

U.S. NUCLEAR REGULATORY COMMISSION  
REGION I

Report No. 50-271/84-09

Docket No. 50-271

License No. DPR-28 Priority -- Category C

Licensee: Vermont Yankee Nuclear Power Corporation  
RD 5, Box 169  
Ferry Road  
Brattleboro, Vermont 05301

Facility Name: Vermont Yankee

Inspection At: Vernon, Vermont

Inspection Conducted: April 30 - May 4, 1984

Inspectors: Peter C. Wen  
P.C. Wen, Reactor Engineer

5/24/84  
date

Approved by: L.H. Bettenhausen  
L.H. Bettenhausen, Chief, TPS

5/31/84  
date

Inspection Summary: Inspection on April 30 - May 4, 1984  
(Report No. 50-271/84-09)

Areas Inspected: Routine, unannounced inspection of startup testing following refueling of Cycle 10. The inspection included the testing program, pre-critical tests and power ascension tests. The inspection involved 28 hours onsite by one region-based inspector.

Results: In the areas inspected, no items of noncompliance were identified.

## DETAILS

### 1. Persons Contacted

- L. Bozek, Senior Engineer, Operational Quality Group
- \* J. Brooks, Reactor Engineer
- B. Buteau, Reactor Engineering and Computer Supervisor
- \* S. Jefferson, Assistant to Plant Manager
- T. McClure, Computer Engineer
- J. Pelletier, Plant Manager
- \* D. Pike, Manager, Operational Quality Group
- D. Reid, Operations Superintendent
- T. Stetson, Reactor Engineer
- \* R. Wancyzk, Technical Services Superintendent

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- \* W.J. Raymond, Senior Resident Inspector
- \* denotes those present at the exit interview on May 4, 1984.

The inspector also contacted other licensee employees in the course of the inspection.

### 2. Cycle 10 Startup Physics Test Program

The startup physics test program was conducted according to Vermont Yankee Cycle 10, Reactor Engineering Beginning of Cycle Startup Testing, O.P. 4408, Revision 0. The test program outlined the steps in the testing sequence, set initial conditions and prerequisites, specified calibration or surveillance procedures at appropriate points, and referenced detailed test procedures and data collections in attachments. Initial criticality of Cycle 10 was achieved on May 28, 1983. The startup tests were completed about July 8, 1983.

The inspector independently verified that the predicted values and acceptance criteria were obtained from "Vermont Yankee Cycle 10 Core Management Report", YAEC-1344, dated April, 1983. The inspector reviewed test results and documents described in this inspection report to ascertain that the startup testing was conducted in accordance with technically adequate procedures and as required by Technical Specifications (TS). The details and findings of the review are described in Section 3.

### 3. Cycle 10 Startup Testing

The inspector reviewed selected test programs and their results to verify the following:

- Procedures were provided with the detailed stepwise instructions, including Precautions, Limitations, and Acceptance Criteria;

- Technical content of the procedures was sufficient to result in satisfactory calibration and test;
- Test programs were implemented in accordance with test sequencing procedures;
- Provisions for recovering from anomalous conditions were provided;
- Methods and calculations were clearly specified and tests were conducted accordingly;
- Review, approval, and documentation of the results were in accordance with the requirements of the TS and the licensee's administrative controls.

The following tests were reviewed:

### 3.1 Control Rod Drive Scram Time Test

The control rod drive (CRD) scram time test was performed in accordance with procedure O.P. 4424, Control Rod Scram Testing and Data Reduction, Revision 8. The inspector verified by review of the recorder traces and data obtained on June 5, 1983 that the average scram times at various insertion levels were all within the TS limits. The maximum scram time for 90% insertion of 2.8 seconds was well within the TS limit of 7 seconds.

No unacceptable conditions were identified.

### 3.2 Shutdown Margin

The Shutdown Margin Demonstration was performed in accordance with procedure O.P. 4426, Shutdown Margin Check, Revision 9. The test was performed on May 28, 1983 with moderator temperature of 103°F. A shutdown margin of at least 1.2972 %  $\Delta K/K$  was demonstrated by pulling margin rod (30-31) at position 16, with the strongest rod (34-35) fully withdrawn.

The TS requirement was a margin greater than  $R + 0.25\% \Delta K/K$ , where R was 0.43% including 0.07 %  $\Delta K/K$  for possible inverted boron tubes in the control blades. Based on the record reviewed, the inspector noticed that the 1/M plot was performed by the Reactor Engineering Group throughout the test.

No unacceptable conditions were identified.

