FPL

July 20, 2015
L-2015-200

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

RE: Turkey Point Unit 4
Docket No. 50-251
FPL Records- Letters L-2003-255 and L-2013-218

Florida Power & Light Company (FPL) submitted letter L-2003-255, "Turkey Point Unit 4 Docket No. 50-251 Steam Generator Tube Plugging 15-Day Report," on October 30, 2003. FPL submitted letter L-2013-218, "Turkey Point Unit 4 Renewed Facility Operating License No. DPR-41 Extended Power Uprate Cycle 27 Startup Report," on July 16, 2013.

It was brought to our attention that the Nuclear Regulatory Commission (NRC) Document Control Desk has not received FPL letters L-2003-255 and L-2013-218. As such, enclosed please find a copy of the referenced letters for your records.

If you have any questions, please contact Mr. Mitch Guth, Licensing Manager, at (305) 246-6698.

Sincerely,

Thomas Summers
Site Vice President
Turkey Point Nuclear Plant

Enclosure

cc: Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, Turkey Point Plant

A001
NRR

L-2015-200

ENCLOSURE

One Copy of FPL Letters L-2003-255 and L-2013-218

FPL

OCT 3 0 2003

L-2003-255
10 CFR 50.36

Luis A. Reyes
Regional Administrator
U. S. Nuclear Regulatory Commission
Atlanta Federal Center
61 Forsyth Street, S. W., Suite 23T85
Atlanta, GA 30303

Dear Mr. Reyes:

Re: Turkey Point Unit 4
Docket No. 50-251
Steam Generator Tube Plugging 15-Day Report

In accordance with Turkey Point Technical Specification 4.4.5.5.a, the subject Special Report is submitted pursuant to Technical Specification 6.9.2 for Turkey Point Unit 4, as a result of the End of Cycle 20 inservice inspection of steam generator tubes.

The Turkey Point Unit 4 steam generators were inspected from October 15, 2003, through October 20, 2003. A total of 4 tubes in steam generator 4A were plugged as a result of this examination. Three tubes were preventively plugged due to volumetric indications which are not associated with corrosion or cracking. One tube was preventively plugged due to a mechanical wear indication. There were no tubes plugged in steam generators 4B or 4C.

TUBES PLUGGED THIS OUTAGE

SG 4A	SG 4B	SG 4C
4	0	0

Should there be any questions, please contact Walter Parker at 305-246-6632.

Very truly yours,

Terry Jones

Terry O. Jones
Vice President
Turkey Point Nuclear Plant

OIH

cc: USNRC, Document Control Desk, Washington, D.C.
Senior Resident Inspector, USNRC, Turkey Point Plant

L-2013-218
10 CFR 50.36
July 16, 2013

FPL

U. S. Nuclear Regulatory Commission
Attn.: Document Control Desk
Washington, D.C. 20555-0001

Re: Turkey Point Unit 4
Docket No. 50-251
Renewed Facility Operating License No. DPR-41
Extended Power Uprate Cycle 27 Startup Report

Reference:

(1) J. Page (NRC) to M. Nazar (FPL), Turkey Point Units 3 and 4 – Issuance of Amendments Regarding Extended Power Uprate (TAC Nos. ME4907 and ME 4908), June 15, 2012 (Accession No. ML11293A365).

Pursuant to Turkey Point Unit 4 Technical Specification (TS) 6.9.1.1, Florida Power & Light Company (FPL) is submitting the Cycle 27 Startup Report. This attached report is required due to implementation of Unit 4 Amendment No. 245 for the Extended Power Uprate (EPU) Project that was issued via Reference 1. This report summarizes the power ascension testing results completed to date through 87% rated thermal power (RTP). A supplemental report addressing the results through 100% RTP will be provided upon completion of final testing.

Should you have any questions regarding this submittal, please contact Mr. Robert Tomonto, Turkey Point Licensing Manager, at 305-246-7327.

Sincerely,

Michael Kiley
Site Vice President
Turkey Point Nuclear Plant

Attachment (1)

cc: USNRC Regional Administrator, Region II
USNRC Project Manager, Turkey Point Nuclear Plant
USNRC Senior Resident Inspector, Turkey Point Nuclear Plant

Turkey Point Unit 4 - Cycle 27
Extended Power Uprate
Power Ascension Testing Summary

Table of Contents

I. Introduction

The purpose of this Startup Report is to provide a summary description of the plant startup and power ascension testing performed at Turkey Point Unit 4 following Cycle 27 refueling which implemented the Extended Power Uprate (EPU) project. The EPU License Amendment Request (LAR) 245 was submitted by Florida Power and Light Company (FPL) to NRC and approved and issued on June 15, 2012. The amendment increased the authorized maximum steady-state reactor core power from 2300 megawatts thermal (MWt) to 2644 MWt. This Cycle 27 Startup Report is being submitted in accordance with Turkey Point Unit 4 Technical Specification 6.9.1.1, items (2) and (4).

