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

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION
DOCKET NOS. 50-445 AND 50-446
UNIT 1, CYCLE 14 STARTUP REPORT

Dear Sir or Madam:

Luminant Generation Company LLC (Luminant Power) implemented License Amendment 146 in Unit 1 Cycle 14 and increased reactor power 4.5%. In accordance with the Final Safety Analysis Report (FSAR) Section 4.6.6, enclosed is a summary report of the unit startup and power escalation testing following an amendment to the license involving a planned increase in power level.

This communication contains no new licensing basis commitments regarding Comanche Peak Units 1 and 2.

Please contact Mr. J. D. Seawright at (254) 897-0140 should you have any questions.

Sincerely,

Luminant Generation Company LLC

Mike Blevins

By: Fred W. Madden
Fred W. Madden
Director, Oversight & Regulatory Affairs

Enclosure - Startup Test Report, Cycle 14

c - E. E. Collins, Region IV
B. K. Singal, NRR
Resident Inspectors, Comanche Peak

IE26
NRR

COMANCHE PEAK NUCLEAR POWER PLANT

UNIT NO. 1

STARTUP TEST REPORT

CYCLE 14

INDEX

1.0 EXECUTIVE SUMMARY

This report summarizes the Cycle 14 startup testing performed following the completion of the 1RF13 refueling outage, September 27 to October 16, 2008. Preparations for both the refueling outage and Cycle 14 operation included a stretch power uprate (SPU) to allow operation at 3612 MWt. The planning for the SPU included the following:

- On August 29, 2007, the station submitted License Amendment Request LAR 07-004, "Revision to the Operating License and Technical Specification 1.0, 'Use and Application' and 3.7.17, 'Spent Fuel Assembly Storage' to Revise Rated Thermal Power from 3458 MWt to 3612 MWt," requesting approval to operate at a 3612 MWt power level starting in Cycle 14.

- On June 27, 2008, License Amendment Request LAR 07-004 "Revision to the Operating License and Technical Specification 1.0, 'Use and Application' and 3.7.17, 'Spent Fuel Assembly Storage' to Revise Rated Thermal Power from 3458 MWt to 3612 MWt," was approved by the Nuclear Regulatory Commission (NRC).

- Nuclear Supply Safety System (NSSS) and Balance of Plant (BOP) modifications were planned to support the cycle 14 stretch power uprate. The modifications included the following:

  BOP / NSSS Systems:
  - Reactor Coolant Pump Protection and Penetration Protection Relay Setting changes
  - Rescaling of the Condensate Pump discharge flow indicators, Feedwater pump suction flow indication, Heater Drain Pump discharge flow indication and Control Room instrumentation banding changes
  - Feedwater Pump Section Pressure Trip setpoint changes
  - Rescaling of back-up Feedwater flow transmitters (1-FT-0510A, 1-FT-0511A, 1-FT-0520A, 1-FT-0521A, 1-FT-0530A, 1-FT-0531A, 1-FT-0540A, 1-FT-0541A) which provide input to the plant calorimetric calculation [if Leading Edge Flow Meter (LEFM) is unavailable]
  - Circ Water Discharge Temp monitoring (X-TR-2937) changes (an improvement in the reliability of instrumentation used for Texas Pollutant Discharge Elimination System (TPDES) compliance)
  - Turbine impulse pressure scaling calc changes
  - Steam Dumps scaling calc changes
  - Rod Control System scaling calc changes

  Main Turbine - Generator:
  - Installation of a new High Pressure Turbine
  - Re-rating of the Main Generator Exciter
  - Primary Water parameter changes
  - Lube Oil parameter changes

Turbine Digital Control System:
- Turbine Generator Digital Control system changes to TXP, STRUC, SIMADYN & TVR

Isophase Bus Duct:
- Replace the Isophase Bus Duct Coolers with 40,000 cfm units
- New inspection ports and test ports for fan testing
- Replace Isophase Bus Ducts & Flexible Links (a system reliability enhancement based on industry operating experience)
- Modify Turbine Plant Cooling Water (TPCW) System Piping & Supports

Heater Drain System:
- Replace Heater Drain Pump Motors with 2000 horsepower (HP) Motors
- Replace Heater Drain Pump 3rd stage impellers (1st & 2nd impellers stay the same)
- Replace 3rd point heater drain vent line air operated valves (AOVs) (LV-2031C & LV-2032C) with 8" pipe spool piece
- Increase valve size for 5A & B feedwater heater (FWHTR) normal control valves (LV-2533 & LV-2537) from 6" to 8" valves
- Re-slope FWHTR 6A & B drain lines on turbine building TB 803' elevation
- Increase HI-HI level in FWHTR 3A & B Extraction Steam isolation
- Modification of hangers on 3A & B drain line to heater drain tank (HDT)