### 3.3 Critical Configuration and Anomaly Check

The inspector reviewed test procedure O.P. 4430, Reactivity Anomalies, Revision 6 and the test results of May 28, 1983. The inspector verified that the critical rod configuration was within

$\pm 1\%$   $\Delta K/K$  of the predicted critical pattern. The inspector noticed that 1/M plot was performed by the Reactor Engineering Group throughout the test, and the Rod Worth Minimizer TS surveillance requirements were properly complied with prior to plant startup.

No unacceptable conditions were identified.

### 3.4 Core Thermal Power and APRM Calibration

The licensee's procedure O.P. 4400, Calibration of the Average Power Range Monitoring System to Core Thermal Power, Revision 8 was reviewed for technical adequacy. The inspector reviewed the calibration results of June 21 through 27, 1983, and verified that the Core Thermal Power was determined by the on-demand program OD-3. The final APRM readings were all within 1% of adjusted rated Core Thermal Power.

The inspector also reviewed procedure O.P. 2410, Revision 8. This procedure provides alternative methods to calculate core thermal power. These methods consist of (i) hand calculation and (ii) a backup computer method using an on-line Time-Share System (TSS) program "CTP". During the startup testing period at appropriately 25%, 50%, and 75% power plateaus, licensee performed heat balance comparisons between the process computer OD-3 and TSS method. The inspector independently calculated a heat balance using O.P. 2410 Hand Calculation Method. All comparisons were in good agreement as shown in the following:

<u>Test Date</u>	<u>Method</u>	<u>Result (MWE)</u>
6/20/83	OD-3	360.80
	TSS	351.13
6/22/83	OD-3	738.79
	TSS	730.17
6/23/83	OD-3	1184.30
	TSS	1181.01
	Hand Calculation (by inspector)	1185.1

The inspector had no further questions.

### 3.5 Thermal Hydraulic Limits and Power Distribution

The inspector reviewed the test procedure O.P. 4401, Core Thermal Hydraulic Limits Evaluation, Revision 9 and results of June 22 through July 3, 1983. The inspector verified by review of the program OD-6, Option 4, and P-1 results that the thermal limits, LHGR, MAPLHGR, and MCPR were all within the TS limits during this period.

The inspector determined from the core limit data of June 28, 1983 that the backup computer program BUCLE results and the P-1 results were identical.

The inspector also examined the data monitored during April 1-30, 1984. The thermal limits were all within the TS limits.

No unacceptable conditions were identified.

### 3.6 Local Power Range Monitor (LPRM) System Calibration

The inspector reviewed test procedure O.P. 4406, LPRM Calibration and Functional Check, Revision 5 for technical adequacy. The calibration of an LPRM system involves the combination of calculated and measured quantities to determine the local average heat flux at the location of each LPRM chamber. The actual LPRM meter reading is compared with the calculated average heat flux of the four adjacent fuel rods. The calculated value is derived either from the process computer or from normalized TIP data. The gain of each LPRM amplifier is then adjusted to produce the desired reading. The inspector observed flux mapping and associated LPRM calibration activities in the control room on May 1, 1984 and noted that:

- Full core flux map was performed by means of the TIP system just prior to amplifier gain changes.
- P-1 was run after the full core flux map and no unacceptable Base Crit Code was detected.
- Proper LPRM calibration adjustments were made by qualified personnel utilizing an approved written procedure and the newly calculated values.
- A second full core flux map and subsequent P-1 calculation were performed. The results verified that Gain Adjustment Factor (GAF) array was within the established limits.

No unacceptable conditions were identified.

## 4. QA Role in Cycle 10 Startup Testing

The inspector discussed the subject of QA's role in Cycle 10 startup testing with cognizant licensee QA personnel. The inspector was told that QA independently verified the core loading and performed QA audit on TS surveillance requirements. The inspector reviewed QA inspection report OQA-VY-SI-83-32 and audit report VY-84-15 and noted the QA verification of these activities. However, the inspector did not find evidence that QA had an active surveillance program which covered startup physics testing. To further strengthen QA coverage in this area, a licensee QA representative stated that QA plans to verify test results and surveillances at appropriate power plateaus for the future cycle startup testing.



The inspector had no further questions.

5. Control Room Observations and Facility Tours

The inspector observed control room operations for control room manning and facility operation in accordance with the administrative procedures and Technical Specification requirements.

No unacceptable conditions were identified.

6. Exit Interview

Licensee management was informed of the purpose and scope of the inspection at the entrance interview. The findings of the inspection were periodically discussed and were summarized at the conclusion of the inspection on May 4, 1984. Attendees at the exit interview are denoted in paragraph 1.

No written material was provided to the licensee by the inspector at any time during this inspection.