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September 8, 2003

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

SUBJECT: Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
Docket No. 50-293
License No. DPR-35

Startup Test Report Pilgrim Nuclear Power Station Cycle 15

LETTER NUMBER: 2.03.106

Dear Sir or Madam:

Enclosed is the Startup Test Report for Pilgrim Nuclear Power Station Cycle 15, submitted in accordance with Pilgrim Updated Final Safety Analysis Report Section 13.5.7.

If further information is required concerning this report, please do not hesitate to contact Mr. Bryan Ford at (508) 830-8403.

Sincerely,

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WJR/dd
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STARTUP TEST REPORT, PILGRIM NUCLEAR POWER STATION, CYCLE 15

STARTUP TEST REPORT, PILGRIM NUCLEAR POWER STATION

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A. INTRODUCTION

Final Safety Analysis Report (FSAR) Section 13.5.7 requires that a summary report of plant startup and power escalation testing be submitted to the NRC within 90 days following the completion of a significant milestone (increase in licensed power level). A power uprate from 1998 MWt to 2028 MWt was implemented on June 10, 2003. This report satisfies the FSAR 13.5.7 start-up report requirement.

B. SUMMARY OF TPO MODIFICATIONS

Pilgrim Nuclear Power Station implemented a power uprate during Refueling Outage (RFO) 14. This was accomplished by:

- HP Turbine rotor and diaphragm replacement.
- Turbine Moisture separator internals replacement.
- Installation of Advanced Measurement & Analysis Group (AMAG) ultrasonic flow meters for improved feedwater flow measuring. This also included implementation of a data link between AMAG flow meters and EPIC Computers.
- Safety Relief Valve (SRV) throat enlargement.

C. CYCLE 15 CORE DESIGN

The Cycle 15 core was designed to provide 663 EFPDs of cycle energy capability. The Cycle 15 core loading pattern is based on the low-leakage and control-cell-core design principles in use at Pilgrim since Cycle 5. The control-cell-core design simplifies operation, improves fuel reliability, increases operating thermal margin and improves capacity factors.

The low-leakage design principle preferentially loads twice-burned and thrice-burned low-reactivity fuel on the core periphery to reduce radial neutron leakage, thereby yielding improved fuel cycle efficiency and reduced reload fuel costs. Reduced radial neutron flux also yields a reduced fast-neutron flux at the reactor pressure vessel wall, the reactor shroud and other core internals.

Number of Bundles	Bundle Type	Cycle Loaded
144	GE14-P10DNAB-412-16GZ-100T-145-T6-3901	14
119	GE11-P9DUB407-14GZ1-100T-141-T	13
40	GE11-P9DUB408-6G5.0/7G4.0-100T-141-T	13
40	GE11-P9DUB408-6G5.0/7G4.0-100T-141-T	12
73	GE11-P9DUB408-16GZ1-100T-141-T	12
36	GE14-P10DNAB397-10G6.0/3G5.0-100T-145-T6-2613	15
88	GE14-P10DNAB397-14GZ-100T-145-T6-2621	15
40	GE14-P10DNAB398-866.0/5G5.0/1G2.0-100Y-145-T6-2614	15

Figure 1 represents the as-loaded Cycle 15 core map showing fuel loading by bundle type. The Cycle 15 core design meets all licensing criteria specified in Revision 14 of NEDE-24011-P-A and NEDE-24011-P-A-US, the General Electric Standard Application for Reactor Fuel (GESTAR-II).

D. CORE VERIFICATION

The final as-loaded Cycle 15 core loading was verified on May 6, 2003 consistent with the requirements of PNPS Procedure 4.5 "*Reactor Core Verification*". Three separate criteria were verified: bundle orientation, bundle seating, and bundle location.

Bundle seating was verified by observing that the channel fasteners of adjacent bundles in each fuel cell were vertically aligned.

Bundle orientation was verified by observing that the channel fasteners of adjacent bundles in each fuel cell were oriented toward the center of the cell.

Bundle location was verified by observing that bundle serial numbers in the core were consistent with bundle serial numbers in the final fuel-loading plan.

Verification of the final as-loaded Cycle 15 core loading identified no core-loading errors.

E. CONTROL ROD COUPLING INTEGRITY

Control Rod coupling integrity was verified whenever a Control Rod was fully withdrawn as required by TS SR 4.3.B.1.3. Coupling integrity was established by observing that the rod would not reach its over-travel position upon withdrawal.

F. CONTROL ROD SCRAM TIME TESTING

Single rod scram time testing on 144 of 145 Control Rods was successfully completed on May 21, 2003, prior to exceeding 40% of rated core thermal power as required by Technical Specification 4.3.C.1. One control rod experienced difficulty on withdrawal and was declared inoperable. Results of this testing met TS 3.3.C.1 and 3.3.C.2 limits.

Control Rod scram time testing was performed in accordance with PNPS Procedure 9.9, *"Control Rod Scram Time Evaluation."*

G. SHUTDOWN MARGIN (SDM)

SDM was demonstrated using the insequence critical method in accordance with PNPS Procedure 9.16.1, on May 1, 2003.