Technical Specification 6.9.1.1, Startup Report, states that, "a summary report of plant startup and power escalation testing shall be submitted following: ... (2) amendment to the license involving a planned increase in power level and (4) modifications that may have significantly altered the nuclear, thermal, or hydraulic performance of the unit. The report shall address each of the tests identified in the FSAR and shall in general include a description of the measured values of the operating conditions of characteristics obtained during the test program and a comparison of these values with design predictions and specifications. Any corrective actions that were required to obtain satisfactory operation shall also be described. Any additional specific details required in license conditions based on other commitments shall be included in this report. Subsequent Startup Reports shall address startup tests that are necessary to demonstrate the acceptability of changes and/or modifications."

As of the issuance date of this report, not all required testing per the Startup Test Program has been completed for Turkey Point Unit 4 Cycle 27. Technical Specification 6.9.1.1, Startup Report, states "If the Startup Report does not cover all three events (i.e. initial criticality, completion of the Startup Test Program, and resumption or commencement of commercial operation), supplementary reports shall be submitted every 3 months until all three events have been complete." In accordance with the Technical Specifications, additional reports will be provided every 3 months until completion of the Startup Test Program.

The plant startup and power escalation testing verifies that key EPU core and plant parameters are operating as predicted. The major parts of this testing program include:

1) Cycle 27 core design summary

2) Low power physics testing, and

3) Power ascension testing.

II. Cycle 27 Core Design Summary

The Unit 4 Cycle 27 core is designed to operate for 20,030 MWD/MTU. Seventy-two fresh fuel assemblies of the UPGRADE design were loaded into the Cycle 27 core. Thirty-two have a

nominal enrichment of 4.0 w/o and forty have a nominal enrichment of 4.4 w/o. Sixty-one of the assemblies reloaded were first-burn of the UPGRADE design and the remaining twenty-four were second-burn of the DRFA design.

Core Testing Summary

The Startup Test Program for Turkey Point Unit 4 Cycle 27 includes, Low Power Physics Testing, Power Ascension Testing, Extended Power Uprate Testing and RCS Flow Verification. Low Power Physics Testing is performed in accordance with ANSI/ANS-19.6.1 1985, Reload Startup Physics Tests for Pressurized Water Reactors. Power Ascension Testing addresses the various flux maps and RCS temperature measurements performed at intermediate power levels as the Unit ascends to 100% power. Extended Power Uprate Testing includes all tests FPL committed to perform during power ascension. The RCS Flow Verification is performed per Technical Specification 3/4.2.5, after each fuel loading and at least once per 18 months. Each phase of the Startup Test Program is discussed in more detail in the following paragraphs.

Low Power Physics Testing

Low Power Physics Testing was performed on April 6, 2013 in accordance with the following general sequence:

1. Initial Criticality: Criticality was achieved by withdrawing all shutdown and control banks and diluting to critical.
2. Zero Power Test Range Determination: This was determined after the point of adding heat had been demonstrated.
3. Online Verification of the Reactivity Computer: This was determined by examining the output of the reactivity computer during rod withdrawal and the determination of the point of adding heat.
4. Boron Endpoint Measurement: This was determined with all the control and shutdown banks withdrawn using the reactivity computer.
5. Rod Worth Measurement: Individual control bank and shutdown bank worths were measured using the rod swap technique. The highest worth bank was measured using the boron dilution technique.
6. Isothermal Temperature Coefficient Measurement (ITC): This was determined using the reactivity computer during a reactor coolant temperature change. The Moderator Temperature Coefficient (MTC) was calculated from the ITC data.

All acceptance criteria were met as can be seen in the table below. The Low Power Physics Test data results versus predictions for Cycle 27 was similar to recent Unit 4 cycles.

Low Power Physics Test Results: Unit 4 Cycle 27

ITEM	MEASURED	PREDICTED	DIFFERENCE (M-P)	CRITERIA
Boron Endpoint: HZP All Rods Out (ppm)	1707.9	1709	-1.1	±50
All Rods Out ITC (pcm/°F)	-1.764	-1.456	0.308	±2
All Rods Out MTC (pcm/°F)	-0.122	0.186		
Control Bank Rod Worths (pcm)				
A	942.6	1018	-75.4 (-8.00%)	
B	327	332	-5.00 (-1.53%)	
C	1215.3	1237	-21.7 (-1.78%)	100 pcm or 15%
D	595.3	642	-46.7 (-7.85%)	
SA	821.9	838	-16.1 (-1.96%)	
SB	1086.5	1144	-57.5 (-5.29%)	
Total	4988.6	5211	-222.4 (-4.5 %)	±7%

Power Ascension Flux Mapping

Thermal hydraulic parameters, nuclear parameters and related instrumentation were monitored throughout 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. Power changes were governed by operating procedures and fuel preconditioning requirements.

