARRANTY HEREUNDER, EXPRESS OR IMPLIED, OR STATUTORY, OF ANY KIND OR NATURE WHATSOEVER, REGARDING THIS REPORT OR ITS USE, INCLUDING BUT NOT LIMITED TO ANY WARRANTIES ON MERCHANTABILITY FOR FITNESS FOR A PARTICULAR PURPOSE.

By making this report available, TXU Generation Company LP does not authorize its use by others, and any such use is forbidden except with the prior written approval of TXU Generation Company LP. Any such written approval should itself be deemed to incorporate the disclaimers of liability and disclaimers of warranties provided herein. In no event should TXU Generation Company LP have any liability for any incidental or consequential damages of any type in connection with the use, authorized or unauthorized, of this report or the information in it.

TABLE OF CONTENTS

LIST OF TABLES and FIGURES

1.0 INTRODUCTION

This report presents a summary of the startup of Comanche Peak Steam Electric Station (CPSES), Unit 1, Cycle 10. Cycle 10 contains 105 reload fuel assemblies supplied by Framatome ANP (FRA-ANP) (formerly Siemens Power Corporation), as well as 88 fresh assemblies of Westinghouse supplied fuel.

This report satisfies the requirements of CPSES FSAR section 4.6.6, which states that a summary report of unit startup and power escalation testing shall be submitted following installation of fuel of a different design or that has been manufactured by a different supplier.

CPSES, located in North Central Texas, is a two unit nuclear power plant. Unit 1 completed initial startup in 1990 and was declared to be in commercial operation on August 13, 1990. Unit 2 completed initial startup in 1993 and was declared to be in commercial operation on August 3, 1993. Unit 2 is currently in Cycle 7. Each unit utilizes a four loop Westinghouse (W) Pressurized Water Reactor as the Nuclear Steam Supply System. Both units are rated for a thermal reactor power level of 3458 MWth. The plant is operated by TXU Generation Company LP.

Cycle 10 initial criticality occurred on November 10, 2002, and Low Power Physics Testing was completed November 11, followed by a reactor shutdown due to equipment problems. The plant was synchronized to the grid on November 18, 2002. Power ascension testing continued, and 80% RTP was reached on November 21, but the reactor was shutdown again prior to reaching 100% RTP due to equipment problems. The reactor achieved 100% RTP on November 29, but did not reach stable conditions before a dropped control rod forced another shutdown for repairs. Full power was again reached on December 15, and power ascension testing was completed with the performance of a full power flux map on December 18.

2.0 DISCUSSION OF THE WESTINGHOUSE FUEL DESIGN

The CPSES Unit 1 Cycle 10 reactor core is comprised of 193 fuel assemblies arranged in a similar core configuration as found in recent CPSES cycles. The cycle 10 core contains 105 partially spent FRA-ANP fuel assemblies (Regions 2-7A, 10A, 10B, and 11), and 88 fresh Region 12 fuel assemblies supplied by Westinghouse. The Region 12 assemblies are of the Optimized Fuel Assembly (OFA) design, similar to the design used in early CPSES cycles. Unit 2 Cycle 7 is currently using 8 lead use assemblies of a similar design. A summary of the Cycle 10 fuel inventory is provided in Table 1.

The energy content of the Cycle 10 core has been designed to accommodate a refueling interval of approximately 18 months.

The CPSES Unit 1 Cycle 9 core configuration was comprised of 192 FRA-ANP (formerly Siemens Power Corporation) fuel assemblies (Regions 9A, 9B, 10A, 10B, and 11), as well as 1 partially spent Westinghouse fuel assembly (Unit 2 Region 2). The Cycle 10 configuration includes 105 FRA-ANP fuel assemblies and 88 W OFA fuel assemblies. Both the FRA-ANP and W fuel designs have a nominal outside rod diameter of 0.360 inches, and utilize a 17 x 17 lattice configuration.