Feedwater System:
- Feedwater System (outside containment) Pipe Support Modifications
- Feedwater pump (FWP) Mark V digital control system changes

Plant Computer:
- Plant Computer Database Changes

Turbine Plant Cooling Water (TPCW):
- Remove 4 flow orifices (FE-3067, FE-3068, FE-3120, and FE-3092) and install Annubars (to reduce overall system resistance and enhance system flow)
- Installation of new Generator H2 Coolers
- Installation of new Exciter Air Coolers

The Main Step-Up Transformers can support the power uprate with current administrative guidelines on mega vars (MVARs). The Main Step-Up Transformers will be replaced during 1RF14 to eliminate MVAR limitations.

With the exception of the "Circ Water Discharge Temp monitoring (X-TR-2937) changes," the above modifications were implemented during the 1RF13 refueling outage with required modification retests performed during plant heatup or power ascension. The "Circ Water Discharge Temp monitoring (X-TR-2937) changes" were implemented and tested at power prior to the 1RF13 outage.

1RF13 Refueling Outage Milestones and Timeline:

- Breakers open (plant separates from the grid): 9/27/08 @ 1200hrs
- Synchronize to the grid: 10/16/08 @ 2139hrs
- Completed ramp to 28% rated thermal power (RTP): 10/17/08 @ 0447hrs (start of 28% RTP plateau)
- Completed ramp to 45% RTP: 10/17/08 @ 2400hrs (start of 45% RTP plateau)
- Completed ramp to 77% RTP: 10/18/08 @ 2200hrs (start of 77% RTP plateau)
- Completed ramp to 90% RTP: 10/19/08 @ 2000hrs (start of 90% RTP plateau)
- Completed ramp to 3458 MWt: (old 100%) 10/20/08 @ 0755hrs
- Completed ramp to 3535 MWt: 10/20/08 @ 1430hrs
- Completed ramp to 3612 MWt: 10/20/08 @ 2315hrs

2.0 CORE DESIGN SUMMARY

The Cycle 14 core is designed to reach an end of cycle burnup of 519.3 effective full power days (EFPD) (23,133 megawatt days per metric ton of uranium (MWD/MTU)) at normal operating conditions. The safety analysis for Cycle 14 supports end of life power coastdown up to a burnup of up to 541.4 EFPD (24118 MWD/MTU). The Cycle 14 core contained 92 fresh fuel assemblies (72 with an enrichment of 4.50 w/o, and 20 with an enrichment of 4.90 w/o). In addition, the top and bottom 6 inches of fuel (the axial blanket region) has an enrichment of 2.6 w/o. By comparison, Cycle 13 utilized 88 fresh fuel assemblies (72 with an enrichment of 4.45 w/o, and 16 with an enrichment of 4.90 w/o).

The following mechanical design is used in the Cycle 14 core:

- The Cycle 14 core contains 101 burned fuel assemblies in Regions 15A/15B, 14B, and 13B and 92 fresh fuel assemblies in Regions 16A/16B. Region 13B is of the Westinghouse 17x17 VANTAGE+ (Optimized Fuel Assembly (OFA) design without IFM grids). Regions 16A/16B, 15A/15B, and 14B are of the Westinghouse 17x17 VANTAGE+ design (OFA design with IFM grids).

- The fuel rods are supported at intervals along their length by a total of eight structural grid spacer assemblies which maintain the lateral spacing between rods. The Westinghouse fuel assemblies utilize six mid-span ZIRLO™ grids and one Inconel grid on each end. The Region 15A/15B and Region 16A/16B fuel assemblies incorporate three Intermediate Flow Mixing (IFM) grids in the top half of each assembly for improved fuel mechanical and thermal performance.

- All Integral Fuel Burnable Absorber (IFBA) containing fuel rods in Cycle 14 have 2.6 w/o reduced enrichment annular axial blankets in the top and bottom six inches of each fuel rod. The annular axial blanket is required to accommodate the gas volume produced in the IFBA. All non-IFBA fuel rods in Cycle 14 have 2.6 w/o reduced enrichment solid axial blankets.