Flux mapping was performed at approximately 30%, 50%, 87%, and 100% rated thermal power using the Moveable Incore Detector System. The resulting 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. The flux map results are shown in the table below. Also shown in the table is a comparison of FΔH to design predictions. The results show that the measured to predicted fidelity for Cycle 27 is very good and similar to recent Unit 4 cycles. In addition, incore tilt and radial power distribution fidelity was also good and similar to recent Unit 4 cycles.

Power Ascension Flux Map Results: Unit 4 Cycle 27

ITEM	MAP 1	MAP 2	MAP 3	MAP 4
Date of Map	4/28/13	4/29/13	5/7/13	6/13/13
Power Level (%)	29.14	48.26	85.92	99.78
Control Bank D Position (steps)	154	169	194	229
Predicted FΔH (from map)	1.480	1.467	1.417	1.406
FΔH	1.513	1.498	1.454	1.424
FΔH Difference (|M-P| in %)	2.2	2.1	2.5	1.3
Incore Tilt	1.656%	1.585%	1.478%	1.708%
Maximum Measured to Predicted Assembly Power Difference (%)	5.3	5.2	4.4	4.7
RMS Measured to Predicted Assembly Power Difference (%)	1.81	1.74	1.55	1.63

Reactor Coolant System (RCS) Flow Verification

The RCS flow verification was performed to satisfy the TS 4.2.5.4 which requires that after each fuel loading and at least once per 18 months, the RCS flow rate be determined by precision heat balance after exceeding 90% power. In addition, TS 3.2.5 requires that the measured RCS flow be greater than or equal to 270,000 gpm. This test was conducted on 6/19/2013. The measured RCS flow met the Technical Specification requirements and was similar to recent cycles.

III. Power Ascension Test Program

The EPU power ascension test program consisted of a combination of normal startup and surveillance testing, post-modification testing, and power ascension testing deemed necessary to support acceptance of the proposed EPU. During the EPU start-up, power was increased in a slow and deliberate manner, stopping at pre-determined power levels for steady-state data gathering and formal parameter evaluation. These pre-determined power levels are referred to as test plateaus. The typical post-refueling power plateaus were used until the previously licensed full power condition (2300 MWt) was attained (approximately 87% of the EPU full power level of 2644 MWt). A summary of the power ascension test plan from license amendment request 205 [Reference 2] for power levels beginning at 2300 MWt is provided in Tables 2.12-1 and 2.12-2 below.

Table 2.12-1

PTN Extended Power Uprate Power Ascension Test Plan

Test / Modification	Test Description	Prior To Startup	Rated Thermal Power - % of 2644 MWt (Allowance +0%, -5%)																	(Allowance +0%, -1%)				
			0	5	10	15	20	25	30	40	45	50	55	60	65	70	75	80	87	89	92	95	98	100
Nuclear Steam Supply System (NSSS) Data Record	Data Collection						X		X			X					X		X	X	X	X	X	X
Balance of Plant Data Record	Data Collection						X		X			X					X		X	X	X	X	X	X
Transient Data Record(6)	Data Collection						X		X			X							X	X	X	X	X	X
Core Map	Power Distribution and COLR Parameters											X					X(1)		X	X(1)	X(1)	X(1)	X(1)	X
NSSS Calorimetric and Power Range Channel Adjustment	Verify Thermal Power and Adjust Nuclear Instrumentation						X		X			X					X		X	X	X	X	X	X
Reactor Coolant System (RCS) Flow Measurement	RCS Flow Calorimetric																							X

Table 2.12-1

PTN Extended Power Uprate Power Ascension Test Plan

Test / Modification	Test Description	Prior To Startup	Rated Thermal Power - % of 2644 MWt (Allowance +0%, -5%)																	(Allowance +0%, -1%)				
			0	5	10	15	20	25	30	40	45	50	55	60	65	70	75	80	87	89	92	95	98	100
Incore-Excore Axial Offset Calibrations	Calibrate Excore Instrumentation to Incore Axial Offset									X(2)									X(3)					X(4)
Load Changes	10% Ramp to Verify System Response								X															X(5)
Turbine Trip	OST Turbine to Verify System Response			X																				
Turbine Stop Valve, Governor Valve, and Intercept Valve Testing.	Standard turbine valve tests w/post-modification tests									X(6)														
Steam Generator Level Feedwater Flow Response Testing	Manually inserted level setpoint step-changes in the steam generator.								X										X			X		

