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JUL 28 2011

L-2011-213
10 CFR 50.36

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

Re: Turkey Point Unit 4
Docket No. 50-251
Turkey Point Unit 4 Cycle 26 Startup Report

Technical Specification (TS) 6.9.1.1, Startup Report, states that a summary report of plant startup and power escalation testing shall be submitted following installation of fuel that has a different design. Turkey Point Unit 4 implemented new 15x15 UPGRADE fuel assemblies in support of the future implementation of power uprate at Turkey Point Unit 4. Cycle 26 is the first cycle in which Unit 4 is operating with the new 15X15 UPGRADE fuel assemblies and the old 15X15 Debris Resistant Fuel Assemblies (DRFA) in the same core.

The new 15x15 UPGRADE fuel assemblies have different thermal-hydraulic characteristics than the old 15x15 DRFAs. The differences between the two fuel designs include the addition of intermediate flow mixing grids, a change in the structural grid design and a change in the elevation of the active fuel stack which is 2.103 inches lower for the UPGRADE fuel.

In accordance with TS 6.9.1.1 the attached startup report is provided.

Should there be any questions, please contact Robert Tomonto, Licensing Manager, at 305-246-7327.

Very truly yours,

Michael Kiley
Vice President
Turkey Point Nuclear Plant

Attachment

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

IE26
NRR

TURKEY POINT UNIT 4 CYCLE 26 STARTUP REPORT

1.0 DESCRIPTION AND PURPOSE

Turkey Point Unit 4 implemented new 15x15 UPGRADE fuel assemblies in support of the future implementation of power uprate at Turkey Point Unit 4. On May 17, 2011, Turkey Point Unit 4 completed the Cycle 26 refueling outage and the Unit was placed on line. Cycle 26 is the first cycle in which Unit 4 is operating with the new 15X15 UPGRADE fuel assemblies and the old 15X15 Debris Resistant Fuel Assemblies (DRFA) in the same core.

This startup report is generated on the basis that the new 15x15 UPGRADE fuel assemblies have different thermal-hydraulic characteristics than the old 15x15 DRFAs. The differences between the two fuel designs include the addition of intermediate flow mixing grids, a change in the structural grid design and a change in the elevation of the active fuel stack which is 2.103 inches lower for the UPGRADE fuel.

Technical Specification (TS) 6.9.1.1, Startup Report, states that "a summary report of plant startup and power escalation testing shall be submitted following: ... (3) installation of fuel that has a different design or has been manufactured by a different fuel supplier, 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."

2.0 CORE DESIGN SUMMARY

The Unit 4 Cycle 26 core is designed to operate for 17,440 MWD/MTU. Sixty-four fresh fuel assemblies of the UPGRADE design were loaded into the Cycle 26 core. Fifty-two have a nominal enrichment of 4.000 w/o and twelve have a nominal enrichment of 4.400 w/o. In addition, the top and bottom 8 inches have a natural uranium annular blanket vs. the 6 inch natural uranium annular blanket for the previous DRFA fuel.

The following is a summary of the mechanical fuel design features of the UPGRADE assemblies:

- The fuel envelope, fuel assembly height, outside diameter of the fuel rods (0.422 in), and the pellet stack length (144 in) will be unchanged. However, pellet stack elevation will be shifted down by 2.103 inches.

- The fuel rod length will increase from 152.600 to 152.880 inches.
- The same Removable Top Nozzle (RTN) design currently in operation at Turkey Point Units 3 and 4 will be used.
- ZIRLO™ OFA structural mid grids with unbalanced vane pattern will be changed to ZIRLO™ I-Spring mid grids with balanced vane pattern.
- Three Intermediate Flow Mixer (IFM) grids with a balanced vane pattern referred to as the Enhanced IFM (IFM) will be included in the 15x15 UPGRADE design.
- Tube-in-Tube ZIRLO™ guide thimbles.
- High-force Alloy 718 bottom grid as currently used in the DRFA fuel design.
- Alloy 718 top grid as currently used in the DRFA fuel design.
- ZIRLO™ instrument tube as currently used in the DRFA fuel design.
- ZIRLO™ fuel rod cladding as currently used in the DRFA fuel design.
- Debris mitigation features will replace the long end cap DRFA design by:
  - Debris filter bottom nozzle (DFBN)
  - Zirconium Dioxide (ZrO_2) coated cladding on lower portion of the fuel rod will be added.
  - Alloy 718 protective bottom grid (pinned to add more stress corrosion cracking margin)

Based on the design changes between the DRFA fuel design and the UPGRADE fuel design, and the potential changes in the operational characteristics of the UPGRADE fuel in the Cycle 26 core, the following tests will be reported in the Unit 4 Cycle 26 Startup Test Report. They are:

1. Rod Drop Test, due to a change in the guide thimbles.

2. RCS Flow Verification, due to a change in the hydraulic characteristic from grid and bottom nozzle differences.

3. Low Power Physics Testing, due to nuclear characteristic changes associated with overall assembly design.

4. Power Ascension Testing, due to nuclear characteristic changes associated with overall assembly design.

<u>ROD DROP TEST</u>

The rod drop time verification was performed to satisfy the requirements of TS 3.1.3.4 which requires that after reactor vessel head removal, maintenance or modification to the Control Rod Drive System (only specific rods) and at least once per 18 months, the rod drop time for all full length rods shall be determined to be less than or equal to 2.4 seconds. For Cycle 26, the placement of the UPGRADE fuel assemblies under rod cluster control assembly (RCCA) locations was limited to positions G5, E9, J11, L7, J5, E7, G11, L9, G3, C9, J13, N7, J3, C7, G13, N9, H6, H10, F8 and K8. The rod drop times for these RCCA's were compared to rod drop times for the other RCCA locations containing DRFA fuel assemblies in Cycle 26. The comparison was also performed for Cycles 23 to 25 where all RCCA locations contained DRFA fuel assemblies. The results indicate negligible differences in rod drop times of the UPGRADE fuel assemblies vs. DRFA fuel assemblies and the Rod Drop Test TS requirement is met for Cycle 26 for all RCCAs.

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 264,000 gpm. This test was conducted on 7/11/11. The measured RCS flow was 284,394 gpm, which is similar to the measured RCS flow in recent cycles, and meets the TS requirement.

LOW POWER PHYSICS TESTING SUMMARY

Low Power Physics Testing was performed 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. On-line 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 Data fidelity with predictions for Cycle 26 is similar to recent Unit 4 cycles.

LOW POWER PHYSICS RESULTS: UNIT 4 CYCLE 26

ITEM	MEASURED	PREDICTED	DIFFERENCE (P-M)	CRITERIA
BORON END POINT:				
HZP ALL RODS OUT (ppm)	1746	1752	+6	± 50
ALL RODS OUT ITC (pcm/°F)	-0.337	-1.039	-0.702	± 2
ALL RODS OUT MTC (pcm/°F)	+1.336	+0.634		
CONTROL BANK ROD WORTHS: (pcm)				
A	1104	1152	+48 (+4.3%)	
B	278	279	+1 (+0.4%)	
C	1499	1479	-20 (-1.3%)	
D	712	757	+45 (+6.3%)	
SA	1041	1051	+10 (+1.0%)	100 pcm or 15%
SB	1018	1065	+47 (+4.6%)	
TOTAL	5652	5783	+131 (+2.3%)	± 7%

POWER ASCENSION TESTING SUMMARY

Thermal-hydraulic parameters, nuclear parameters 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. Power changes were governed by operating procedures and fuel preconditioning guidelines.

Flux mapping was performed at approximately 30%, 50% and 100% rated thermal power (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. The flux map results are shown in the table below. Also shown in the following table is a comparison of $F_{\Delta H}$ to design predictions. The results show that the measured to predicted fidelity for Cycle 26 is very good and is similar to recent Unit 4 cycles. In addition, incore tilt and radial power distribution fidelity is also good and similar to recent Unit 4 cycles.

POWER ASCENSION FLUX MAP RESULTS: UNIT 4 CYCLE 26

ITEM	MAP 1	MAP 2	MAP 3
DATE OF MAP	5/17/11	5/17/11	5/31/11
POWER LEVEL (%)	28.0	47.7	99.9
CONTROL BANK D POSITION (steps)	155	168	228
Predicted $F_{\Delta H}$ (from map)	1.500	1.476	1.442
$F_{\Delta H}$	1.563	1.507	1.463
$F_{\Delta H}$ Difference ((M-P)/P in %)	4.2	2.1	1.5
INCORE TILT	1.0135	0.9887	1.0101
MAXIMUM MEASURED TO PREDICTED ASSEMBLY POWER DIFFERENCE (%)	-5.5	-3.8	+3.7
RMS MEASURED TO PREDICTED ASSEMBLY POWER DIFFERENCE (%)	1.91	1.53	1.20

4.0 CONCLUSIONS

As demonstrated in this report, the transition from DRFA fuel with 6" natural uranium annular blankets to UPGRADE fuel with 8" natural uranium annular blankets in the Turkey Point Unit 4 Cycle 26 core has resulted in no increased deviation from predicted core design behavior with all operating and surveillance criteria met.