Minimum Cycle 15 SDM of 1.51 % Δk was demonstrated on May 12, 2003. This SDM exceeds both the TS requirement of 0.25% and the FSAR requirement of 1% Δk.

H. INSTRUMENT CALIBRATIONS

H.1 APRMs

APRMs were calibrated as required during the power ascension to maintain the APRM gain adjustment factors (AGAFs) between 0.87 and 1.00 and to scale APRMs to the new licensed power level (5/12/03). AGAFs are the ratio of the actual reactor power reading as determined from a reactor heat balance to the APRM reading.

All APRM calibrations were performed consistent with the requirements of PNPS Procedure 9.1, "*APRM Calibration.*" APRM flow control Trip Reference (FCTR) Cards were calibrated and adjusted on May 28, 2003 as required by E1A stability mythology in accordance with PNPS Procedure 9.17.1 "*Core Flow Evaluation*".

H.2 LPRMs

LPRMs were calibrated as required by PNPS Procedure 9.5, "*LPRM Calibration.*" LPRMs are calibrated to maintain gain adjustment factors (GAFs) between 0.95 and 1.05. GAFs are the ratio between the actual LPRM console readings and the desired LPRM console readings.

LPRMs were first calibrated in Cycle 15 on May 22, 2003 at 98.5% power. Calibration was performed again at 100% power on July 10, 2003.

H.3 Jet Pump Flow Instrumentation

Core flow instrumentation was calibrated as required during the power ascension consistent with the requirements of PNPS Procedure 9.17 "*Core Flow Mapping For The Flow Control Trip Reference Card*".

The acceptance criteria for core flow calibration is within ± 5% between Panel C-905 indicated core flow and calculated core flow. The acceptance criteria for recirculation drive flow calibrations is within ± 2% between the two process computer loop flows and within ± 5% between the indicated analog loop flows and the computer calculated loop flows.

I. PROCESS COMPUTER DATA PROCESSING CHECKS

The 3D MONICORE Process Computer databank was updated consistent with the requirements of PNPS Procedure 9.34 "*3D MONICORE New cycle Update and Databank Maintenance*".

PNPS Procedure 9.34 specifies a number of checks, to verify the new Process Computer databank is consistent with the reload core design and has been correctly loaded into the Process Computer. These checks were completed satisfactorily by May 6, 2003.

Consistency between the official databank transmittal and the reload core design was verified by a general review of the relevant core design documents against the official databank transmittal.

J. THERMAL LIMITS

The maximum fraction of limiting critical power ratio (MFLCPR), the maximum fraction of limiting power density (MFLPD) and the maximum average planar linear heat rate (MAPRAT) were monitored throughout the startup using the 3D MONICORE core monitoring software. Margins to thermal limits were maintained as required by TS. Thermal limits were reviewed to establish compliance with the TS and Core Operating Limits Report in accordance with PNPS Procedures 9.19, *"Minimum Critical Power Ratio Evaluation"* and 9.22, *"Maximum Average Planar Linear Heat Generation Rate"* throughout the startup. Specifically, thermal limits were found within expected ranges when reviewed at 98.5% on May 22, 2003, and again at 100% power on June 10, 2003.

The 3D MONICORE power distribution was updated as required during the power ascension using the TIP system at 50% and 100% power during the ascent to rated power.

K. HOT EXCESS REACTIVITY

The actual Control Rod notch inventory (adjusted to reflect rated reactor dome pressure, rated core inlet flow rate and nominal core inlet sub-cooling) was verified to be consistent with the design notch inventory at 98.5% power on May 29, 2003 and again at 100% power on June 20, 2003. The acceptance criterion for this comparison is an actual Control Rod notch inventory that differs from the design notch inventory by no more than ± 1% Δk reactivity. Cycle 15 operation during start-up was verified to be within ± 1% Δk reactivity of the nominal expected hot critical K_{eff} shown in the Cycle Management Report (design) and therefore meets TS 3.3.E.

PNPS Procedure 9.8 "*Reactivity Follow*" governs monitoring of hot excess reactivity.