Table 2.12-1

PTN Extended Power Uprate Power Ascension Test Plan

Test / Modification	Test Description	Prior To Startup	Rated Thermal Power - % of 2644 MWt (Allowance +0%, -5%)																	(Allowance +0%, -1%)				
			0	5	10	15	20	25	30	40	45	50	55	60	65	70	75	80	87	89	92	95	98	100
Vibration Monitoring	Monitor Vibration in Plant Piping and Supports	X																	X	X	X	X	X	X
Thermal Expansion	Monitor Thermal Expansion in Plant Piping	X																	X	X	X	X	X	X
Plant Radiation Surveys	Verify Expected Dose Rates																		X					X
Plant Temperature Surveys	Verify Expected Temperatures																		X					X

NOTES:

(1) If required.
(2) Incore flux map for data acquisition will be performed at 50% of 2644 MWt or when annunciator B2/2 or B2/3 alarms, whichever comes first.
(3) Incore flux map for data acquisition will be performed at approximately 87% of 2644 MWt, if required.
(4) At steady state equilibrium Xenon conditions.
(5) Only a load reduction will be performed
(6) Test moved from 35% to 50% to ensure that ESFAS high steam flow and AMSAC arming setpoint are not adversely affected by steam flow imbalance.

Table 2.12-2
Large Plant Transient Tests in Turkey Point EPU Power Ascension Test Plan

Proposed Test	Description	Expectation
Turbine Overspeed Trip from 5% EPU Power	The turbine will be, with the reactor at approximately 5% power, automatically tripped as speed exceeds the electronic overspeed trip setpoint.	This test will verify proper operation of the overspeed mechanism for the new EHC turbine control, and proper operation of the new turbine control valves.
10% Ramp Load Change at new 30% and 100% EPU Power	Ramp load change limited by station license conditions and fuel pre-conditioning considerations.	These ramps will test NSSS and BOP control system operation, to ensure that no unanticipated aggregate effects have been produced by interaction of the plant modifications.
Turbine Stop Valve, Governor Valve, and Intercept Valve Testing at 35% EPU Power	Standard turbine valve testing augmented by post-modification tests associated with EHC Turbine control and Governor Valve Replacement.	Validate dynamic performance of new governor valve design to ensure adequate transient response. Verify acceptable dynamic performance of the new HP turbine rotor during changes in individual arc steam flows.
Steam Generator Level / Feedwater Flow Dynamic testing at 30%, 87% and 95% EPU Power	Verify response to manually inserted level setpoint step-change of 5% in the steam generator. Both up-going and down-going setpoint changes of different magnitudes will be inserted.	Verify SG level control system response and acceptability of over-shoot, damping and steady-state limit cycling at the new licensed power level. Verify acceptable operation of the feedwater control system.

FPL provided specific acceptance criteria in response to NRC request for information [Reference 3] for the 10% ramp load change list in Table 2.12-2 above as follows:

- Reactor coolant system (RCS) average temperature, pressurizer pressure, and pressurizer water level will be controlled to the programmed values.
- Steam generator water level will demonstrate good feedwater level control and maintain acceptable margin to the trip level setpoint.
- Nuclear power peak overshoot/undershoot should be less than 3 percent reactor thermal power.

- Steam generator water level should return to programmed level setpoint within ±2 percent narrow range with dampening oscillations within 15 to 20 minutes.

Prior to exceeding the previous licensed core thermal power of 2300 MWt, the data gathered at the pre-determined power plateaus, as well as observations of the slow, but dynamic power increase between the power plateaus, allowed verification of the performance of the EPU modifications. The steady-state data collected at approximately 87% power was especially significant because this test plateau corresponded to the previous full power level of 2300 MWt. Data collected at this plateau formed the basis for comparison of data collected at higher plateaus.

Once testing was completed at the 2300 MWt plateau, power was slowly and deliberately increased through four additional test plateaus, each differing by approximately 3% of the EPU rated thermal power. Both dynamic performance during the ascension and steady-state performance for each test plateau were monitored, documented and evaluated against predetermined acceptance criteria and expected values. The acceptance criteria for the power ascension test plan were established as discussed in Regulatory Guide (RG) 1.68, Initial Test Programs for Water-Cooled Nuclear Power Plants and NUREG 0800, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition, Section 14.2.1. Criteria were provided against which the success or failure of the test was judged. In some cases, the criteria were qualitative where applicable, quantitative criteria had appropriate tolerances.