- All fuel assemblies in Cycle 14 core include removable top nozzles. All fuel assemblies are equipped with the Westinghouse "Small Hole" debris filtering bottom nozzle, an alternate protective grid (P-grid), and long solid end plugs. The P-grid is an additional grid, positioned on top of the bottom nozzle, designed to catch debris and provides increased support to the fuel rod end. The long solid end plug feature ensures that debris caught in the P-grid will not fret through the fuel rod. The Region 16A/16B assemblies also incorporate a thin zirconium oxide coating applied to the bottom seven inches of each fuel rod to provide additional debris fretting protection during the first several months of fuel operation.

The Cycle 14 core was designed for an uprated thermal power (RTP) condition of 3612 MWt. The previous RTP for Cycle 13 was 3458 MWt.

The Core Design and Safety Analysis of Cycle 14 were performed using Westinghouse Methodologies, similar to the current operating cycle of Comanche Peak Nuclear Power Plant (CPNPP) Unit 2. Cycle 14 is the first Unit 1 cycle which utilized these methodologies.

3.0 LOW POWER PHYSICS TESTING SUMMARY

Testing was performed in accordance with the following general sequence:

1. Initial Criticality: Criticality was achieved by withdrawing all shutdown and control banks, and then diluting to reach critical conditions.

2. Zero Power Test Range Determination: This was determined after the point of adding heat had been demonstrated.

3. Reactivity Computer Checkout: This was determined during the positive reactivity maneuver for the Boron Endpoint Measurement, by comparing the reactivity output of the Digital Reactivity Computer (DRC) to a reactivity value calculated using the Inhour equation.

4. Boron Endpoint Measurement: This was determined with all Control and Shutdown banks withdrawn using the Reactivity Computer and measured RCS Boron values.

5. Isothermal Temperature Coefficient Measurement (ITC): This was determined using the DRC during a RCS temperature change. The Moderator Temperature Coefficient (MTC) was calculated from the ITC Data.

6. Rod Worth Measurement: The reference bank was measured using the Boron Dilution technique. All other test banks were measured using the Rod Swap method (exchanging the banks with the Reference Bank to determine each bank total worth).

All review and acceptance criteria were met and the results are presented in Table 1.

4.0 POWER ASCENSION TESTING SUMMARY

Since the power ascension for Cycle 14 included first time operation at the new uprated thermal power level of 3612 MWt, the standard post-refuel power ascension test program was augmented to include additional testing and evaluations. The scope of the additional testing and evaluations was determined as follows:

- As part of the preparations for rated thermal power increase from 3458 MWt to 3612 MWt, an applicability assessment of initial plant startup tests as described in Chapter 14 of the Updated Final Safety Analysis Report (UFSAR) was performed. The assessment results are summarized below:

  - A number of UFSAR Chapter 14 tests now exist as routine operating and surveillance procedures that are performed as part of each refueling and post-refueling startup. The scope of these procedures was determined to be acceptable for use in the uprated power condition or not required for the uprated power condition and as such are not reported in the startup report. Examples of these procedures are:
    - Reactor Coolant System Flow Test
    - Control Rod Drive Test
    - Rod Position Indication
    - Reactor Trip System
    - Calibration of Process Temperature and Nuclear Instrumentation
    - Moderator Temperature Reactivity Coefficient
    - Control Rod Reactivity Worth
    - Boron Reactivity Worth
    - Core Reactivity Balance
    - Loss of Offsite Power
    - Rod Drop Tests
    - Flex Distribution Measurements
    - Core Performance Evaluation
    - Remote Shutdown
    - Turbine Trip / Generator Load Rejection
    - Reactor Coolant Leak
    - Rod Control system
    - Automatic Control System Test
    - Incore Nuclear Instrumentation

  - A number of UFSAR Chapter 14 tests performed as part of the initial Unit 1 startup were determined <u>not</u> required to support the uprated power condition and as such are not reported in the startup report. Examples of these procedures are:
    - Reactor Coolant System Flow Coastdown Test
    - Auxiliary Startup Instrumentation
    - Chemical Test (RCS and Secondary Coolant Chemistry)

- The dynamic tests described in the UFSAR Chapter 14 were not re-performed. The assessment determined that these tests were not necessary based on analysis and the experience of other plants with similar uprates. Examples of these procedures are:
    - Unit Load Transients (10% Load Swings / 50% Turbine Load Reduction / Turbine Trip – Generator Load Rejection)
    - Reactor Trip

  However, a 50 MWe load reduction was performed to demonstrate the integrated response of the Feedwater control system setting changes.