In the CPSES Unit 1 Cycle 9 core, solid burnable absorbers (B_4C - Al_2O_3) encased in a Zircaloy-4 clad and manufactured by FRA-ANP were used to shape the power distribution and to achieve a desirable moderator temperature coefficient. Cycle 10 uses two types of W fabricated burnable absorbers: Wet Annular Burnable Absorbers (WABA) and Integral Fuel Burnable Absorbers (IFBA). The WABAs consist of B_4C - Al_2O_3 pellets encased between inner and outer Zircaloy-4 clad. IFBAs employ a thin ZrB_2 coating on the fuel pellet surface in selected fuel rods. WABAs were previously used in early CPSES cycles, and are currently being used in eight assemblies in Unit 2 Cycle 7. Unit 1 Cycle 10 is the first cycle to employ IFBAs at CPSES.

TABLE 1

Fuel Assembly Design Parameters

CPSES Unit 1 Cycle 10

Region	2-7A	10A	10B	11	12
Enrichment (w/o U_{235}) Central Zone	4.20	4.47	4.60	4.82	4.34
Axial Blanket	Natural	2.0	2.0	2.0	2.6
Geometric Density (% theoretical)	95.0	95.0	95.0	95.0	95.5
Number of Assemblies	1	8	4	92	88
Pellet Diameter (inches)	0.3035	0.3035	0.3035	0.3035	0.3088

All enrichments and densities are design values.

2.1 MECHANICAL DESIGN

The W 17 x 17 fuel assembly design, used for the Region 12 fuel assemblies, contains 264 fuel rods which are supported by eight grid spacers in the fuel assembly structure. Mid-span grids are composed of ZIRLO™ while the top and bottom grids are composed of Inconel-718. The fuel assembly structure consists of an upper nozzle, a lower nozzle, twenty-four guide tubes, one instrument tube and eight spacer grids.

The major differences between the W fuel assembly (Region 12) design and the FRA-ANP fuel assembly (Region 11) design are:

- 72 of the W assemblies contain IFBA as burnable absorbers, which have not been previously used at CPSES.

- The W fuel assemblies contain annular axial blankets to accommodate the gas volume produced in the IFBA containing fuel rods. The 2.6 w/o enriched annular axial blankets are nearly identical in reactivity characteristics to the 2.0 w/o enriched solid axial blankets used in the FRA-ANP fuel.

- The W cladding, Guide Tube, Instrumentation Thimble, and mid-span grid assembly material is ZIRLO™, while the FRA-ANP fuel uses bimetallic (Zircaloy-4/Inconel-718) grid assemblies, with Zircaloy-4 Instrumentation Thimbles and Guide Tubes.

- The W fuel has a clad thickness of 0.0225 inches, while the FRA-ANP clad has a thickness of 0.025 inches.

- The W fuel has a nominal density of 95.5 (percent of theoretical), while the FRA-ANP fuel has a nominal density of 95.0.

- The W fuel pellets measure 0.370 inches in length with a 0.3088 inch diameter. FRA-ANP fuel pellets measure 0.350 inches in length with a 0.3035 inch diameter.

- The FRA-ANP fuel assemblies are equipped with the FUELGUARD™ enhanced debris filtering bottom nozzles for improved debris filtering performance. The W assemblies are equipped with the W "Small Hole" debris filtering bottom nozzle, an alternate protective grid (P-grid), and long solid end plugs.

- The top nozzle design of the W fuel is incompatible with standard thimble plugs, and must use dually compatible thimble plugs. FRA-ANP fuel can use either the standard or the dually compatible thimble plugs.

In other respects, the FRA-ANP and W fuel designs are similar. Both are provided with unique serial numbers engraved on the top nozzle. Both use removable top nozzles. All locator holes in the top and bottom nozzles are compatible with the upper and lower core support plates.

Along with the fuel assemblies, W provided 1056 WABA rodlets distributed among 60 clusters. These WABAs are similar to those used in W fuel in previous CPSES cycles.

The physical (including geometrical) properties of the W OFA fuel are compatible with the FRA-ANP fuel assembly designs and with the CPSES reactor vessel internals, spent fuel racks, and fuel handling equipment. CPSES has previously operated with mixed cores of FRA-ANP / W OFA fuel designs, and successfully demonstrated compatibility with existing rod control clusters and fuel handling equipment.

The mechanical design criteria to which the W fuel rods, fuel assemblies, and burnable absorber and thimble plug clusters have been designed are consistent with the design criteria used for the FRA-ANP fuel assemblies. Compliance with these mechanical design criteria has been demonstrated through mechanical analyses of the W fuel rod and fuel assembly designs, using W methodologies which have been approved by the NRC.