Specific acceptance criteria and expected values were established and incorporated into the power ascension test procedures. Level 1 acceptance criteria are values for process parameters assigned in the design of the plant that are safety significant. If a Level 1 criterion is not satisfied, the power ascension will be stopped and the plant will be placed in a condition that is judged to be safe based upon prior testing. Resolution of the issue that resulted in exceeding the Level 1 criterion must be resolved by equipment changes or through engineering evaluation, as appropriate. Level 2 acceptance criteria are values that relates to plant functions or parameters that are not safety significant. If Level 2 criteria are not met, the Power Ascension Test Plan may continue. Investigation of the issue that resulted in exceeding the Level 2 criterion may continue in parallel with the power escalation. These investigations would be handled by existing plant processes and procedures.

Following each increase in power level, test data was evaluated against its performance acceptance criteria (Level 1 and 2 and expected values, i.e., prediction targets for power level). If the test data satisfied the acceptance criteria, then system and component performance were considered to have complied with their design requirements. Predicted values are used for optimizing SSC performance only and are not acceptance criteria.

In addition to the steady-state parameter data gathered and evaluated at each test condition, the dynamic parameter response data gathered during the ascension between test plateaus was also evaluated and demonstrated overall stability of the plant.

Hydraulic interactions between the new main feedwater pumps and the steam generator flow control valves, as well as the impact of the higher main feedwater flow, were monitored and evaluated. Individual control systems, such as steam generator level control and feedwater heater drain level control, were optimized for the new EPU conditions, as required. The power ascension testing done to date has adequately identified any unanticipated adverse system interactions and allowed them to be corrected in a timely fashion prior to operation at higher power levels.

At the present date of this report, Turkey Point Unit 4 has reached the 100% EPU power level but has not completed all the dynamic testing due MSR level control issues. One of the newly installed MSR level sensors failed and has subsequently been repaired. The repair effort caused the 10% ramp test to be rescheduled until after the 90 day startup report period. Once the test is completed, a supplemental report will be provided. Due to delays in completing the remaining ramp test, the complete summary report of data for power plateaus between 89% and 100% could not be completed in time for the 90 day report and will be included within the supplemental report.

Vibration Monitoring

A piping and equipment vibration monitoring program, including plant walkdowns and monitoring of plant equipment, was established to ensure that any steady-state flow induced piping vibrations following EPU implementation were not detrimental to the plant, piping, pipe supports, or connected equipment.

The predominant way of assessing piping and equipment vibrations was to monitor the piping during the plant heat-up and power ascension. The methodology used for monitoring and evaluating vibration was in accordance with ASME OM-S/G-2007, Standards and Guides for Operation and Maintenance of Nuclear Power Plants, Part 3, Requirements for Preoperational and Initial Startup Vibration Testing of Nuclear Power Plant Piping Systems.

The scope of the piping and equipment vibration monitoring program included accessible piping that experienced an increase in process flow rates. Branch lines attached to this piping that experienced increased process flows were also monitored as operating experience has shown that branch lines are susceptible to vibration-induced damage. The scope of the program included the following systems:

- Main steam (outside of containment), including Reheater Inlet,
- Main Steam modified supports (inside containment),
- Feedwater (outside of containment),
- Condensate,
- Extraction Steam,
- Heater Drains,
- Moisture Separator Drains, and
- Turbine Gland Steam and Drains.

IV. Power Ascension Program Results

NSSS Data Collection

The Turkey Point Unit 4 nuclear steam supply system (NSSS) significant parameters were observed at the 20%, 30%, 50%, 75%, and 87% EPU power plateaus. These significant parameters included RCS temperatures, pressurizer pressure, pressurizer level, containment pressure, containment temperature, steam generator pressure, and steam generator level. During power ascension, the NSSS significant parameter values compared well with the predicted values at the various power plateaus.

Below provides a brief summary of major control parameters. In addition, Table 3 provides a summary of the NSSS significant parameters at the various power plateaus.

- RCS temperatures – As can be seen from Table 3, the maximum measured average RCS temperature at 87% EPU power is 574.8°F which is below the EPU full power limit of 581.5°F and is expected to remain below this limit once 100% is achieved.

- Pressurizer pressure – remained at 2235 psia +/- 5% within normal operating band throughout the power ascension and transient test.

- Pressurizer level – The pressurizer level program changes from 22.5% at RCS average temperature 547 °F to 56.9% at full load RCS average temperature of 580°F. Pressurizer level was maintained on program throughout the power escalation within normal control system tolerances.