- A number of secondary side modifications were completed as part of the uprate to improve design and operating margins, plant performance and efficiency. Specific performance tests for these modifications were developed and included in the scope of the power ascension test program.

A specific station procedure was written for the power ascension to the uprated power level of 3612 MWt. This procedure directed the performed of required testing and evaluations. This power ascension procedure provided the overall sequence of required activities as well as the types of management review and approvals needed to continue the power ascension to the next power plateau.

Testing was preformed at specific power plateaus of 28%, 45%, 77%, 90%, 95.7% (3458 MWt), 97.7% (3535 MWt), and 100% Rated Thermal Power (RTP). Power changes were governed by operating procedures and fuel preconditioning guidelines.

Test activities 1 through 10 described below are standard power ascension activities performed following all refueling outages. Items 11 through 19 describe the additional testing and evaluations performed to ensure a conservative, deliberate approach to the uprated power level of 3612 MWt.

Thermal-hydraulic parameters, nuclear parameter and related instrumentation were monitored throughout the Power Ascension. Data was compared to previous cycle power ascension data and engineering predictions, as required, at each test plateau to identify calibration or system problems. The major areas analyzed were:

1. Core Performance Evaluation: Flux mapping was performed at 28%, 77%, and 100% RTP using the Movable Incore Detector System. The resultant peaking factors and power distribution were compared to Technical Specification limits to verify that the core was operating within its design limits. All analysis limits were met, and the results are summarized in Table 2.

2. Nuclear Instrumentation Indication: Overlap data was obtained between the Intermediate Range and Power Range channels. Secondary plant

heat balance calculations were performed to verify the Nuclear Instrumentation indications.

3. RCS Delta-T Indication: Delta-T calculations at the 78% power plateau were accomplished during the transient time flow meter (TTFM) test and documented in work order (WO) - 405900. The Delta-T values for each loop varied due to the localized heating in RCS loops 2 and 4. This heating is due to uneven mixing in the upper plenum, and an anomaly called the Upper Plenum Flow anomaly (UPFA).

4. Upper Plenum Anomaly Evaluation: At 100% power, the UPFA was present more than it was absent and is adding to the higher calorimetric in loops 2 and 4. Although the UPFA on Unit 1 is expected, the magnitude and duration of the UPFA was larger than expected. The magnitude of the UPFA is about 1% low for loop 1 and about 2% high for loop 4. The duration of the anomaly is "most of the time" except for several times during a 24-hour period where the anomaly goes away (may be considered as an anti-anomaly) and loop 1 goes high by about 3% and loop 4 moves low by about 3%. Operations procedures account for the UPFA conditions, so it is being handled operationally, but it is a factor to be considered in evolutions involving Tave.

5. RCS Temperatures: RCS RTD's were calibrated during the RCS RTD cross calibration at the 350 degree, 450 degree, and 550 degree plateaus. No out-of-tolerance or drift conditions were observed. With the K9 gain adjustments two weeks after 1RF13, the RCS Tave loops read correctly, and operations is holding the Tave / Tref deviation very close to zero. Tref is indicating 585.4 degrees F at 100% power.

6. Steam and Feedwater Flows: Data was obtained for the steam and feedwater flows. Evaluations for deviations between redundant channels on individual steam generators were performed. The data was as expected.

7. Steam Generator Pressures: Data was obtained for the steam generator pressures. Evaluations for deviations between redundant channels on individual steam generators were preformed. The steam pressures recorded post uprate are within a few pounds of the steam pressure before uprate. The data was as expected.

8. Turbine Impulse Pressure: The initial scaling of impulse pressure was calculated for the start of the Cycle 14 power ascension based on engineering calculations for expected full power turbine impulse pressure. Once at steady state 100% RTP conditions were reached, the turbine impulse pressure was re-normalized to reflect actual conditions.

9. Incore / Excore Calibrations: Calibration factors were calculated from flux map data using the single point calibration methodology. The nuclear instrumentation power range channels were re-scaled at 28%, 77%, and 100% RTP.

10. RCS Flow: RCS flow transmitters were compared to RCS flow requirements during the 78% plateau TTFM (RCS Flow) testing. WO-405900 contains the datasheets on the RCS flow rates. RCS flow transmitters measured greater than 98.0% flow and less than 99.7% flow as required by Instrument and Control Manual procedure INC-7018A. Additionally, the total RCS flow as measured by the TTFM test equipment was 413,504 gpm, which met the Core Operating Limits Report (COLR) requirement of greater than or equal to 403,700 gpm and also met the procedural requirement of less than or equal to 420,820 gpm (INC-7018A). The individual loop flow rates met the procedural requirement of less than 108,183 gpm.