These evaluations are valid for peak fuel rod exposures of 60,000 MWD/MTU (for W fuel with ZIRLO™ clad). This exposure bounds the expected EOC burnup for the W assemblies. The power histories used in the mechanical design are consistent with those histories expected for Cycle 10 operation. An appropriate number of transients (load changes, trips, etc.) have been considered in the fatigue evaluations.

2.2 NUCLEAR DESIGN

The nuclear design of the CPSES Unit 1 Cycle 10 core was performed by TXU in accordance with methodologies approved by the NRC.

The differences between the W OFA fuel assembly design and the FRA-ANP fuel assembly designs, including the IFBAs, are appropriately modeled in the core design and safety analysis codes. Benchmarking was performed by using CPSES core design methodologies to analyze data from other nuclear plants which have used IFBAs. The results from this benchmarking have demonstrated that CPSES core design methodologies properly model the operating characteristics of fuel assemblies which utilize IFBAs.

The Cycle 10 core configuration is designed to meet an $F_Q \times P / K(z)$ limit of ≤ 2.42 for an axial flux difference (ΔI) within Technical Specification limits, where P is the reactor power normalized to rated thermal power.

The Cycle 10 core configuration is presented in Figures 1 and 2. The core contains a total of 1056 WABA rodlets and 4704 IFBA located in the Region 12 fuel assemblies.

FIGURE 1
CORE LOADING PATTERN
CPSES Unit 1 Cycle 10

	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A
1					L50 K-07	M31 12	M64 12	K76 N-03	M29 12	M78 12	L77 F-07				
2			K17 D-14	L49 J-15	M20 12	L08 K-01	M26 12	L80 F-05	M84 12	L78 F-01	M30 12	L35 G-15	K13 M-14		
3		K54 B-12	M82 12	M75 12	L46 L-02	M79 12	L12 G-02	M23 12	L85 J-02	M88 12	L32 E-02	M71 12	M27 12	K09 P-12	
4		L39 A-07	M34 12	L03 H-09	M58 12	L90 M-07	M74 12	L38 H-11	M53 12	L73 D-07	M56 12	L26 J-08	M13 12	L15 R-07	
5	L64 J-06	M41 12	L05 P-05	M16 12	L52 F-11	M44 12	L44 K-13	M36 12	L30 F-13	M80 12	L20 L-10	M63 12	L65 B-05	M65 12	L84 G-06
6	M54 12	L54 R-06	M06 12	L07 J-04	M70 12	L27 D-11	L16 M-13	L86 H-13	L13 D-13	L58 L-12	M32 12	L29 G-04	M51 12	L22 A-06	M22 12
7	M15 12	M28 12	L28 P-09	M46 12	L19 C-06	L51 C-04	L71 E-12	M03 12	L75 M-11	L40 N-04	L82 N-06	M10 12	L33 B-09	M09 12	M39 12
8 (90°)	K69 N-13	L81 L-06	M62 12	L37 E-08	M08 12	L25 C-08	M66 12	GG02 N-03*	M67 12	L34 N-08	M87 12	L68 L-08	M19 12	L01 E-10	K61 C-03
9	M61 12	M17 12	L41 P-07	M42 12	L48 C-10	L02 C-12	L60 D-05	M38 12	L42 L-04	L62 N-12	L06 N-10	M60 12	L09 B-07	M33 12	M72 12
10	M05 12	L61 R-10	M47 12	L66 J-12	M59 12	L87 E-04	L47 M-03	L76 H-03	L10 D-03	L24 M-05	M43 12	L14 G-12	M25 12	L69 A-10	M69 12
11	L74 J-10	M40 12	L17 P-11	M81 12	L43 E-06	M83 12	L59 K-03	M86 12	L88 F-03	M77 12	L45 K-05	M73 12	L18 B-11	M18 12	L67 G-10
12		L72 A-09	M24 12	L53 G-08	M45 12	L55 M-09	M11 12	L23 H-05	M14 12	L04 D-09	M37 12	L36 H-07	M48 12	L89 R-09	
13		K28 B-04	M55 12	M68 12	L70 L-14	M85 12	L21 G-14	M12 12	L11 J-14	M57 12	L63 E-14	M04 12	M02 12	K39 P-04	
14			K24 D-02	L91 J-01	M50 12	L83 K-15	M49 12	L79 K-11	M21 12	L56 F-15	M01 12	L92 G-01	K02 M-02		
15					L31 K-09	M07 12	M76 12	K66 C-13	M35 12	M52 12	L57 F-09				