- Containment temperature – temperature ranged from 105.6°F to 108.0°F throughout the power ascension well below the 125 °F limit.

- Steam generator header pressure – ranged between 929 psig at 20% EPU power and 801 psig at 87% EPU power.

- Steam generator level – remained constant at 50% narrow range scale within normal control system tolerances throughout the power ascension.

Balance of Plant (BOP) Data Collection

The Turkey Point Unit 4 balance of plant (BOP) significant parameters were observed at the 20%, 30%, 50%, 75%, and 87% EPU power plateaus. As the majority of the EPU hardware changes were made to BOP equipment, extensive monitoring of the secondary side was performed during the EPU power ascension. Major systems and components monitored included:

- High pressure turbine, low pressure turbine, main generator and exciter vibration,
- High pressure turbine, low pressure turbine, main generator and exciter bearing temperatures,
- High and low pressure turbine steam pressure and temperature,
- Moisture separator reheater (MSR) pressure and temperature,

- Turbine digital controls,
- Main generator gas temperatures,
- Turbine cooling water system performance,
- Condensate, main feedwater, and heater drain system pressure and temperature,
- Condensate, main feedwater, and heater drain pump performance,
- Feedwater heater performance,
- Heater drain valve performance,
- Main condenser performance,
- Main transformer performance,
- Isolated phase bus cooling performance, and
- Main generator electric output.

A portion of the Balance of Plant (BOP) data was obtained through walkdowns at each plateau. The purpose of the walkdowns was to visually observe operation of accessible components during the power ascension not available on the plant process computer. Multiple test personnel were used to accomplish the walkdowns and the test personnel discussed all observations and findings prior to power escalation. The corrective action program was utilized to document any walkdown findings. Several instruments were found either to be out of calibration or require repair. Once the instrument was repaired or alternative instruments provided, accurate data was obtained. The BOP parameters requiring evaluation were 4A and 4B FW heater extraction temperature and the 5A and 5B FW heater levels. The higher than expected extraction steam temperature was evaluated by Engineering and found to meet piping code criteria and was therefore acceptable. As was observed in Unit 3, the 5A and 5B FW heater levels were lower than expected. Engineering evaluated the lower than expected levels and will adjust the DCS low level alarm after obtaining the actual level at 100% power level. There are no level control valves for the #5 FW heaters and Engineering determined that no adverse system performance exists.

During Unit 3 power ascension prior to reaching the 75% plateau, the 5A and 5B FW heater extraction supply was throttled to reduce HDT pressure and allow MSR drain level control valves to function properly. The cause of this condition was determined to be less pressure drop than predicted in the HP exhaust piping. The Unit 4 modification for the # 5 HTR was also changed to incorporate the need to throttle extraction flow but was performed at 50% power due to slightly lower HDT pressure due to 2 HDT pumps running. Once throttling of extraction was performed, the MSR drain valves performed as expected and within level 2 criteria.

Heater Drain Tank (HDT) 3B normal control valve CV-4-1510A, was found to be open 88% which exceeds the level 2 criteria of < 85%. Control valve level 2 criteria of less than 85% open is established to allow sufficient valve capacity for normal operation transients. In the case of the HDT level control system, a separate high level dump valve CV-4-1510B is provided for high level conditions caused by normal operation transients. Therefore, having CV-4-1510A at 88% open was found acceptable.

The BOP data collected during the EPU power ascension testing is too extensive to include in this summary report but Table 3 provides a summary of major control parameters. The completed test procedure and all BOP data collected at the 20%, 30%, 50%, 75%, and 87% EPU power plateaus are available for review on-site, if required.

Vibration Monitoring

The Turkey Point Unit 4 piping and equipment within the scope of the EPU vibration monitoring program were observed at several different plant operating conditions, namely the 30%, 50%, and 87% EPU power plateaus. The first observations were conducted prior to the shutdown in which the EPU modifications were implemented. Data from these observations was used to develop the list of priorities and baseline data for observation during the EPU power escalation. By comparing the observed pipe vibrations / displacements at various power levels with previously established acceptance criteria, potentially adverse pipe vibrations were identified, evaluated and resolved.

Based on a review of the tubing/support configuration, the layout is such that tubing stress levels should remain below the endurance limit while vibrating at these displacement levels Confirmatory piping analysis has verified this conclusion.

Engineering has reviewed the vibration and thermal expansion data from each of the applicable plateaus through 87% and determined that all lines in the monitoring program have met their acceptance criteria

Thermography Checks and Temperature Profiles

Temperature monitoring of the Main and Auxiliary Transformers and the Isophase Bus duct using thermography was performed at the 30%, 50%, 75%, and 87% power levels. This thermography checks were performed to ensure none of the equipment was overheating due to the EPU power increase. The test data was evaluated and found that all temperatures were below the alert range and within expected values for the current generator output.