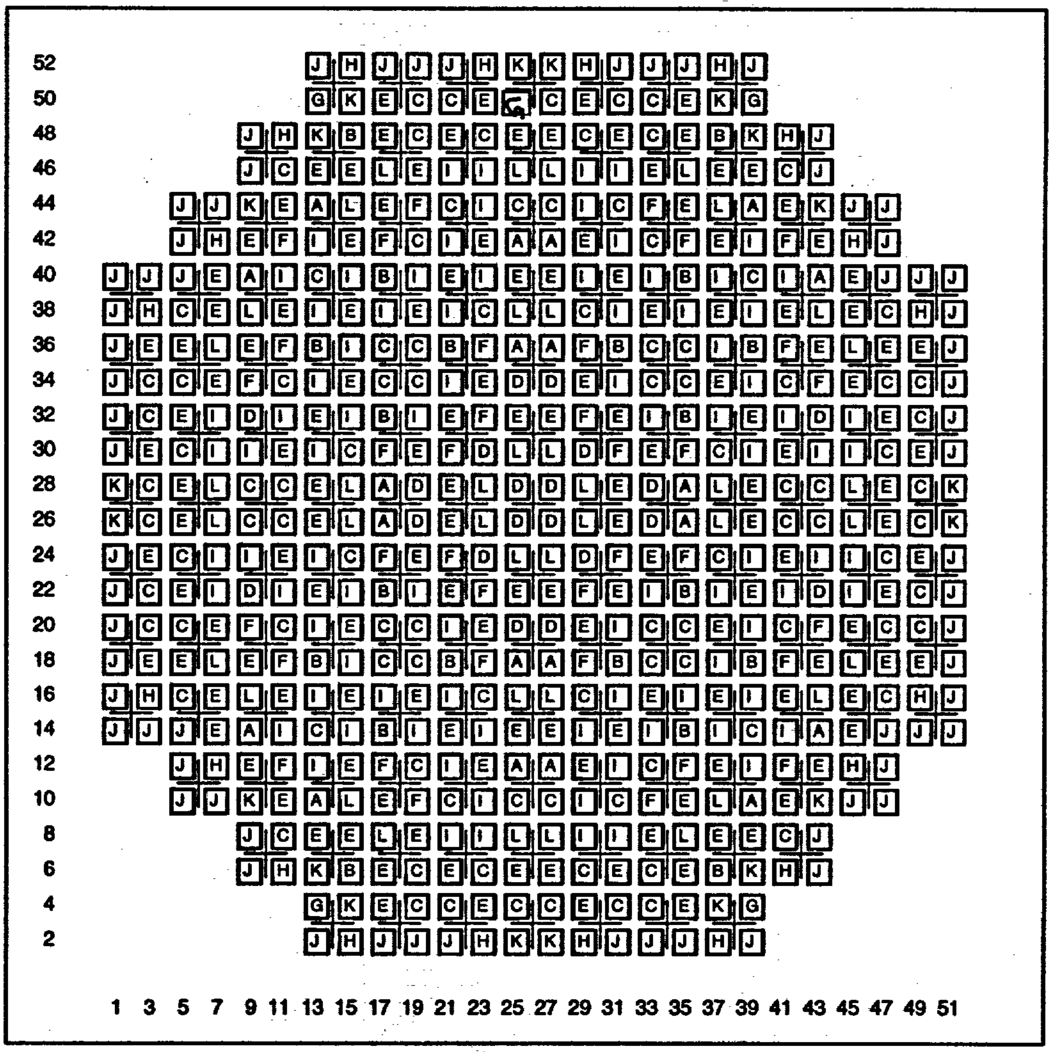
L. TPO START UP TESTING

The Pilgrim RFO 14 power ascension test program was designed to provide a method to safely return to operation following the refueling outage, and to ensure a safe and orderly transition from 1998 MWt to the Thermal Power Optimization (TPO) licensed thermal power limit of 2028 MWt. Temporary procedure TP03-007 "*Operational Guidance Following RFO 14 for Implementation of Thermal Power Optimization*", was written to capture all the normal post RFO surveillances, as well as the special tests performed during this power ascension program. PNPS used a standard Power Ascension Plan (PAP) contained in the standard refueling outage schedule to sequence the various surveillances that are performed following a typical refueling outage; then added those special tests required for the Thermal Power Optimization program.

The temporary procedure identified and captured the completion of those tasks that were required prior to clearing power ascension plateaus up to and including 2028 MWt. The program included acceptance criteria for TPO

modifications including the AMAG Feedwater Measurement instrumentation and the new HP turbine. TPO start up testing was completed on June 10, 2003.

FIGURE 1: PILGRIM CYCLE 15 CORE LOADING MAP BY BUNDLE TYPE



Fuel Type	
A=GE11-P9DUB407-14GZ-100T-141-T6 (Cycle 13)	G=GE11-P9DUB408-16GZ-100T-141-T6 (Cycle 12)
B=GE11-P9DUB408-6G5.0/7G4.0-100T-141-T6 (Cycle 13)	H=GE11-P9DUB408-6G5.0/7G4.0-100T-141-T6 (Cycle 12)
C=GE11-P9DUB407-14GZ-100T-141-T6 (Cycle 13)	I=GE14-P10DNAB397-14GZ-100T-145-T6-2621 (Cycle 15)
D=GE11-P9DUB408-6G5.0/7G4.0-100T-141-T6 (Cycle 13)	J=GE11-P9DUB408-16GZ-100T-141-T6 (Cycle 12)
E=GE14-P10DNAB412-16GZ-100T-145-T6-3901 (Cycle 14)	K=GE11-P9DUB408-6G5.0/7G4.0-100T-141-T6 (Cycle 12)
F=GE14-P10DNAB397-10G6.0/3G5.0-100T-145-T6-2613 (Cycle 15)	L=GE14-P10DNAB398-8G6.0/5G5.0/1G2.0-100T-145-T6-2614 (Cycle 15)