Quad IV N41 Loop 3

Quad I N43 Loop 2

Quad III N44 Loop 4

Quad II N42 Loop 1

ASSEMBLY ID
REGION # OR U1C9 LOCATION

* Unit 2 Cycle 6 Location

0°

GG	UNIT 2 REGION 7A (FRA-ANP, 4.20 w/o, Central Zone)
L	REGION 11 (FRA-ANP, 4.82 w/o, Central Zone)
K	REGION 10A (FRA-ANP, 4.47 w/o, Central Zone)
M	REGION 12 (Westinghouse, 4.34 w/o, Central Zone)
K	REGION 10B (FRA-ANP, 4.60 w/o, Central Zone)

FIGURE 2
BURNABLE ABSORBER AND SOURCE ROD LOCATIONS
CPSES Unit 1 Cycle 10

	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A
1					6S										
2					64I		104I 8W		104I 8W		64I				
3			64I	64I 8W		48I 24W		64I 20W		48I 24W		64I 8W	64I		
4			64I 8W		48I 24W		48I 24W		48I 24W		48I 24W		64I 8W		
5		64I		48I 24W		64I 20W		64I 20W		64I 20W		48I 24W		64I	
6			48I 24W		64I 20W						64I 20W		48I 24W		
7		104I 8W		48I 24W				104I 8W				48I 24W		104I 8W	
8			64I 20W		64I 20W		104I 8W		104I 8W		64I 20W		64I 20W		
9		104I 8W		48I 24W				104I 8W				48I 24W		104I 8W	
10			48I 24W		64I 20W						64I 20W		48I 24W		
11		64I		48I 24W		64I 20W		64I 20W		64I 20W		48I 24W		64I	
12			64I 8W		48I 24W		48I 24W		48I 24W		48I 24W		64I 8W		
13			64I	64I 8W		48I 24W		64I 20W		48I 24W		64I 8W	64I		
14					64I		104I 8W		104I 8W		64I				
15					6S										

Quad IV N41 Loop 3 (upper left); Quad I N43 Loop 2 (upper right); Quad III N44 Loop 4 (lower left); Quad II N42 Loop 1 (lower right)

90° (left side, row 8); 0° (bottom, column H)

6S — SECONDARY SOURCES (2)

xxI — # OF IFBA RODS (48, 64 or 104)

yyW — # OF WABA RODS (8, 20 or 24)

3.0 DISCUSSION OF THE CYCLE 10 STARTUP TESTS

The objectives, methods, and results of each startup test is described in the following sections. The purpose of the overall test program is to ensure the new cycle reactor core behaves in a manner consistent with the design and safety analyses.

3.1 CORE LOADING

OBJECTIVES

Control the loading sequences to ensure that the nuclear fuel assemblies are loaded in a safe and cautious manner, and that the final core configuration is in agreement with the specified design.

TEST METHODOLOGY

Refueling was performed by completely offloading the Cycle 9 core to the Spent Fuel Pool, changing out fuel inserts, and then loading the Cycle 10 core. Cycle 9 had indications of one leaking fuel pin in a high burnup assembly. Inmast sipping inspections and UT inspections were performed and positively identified the leaking assembly, which was a discharge fuel assembly. No leaking fuel assemblies were reloaded into the Cycle 10 core.

The first assembly (one of two source assemblies) to be reloaded was latched on October 17, 2002 and the last assembly to be loaded was unlatched on October 19. Inverse Count Rate Ratio (ICRR) was monitored during fuel loading.

The Cycle 10 core configuration is presented in Figure 1.

SUMMARY OF RESULTS

Prior to reload, fuel assembly insert number/type were verified in the spent fuel pool by Core Performance Engineering and Quality Control. There were no discrepancies identified. Fuel assemblies identifications were again verified via underwater camera for each assembly as it was loaded into the core.

Core loading was completed on October 19, 2002. All 193 assemblies were loaded into the core without incident.