Steam Generator Level / Feedwater Flow Dynamic Test

Feedwater Regulating Valve Performance tests were performed at the 30%, and 87% power levels. Each of the S/G level control systems was tested to demonstrate a stable control system after EPU modifications to the FW system and level control system. The test imposed a 3-5% level deviation and determined if the automatic S/G level control system restored to level program. The test data were evaluated and found that each of the S/G level control system met the acceptance criteria.

Turbine Stop Valve Test

Turbine Stop Valve test was performed at 50% power level rather than 35% as stated in Table 2 above since this is the power level stop valve testing is normally performed and it allowed

AMSAC and Hi Steam flow channels to remain operable. The higher power level has no impact on the validity of the test. This test was completed successfully. The turbine control system sequenced each stop valve closed in automatic and control valves adjusted their position automatically to maintain turbine load.

10% Load Ramp

As stated in Section 2.12 of References 2 and 3, the purpose of the ramp test is to provide additional confidence in the validity of the analytical models and assumptions used in the analysis of plant modifications and integrated plant response to transients, and also verify that no new thermal hydraulic phenomena or adverse system interactions are created by the proposed EPU. A 10 % load ramp down and then back up was performed at the 30% reactor power plateau. A ramp rate of 0.87% and 0.83% was achieved for the 10% down power and 10% up power respectively. The slightly less than the desired 1%/min ramp rate was caused by delays in the automatic turbine control system controller which were more than expected. Neither Reference 2 nor 3 specified a tolerance for the 1% ramp rate or the 10% load reduction and therefore, are interpreted as nominal values.

Actual system response for RCS temperature, Feedwater (FW) control, nuclear power and S/G level process demonstrated the following:

- Reactor coolant system (RCS) average temperature, pressurizer pressure, and pressurizer water level was controlled to the programmed values.
- Steam generator water level demonstrate good feedwater level control and maintain acceptable margin to the trip level setpoint.
- Nuclear power peak overshoot/undershoot was less than 3 percent reactor thermal power.
- Steam generator water level returned to programmed level setpoint within ±2 percent narrow range with dampening oscillations within 15 to 20 minutes.

In addition plant systems followed their program values well within normal expected system accuracies and no unexpected alarms were received. All level 1 and level 2 acceptance criteria were met.

Given the observed margin between plant control system actual performance and the test acceptance criteria reasonable assurance exist that an increase in the test ramp rate and load change would not have an appreciable change on the system response and all acceptance criteria stated above would have been met. In addition, the Unit 3 ramp test done at 30% power did achieve the 1% ramp rate and 10% load reduction with very similar results to the Unit 4 ramp test with a slightly lower ramp rate and load reduction. Therefore, the ramp rate of 0.88%/min and 0.83%/min is considered adequate to demonstrate validity of the analytical models and assumptions used in the analysis of plant modifications and integrated plant response to

transients, and also verify that no new thermal hydraulic phenomena or adverse system interactions are created by the proposed EPU.

This test is planned to be performed again at the 100% reactor power level within the next several weeks.

Generator Power System Stabilizer (PSS)

This test demonstrates the ability of the PSS to aid the generator's voltage regulator in maintaining voltage steady. This test was performed satisfactorily at the 50% power levels.

Plant Radiation Surveys

Plant radiation surveys were taken at the 87% EPU power level. The plant radiation survey areas included portions of the containment, the auxiliary building, the turbine deck, the equipment hatch and ramp areas, as well as the radiation area monitors, taking accessibility and ALARA into consideration. Once the radiation survey information was obtained at the 87% EPU power level, a review of the data was performed by the Radiation Protection department and all values were found to be within normal expected range and no posting changes were required. Surveys will be re-performed at the 100% power level and evaluated for expected dose increases.

Plant Temperature Surveys

Baseline ambient temperature surveys were performed for areas where EPU has significantly impacted heat loads at the 87% power level. Once the temperature survey information was obtained at the 87% EPU power level, a review of the data was performed by the Engineering department and all values were found to be within the normal expected range. Surveys will be re-performed and evaluated at the 100% power level.

Leading Edge Flowmeter (LEFM) Commissioning

As described in Reference 1, the Turkey Point EPU project included a 1.7% Measurement Uncertainty Recapture (MUR) thermal power increase. To achieve the MUR power increase of 1.7%, the Cameron Leading Edge Flow Meter (LEFM) CheckPlus™ ultrasonic flow measurement instrumentation was installed to improve feedwater flow measurement accuracy. An individual LEFM CheckPlus™ system flow element (spool piece) was installed in each of the three main feedwater lines and was calibrated in a site-specific model test at Alden Research Laboratories with traceability to National Standards.