11. Plant Walkdowns: At the 95.7% (3458 MWt), 97.7% (3535 MWt) and 100% Rated Thermal Power (RTP) testing plateaus, walkdown of selected secondary plant systems and components were performed to evaluate the overall response and stability of these systems and components. Acceptable results from these walkdowns were documented as part of the approval process to continue to increase power to the next plateau.

12. Augmented Data Collection / Evaluations: For the areas of NSSS and Balance of Plant (BOP), selected additional monitoring points were evaluated against expected values at the testing plateaus. Acceptable results from these evaluations were documented as part of the approval process to continue to increase power to the next plateau.

13. Radiation Surveys / Process and Effluent Radiation Monitoring: Radiation surveys were completed at the uprated power level. The results were evaluated and found acceptable and consistent with expectations for the uprated power condition.

14. Area Temperature Monitoring: Selected area temperature and process stream measurements were obtained during plant operation at the uprated level. The results were evaluated and found acceptable and consistent with expectations for the uprated power condition.

15. Vibration Monitoring Walkdowns: At the 95.7% (3458 MWt), 97.7% (3535 MWt) and 100% (3612 MWt) Rated Thermal Power (RTP) testing plateaus, walkdowns of selected secondary plant systems and components were performed to evaluate the overall response and stability in regards to piping and component vibrations. Acceptable

results from these walkdowns were documented as part of the approval process to continue to increase power to the next plateau.

16. Heater Drain Pump Performance Monitoring: During the power ascension, Heater Drain Pump performance data was collected at the 30%, 50%, 80%, and 100% RTP. The results were evaluated and found acceptable and consistent with expectations for the uprated power condition.

17. Main Turbine Performance Monitoring Testing: Due to the replacement of the High Pressure Turbine, testing to measure the Turbine-Generator performance was performed once steady state 100% RTP conditions were reached. The results were evaluated and found acceptable and consistent with expectations for the uprated power condition.

18. Dynamic Testing: A 50 MWe load reduction was performed once steady state 100% RTP conditions were reached. The purpose of this test was to demonstrate the integrated response the Feedwater control system setting changes and to perform Feedwater Loop Tuning if required. The results from the test were evaluated and found acceptable and consistent with expectations for the uprated power condition. No feedwater loop tuning was required.

TABLE 1

LOW POWER PHYSIC RESULTS: CYCLE 14

Parameter	Review Criteria	Acceptance Criteria	Results
All Rods Out, Hot Zero Power Critical Boron	Pred - Meas ± 50 ppm	Pred - Meas ± 1000 pcm	SAT -33.2 ppm 253.7 pcm
Differential Boron Worth	(Pred - Meas) / Meas ± 15%	N/A	SAT -1.1%
All Rods Out ITC	Pred - Meas ± 2 pcm /°F	N/A	SAT 0.63 pcm /°F
All Rods Out MTC	N/A	Meas < 5 pcm /°F	SAT -0.5 pcm /°F
Reference Bank Integral Rod Worth	|(Pred - Meas) / Pred| ≤ 10%	|(Pred - Meas) / Pred| ≤ 15%	SAT 1.9%
Test Bank Integral Rod Worth	| Pred - Meas | ≤ 100 pcm <u>OR</u> |(Pred - Meas) / Pred | ≤ 15%, whichever is greater	| Pred - Meas | ≤ 200 pcm <u>OR</u> |(Pred - Meas) / Pred | ≤ 30%, whichever is greater	SAT 33.53 pcm (CBD) 9.67% (SBA)
Sum of All Integral Rod Worths	(Meas / Pred) X 100% ≤ 110%	(Meas / Pred) X 100% ≥ 90%	SAT 97.07%

TABLE 2

POWER ASCENSION FLUX MAP RESULTS: CYCLE 14

Item	Map 01	Map 02	Map 03
Date of Map	10/17/2008	10/19/2008	10/22/2008
Power Level	28.3% RTP	76.7% RTP	100.0% RTP
Control Bank D Position	180 steps	201 steps	215 steps
Limiting F_Q w/ Uncertainty	2.07	1.94	1.92
Limiting $F_{\Delta H}$ w/ Uncertainty	1.54	1.51	1.51
Axial Offset	+4.8%	-1.6%	-3.8%
Maximum Normalized Incore Tilt	1.0132	1.0037	1.0048
Max Measured-to-Predicted Power Distribution Absolute Difference	4.8%	4.4%	4.9%