Following reload, the core loading pattern verification process was completed for the Cycle 10 loading pattern by Core Performance Engineering and Quality Control.

3.2 CONTROL ROD DROP TIME MEASUREMENTS

OBJECTIVE

To determine the drop time of each Rod Control Cluster Assembly (RCCA) under hot, full flow conditions in accordance with Technical Specification SR 3.1.4.3.

TEST METHODOLOGY

The Plant Process Computer (PPC) method was used to determine the rod drop times for Unit 1 Cycle 10. This involves withdrawing each rod bank and opening the reactor trip breakers. The difference between the time the reactor trip breakers open and the time a RCCA has entered the dashpot (according to PPC DRPI indications) is used to determine the rod drop time. This process is repeated for the remaining banks.

SUMMARY OF RESULTS

Technical Specification SR 3.1.4.3 requires the drop time for each RCCA from the fully withdrawn position to be less than or equal to 2.4 seconds from the beginning of decay of stationary gripper coil voltage to dashpot entry with Tavg greater than or equal to 500°F and all reactor coolant pumps running. Under these conditions, the longest drop time was 2.11 seconds for RCCAs at locations D02, B04, D14, P12, and M02.

All rod banks satisfied review and acceptance criteria.

3.3 INITIAL CRITICALITY

OBJECTIVE

To achieve initial criticality following refueling in a deliberate and controlled manner.

TEST METHODOLOGY

From an initial condition of all rods in and a boron concentration of 1953 ppm, the Shutdown and Control Banks were withdrawn to the full out position (FOP) in proper overlap and sequence. Inverse Count Rate Ratio (ICRR) was monitored during bank withdrawal.

Reactor Coolant System (RCS) dilution was initiated. During dilution, ICRR was monitored. Criticality was declared on November 10, 2002, and dilution was terminated. Control Bank D (CBD) motion was used to stabilize flux level.

SUMMARY OF RESULTS

Cycle 10 initial criticality was achieved in a controlled manner on November 10, 2002 at 2322 hours.

3.4 LOW POWER PHYSICS TESTING

Low Power Physics Testing (LPPT) verifies the design of the reactor by performing a series of selected measurements including control/shutdown bank worths, moderator temperature coefficient and boron worth. These measurements are performed by using the Digital Reactivity Computer (DRC) resident on the Plant Process Computer (PPC) to indicate reactivity changes below the point of adding heat.

The individual tests completed during the initial criticality and the low power test sequences are discussed in the following sections of this report. All required tests were satisfactorily completed.

Upon completion of LPPT, the plant was shutdown as directed by the Shift Manager to implement repairs due to equipment problems unrelated to Physics Testing.

3.4.1 DETERMINATION OF THE RANGE FOR PHYSICS TESING

OBJECTIVE

To determine the neutron flux level at which detectable reactivity feedback from fuel heating occurs and to establish the flux range for low power physics testing.

TEST METHODOLOGY

With the reactor critical at a power level of approximately 1.0 E-8 amps (as indicated by the primary IR channel), approximately +40 pcm of positive reactivity was added by withdrawal of Control Bank D. Flux was allowed to increase until fuel temperature feedback effects were observed by a decrease in the indicated core reactivity, as indicated on strip chart recorders.

The physics testing range upper limit was set at 30% of the flux level at which the point of adding heat was observed. The LPPT lower limit is 3% of this point, giving a one decade range in which to perform LPPT.

SUMMARY OF RESULTS

Fuel temperature reactivity feedback was observed at flux levels similar to past CPSES cycles. The LPPT range was set appropriately. There are no review or acceptance criteria for this test.

3.4.2 ARO BORON ENDPOINT MEASUREMENT

OBJECTIVES

To measure the critical boron concentration at the All Rods Out configuration.

TEST METHODOLOGY

Conditions were established with Control Bank D within 30-50 pcm of its full out position configuration with the reactor critical in the low power physics testing range. The control bank was withdrawn to the full out position while monitoring reactivity. The changes in reactivity due to bank movement and Tavg deviation from Tref were converted to equivalent boron concentration units and used to correct the initial boron concentration, yielding the endpoint boron concentration.

SUMMARY OF RESULTS

The ARO boron endpoint measurement satisfied the review and acceptance criteria.