The LEFM CheckPlus™ system was installed and commissioned in accordance with FPL procedures and Cameron installation and test requirements. LEFM CheckPlus™ commissioning included verification of ultrasonic signal quality and evaluated the actual plant hydraulic velocity profiles as compared to those documented during the Alden Research Laboratories testing. Final verification of the site-specific uncertainty analyses occurred as part of the LEFM CheckPlus™ system commissioning process. The commissioning process provides final positive confirmation that actual performance in the field meets the uncertainty bounds established for the instrumentation which satisfies licensing commitment 13 in Section 3.3 (a) of the EPU SER. In addition to the Cameron commissioning test and evaluations, FPL evaluated LEFM performance as follows:

A review of feedwater parameters for LEFM and the Venturi based measurements were completed to determine deviations and reasonableness of the Venturi correction factor. There are no operational alarms or other deficiencies noted. Steam Generator Heat rates and calorimetric calculations were performed using the LEFM and Venturi based data. The LEFM ultrasonic flow transmitters are performing as expected. The LEFM is showing a 0.52% greater thermal power than the Venturi based value at 87%. This measurement difference is expected to decrease slightly as the power level approaches 100%. The Venturi LEFM correction factor adjusts the Venturi flowrate down such that the 0.52% deviation is eliminated and Venturi flow matches LEFM flow.

V. Summary

The test data collected during EPU startup and power ascension and summarized in this report demonstrates that all major systems, structures, and components (SSCs) performed as predicted and there was no adverse impact to the performance of the unit. The EPU startup and power ascension test data satisfied all acceptance criteria and demonstrated conformance to predicted performance. Copies of the completed EPU startup and power ascension test procedures are available on site for review. Supplemental data for the 89% through 100% rated thermal power will be provided upon test completion.

VI. References

1. J. Page (NRC) to M. Nazar (FPL), Turkey Point Units 3 and 4 – Issuance of Amendments Regarding Extended Power Uprate (TAC Nos. ME4907 and ME 4908), (Accession No. ML11293A365, June 15, 2012.

(2) M. Kiley (FPL) to J. Page (NRC) FPL (L-2010-113), License Amendment Request No. 205: Extended Power Uprate (EPU), (TAC Nos.ME4907 and ME4908), Accession No. ML103560169, October 21, 2010

(3) M. Kiley (FPL) to J. Page (NRC) FPL (L-2011-101), Turkey Point Units 3 and 4 Docket Nos. 50-250 and 50-251 Response to NRC Request for Additional Information Regarding Extended Power Uprate License Amendment Request No. 205 and Balance of Plant Issues, Accession No. ML11105A146, December 12, 2012

Table 3
BOP and Primary Parameter Summary

Primary Major Parameter	**20%**	**30%**	**50%**	**75%**	**87%(1)**
Avg Power %	16.4	27.9	47.1	73.7	86.4
Avg Thot °F	556.5	564.4	576.1	594.2	603.1
AvgTcold °F	544.7	544.6	543.1	545.4	546.4
Avg Tavg °F	550.6	554.5	559.6	569.8	574.8
SG A Press psig	929	903	854	820	801
SG B Press psig	928	903	855	821	802
SG C Press psig	929	903	854	821	802
Pzr Avg % Level	27.0	30.9	35.6	46.4	51.4
Turbine Inlet Avg Press (TIP) psig	81.9	163.5	271.4	460.1	559.1
Tref	551.6	555.5	560.6	569.7	574.4
Containment Temp °F Highest	106.7	108.0	105.8	105.6	107.0
BOP Major Parameter					
SG A Level %	49.7	48.7	48.7	48.1	47.4
SG B Level %	49.7	49.9	49.6	48.9	48.4
SG C Level %	49.6	49.3	49.2	48.9	48.6
Avg Steam flow MPPH	0.79	0.98	1.65	2.69	3.23
Avg FW flow MPPH	0.62	1.02	1.73	2.80	3.33
Final Venturi FW Temp °F	292.2	334.3	374.3	412.5	427.5
Condenser Backpressure in-Hg	2.72	1.94	1.74	2.14	2.44
Generator Output Mwe	13.8	184.6	370.1	614.7	736.2
Thermal Output MWt	464.7	769.4	1264.9	1943.2	2278.3

(1) All feedwater flow and thermal output values are based on the Venturi flow meter