3.4.3 MODERATOR TEMPERATURE COEFFICIENT MEASUREMENTS

OBJECTIVE

To measure the Isothermal Temperature Coefficient (ITC) and calculate the Moderator Temperature Coefficient (MTC).

TEST METHODOLOGY

The ITC measurement was performed by first decreasing, then increasing Tavg using Steam Generator blowdown flow and increasing Auxiliary Feedwater Flow to compensate. The resulting reactivity changes were measured and used to calculate the ITC. The ITC is the change in reactivity divided by the associated change in temperature.

The MTC was determined by subtracting the design Doppler Temperature Coefficient from the ITC.

SUMMARY OF RESULTS

The measurement of ITC met the review criteria of being within $\pm$ 2 pcm/°F of the design value. The difference between the measured value and design value was similar to past CPSES cycles. MTC met the acceptance criteria of < +5.0 pcm/°F.

3.4.4 REFERENCE BANK WORTH MEASUREMENT

OBJECTIVE

To measure the Integral Rod Worth (IRW) of the Reference Bank using the standard boron dilution technique.

TEST METHODOLOGY

The Reference Bank is the RCCA bank with the highest predicted IRW. For Unit 1 Cycle 10, the Reference Bank was Shutdown Bank B.

Conditions were established with Control Bank D within 30-50 pcm of its full out position configuration with the reactor critical in the low power physics testing range. CBD is withdrawn in MANUAL to the FOP. Following a short wait for a reactivity measurement, the Reference Bank is selected in individual bank select and inserted to establish reactivity indication on the DRC near zero.

A RCS dilution is then initiated. The Reference Bank is inserted in incremental reactivity steps sufficient to maintain flux and reactivity in the LPPT range as the dilution continues. Reactivity measurements are registered for each incremental insertion. A Target Rod Position is selected for the Reference Bank that corresponds to approximately 60 pcm of remaining worth which indicates when to secure the dilution. After the dilution is terminated and RCS mixing is complete, the Reference Bank will have a small amount of remaining worth at the critical position. The Reference Bank is then fully inserted for the final reactivity measurement and withdrawn back to the critical position.

The incremental reactivity steps are summed to obtain the total worth for the Reference Bank.

SUMMARY OF RESULTS

The Review Criteria states that the absolute value of the percent difference between measured and predicted IRW for the Reference Bank is $\leq$ 10%. This criteria was satisfied.

The Acceptance Criteria states that the absolute value of the percent difference between measured and predicted IRW for the Reference Bank is $\leq$ 15%. This criteria was also satisfied.

The differences between the measured values and design values were similar to past CPSES cycles.

3.4.5 BANK REACTIVITY WORTH MEASUREMENTS (ROD SWAP)

OBJECTIVE

To infer the integral reactivity worth of each Control and Shutdown Bank based on the known IRW of the Reference Bank measurement.

TEST METHODOLOGY

Integral bank worths were measured using the rod swap method. The subject bank was inserted then compensated for by pulling the reference bank in response to the change in reactivity caused by the insertion of the measured bank. Each bank's worth was determined by comparison to the Reference Bank's measured worth.

SUMMARY OF RESULTS

The following review and acceptance criteria were satisfied.

Review Criteria:

> Individual Banks within 15% or within 100 pcm of design worths, whichever is greater.
>
> Total Worth is ≤ 110% of design.

Acceptance Criteria:

> Sum of measured bank worths shall be no less than 90% of the design sum of bank worths.

The differences between the measured values and design values were similar to past CPSES cycles.

3.5 FLUX MAPPING

OBJECTIVE

To verify adequate flux symmetry and power distribution during initial startup following refueling.

TEST METHODOLOGY

Flux maps were taken at the 28%, 80%, and 100% RTP plateaus to monitor flux symmetry and power distribution.

SUMMARY OF TEST RESULTS

A flux map was taken at the 28% plateau. The maximum allowable power level extrapolated above 80% (the next target plateau) based on peaking factors. A check of the core loading pattern was performed by comparing the Relative Power Densities (RPD) from the flux map to design predicted values. All RPD values satisfied review criteria limits.

At 80% RTP, a base case flux map and six quarter-core flux maps were taken for the Confirmation of the Calibration Standard. Peaking factor extrapolation resulted in a most limiting allowable power level in excess of 100% RTP.

Xenon equilibrium was established at 100% power and a full core flux map was performed on December 18. Power distribution factors and flux symmetry satisfied all requirements. Target AFD was established based on the measured axial offset.

The differences between the measured values and design values were similar to past CPSES cycles. All flux maps taken during power ascension displayed adequate flux symmetry and power distributions, and all acceptance criteria were met.

3.6 INCORE/EXCORE DETECTOR CALIBRATION

OBJECTIVES

The objective of this surveillance is to check the validity of the current incore/excore detector calibration equations. The incore axial flux difference (AFD) is measured with a full core flux map and compared to the AFD indicated by the control board indicators, the plant process computer, and the NIS power range excore detector currents. This procedure satisfies Technical Specifications Surveillance Requirements 3.3.1.3.6 and 3.3.1.6.6 for Overtemperature N-16 function.

TEST METHODOLOGY AND RESULTS

Pre-critical adjustment ratios from the Unit 1 Cycle 10 Startup and Operations Report were used to adjust the latest calibration currents from the previous cycle.

A full core flux map was taken at 28% power. AFD Monitor Check calculations passed acceptance criteria, but did not pass review criteria. Therefore, excore detector calibrations were required. Power ascension was allowed to continue as excore detectors were calibrated.

At the next calibration plateau, power was held near 80% for a sufficient amount of time to reach xenon stability. A full core flux map was performed on November 22, 2002. It was determined that AFD indications exceeded the acceptance criteria, therefore excore calibrations were performed prior to starting the Multipoint Measurement.

Six Quarter Core flux maps were performed on November 23, 2002 to be used in the Confirmation of the Calibration Standard. The flux maps were measured over a total change of 18% in incore axial offset. The measurements confirmed that the Calibration Standard could be used in place of multipoint measurements for the calibration of the power range NIS throughout Unit 1 Cycle 10 operation.

Neutron Streaming Gains were determined and transmitted to I&C for calibration of the N16 system.

A full core flux map was performed on November 18, 2002 with the reactor at 100% RTP. The AFD Monitor check satisfied acceptance criteria, but did not satisfy review criteria. Therefore, both the Intercept Current and Delta Q alignments for each excore NIS channel were performed.

3.7 CORE REACTIVITY BALANCE

OBJECTIVE

To compare the overall core reactivity balance with predicted values at hot full power (HFP), all rods out (ARO), equilibrium Xenon/Samarium boron concentration.

TEST METHODOLOGY

Under equilibrium conditions at 100% RTP, the Reactor Coolant System measured boron concentration was corrected to yield the Hot Full Power, All Rods Out, Equilibrium Xenon/Samarium boron concentration for comparison with the predicted boron concentration.

SUMMARY OF RESULTS

The equivalent reactivity difference between measured and predicted boron concentration was within the acceptance criteria of 1000 pcm, as required by Technical Specification SR 3.1.2.1. The difference between the measured value and design value was similar to past CPSES cycles.

4.0 SUMMARY

This report is submitted as required following installation of fuel of a different design. Cycle 10 contains 88 fresh assemblies supplied by W, 72 of which contain Integral Fuel Burnable Absorbers. Comanche Peak has not previously loaded fuel containing this type of burnable absorber.

Comanche Peak has previously used fuel of the Westinghouse OFA design. Since 1993, however, Siemens Power Corporation (now FRA-ANP) has been the primary fuel supplier. Although the Unit 2 Cycle 7 core contains eight W "lead use" assemblies of a similar fuel design, Unit 1 Cycle 10 is the first cycle in recent years in which the full reload has been supplied by Westinghouse. The design of this Westinghouse fuel, including the WABA burnable absorbers, is similar to the previous fuel used at CPSES; however, it uses ZIRLO™ materials to replace Zircaloy and contains IFBAs.

Unit 1 Cycle 10 reload, startup, and physics tests were performed without incident. All required testing was performed, and all acceptance criteria were satisfied. The differences between the measured values and design values were similar to past CPSES cycles. Based on the results, the Westinghouse OFA assemblies and Integral Fuel Burnable Absorbers were properly modeled in the design of the core, and there was no need to perform further testing.