

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-293/84-40

Docket No. 50-293

License No. DPR-35

Priority --

Category C

Licensee: Boston Edison Company

800 Boylston Street

Boston, Massachusetts 02199

Facility Name: Pilgrim Nuclear Power Station

Inspection At: Plymouth, Massachusetts

Inspection Conducted: December 10-13, 1984

Inspectors: C Petrone for
P. C. Wen, Reactor Engineer

1/4/85
date

C Petrone for
J. S. Hodson, Reactor Engineer

1/4/85
date

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

1/8/85
date

Inspection Summary:

Inspection on December 10-13, 1984 (Inspection Report No. 50-293/84-40)

Areas Inspected: Routine, unannounced inspection of startup testing following refueling of Cycle 7. The inspection included the testing program, pre-critical tests and power ascension test procedures review. The inspection involved 46 hours onsite by two region-based inspectors.

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

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DETAILS

1. Persons Contacted

- *J. Aboltin, Senior Reactor Engineer
- M. Akhtar, Senior Modifications Engineer
- T. Beneduci, I&C Supervisor
- *E. Cobb, Principal Engineer
- *J. Crowder, Senior Compliance Engineer
- L. Darsney, Reactor Engineer
- E. Larsson, Senior Quality Assurance Engineer
- *C. Mathis, Manager, Nuclear Operations
- *A. Oxson, Vice President - Nuclear Operations
- J. Poorbaugh, Quality Assurance Engineer
- R. Reilly, Senior Operations Engineer
- *J. Seery, Technical Section Head
- A. Sampere, Senior Quality Control Engineer
- E. Ziemianski, Nuclear Operations Support Manager

U.S. Nuclear Regulatory Commission

- *J. Johnson, Senior Resident Inspector
- M. McBride, Resident Inspector

*Denotes those present at the exit interview on December 13, 1984.

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

2. Cycle 7 Reload Safety Evaluation and Core Verification

The Cycle 7 reload contains 192 new fuel bundles (160 GE P8X8R and 32 GE Barrier-Type BP8X8R). The pressurized P8X8R fuel assemblies are the same as those used in the Cycle 6 reload fuel. The barrier-type fuel provides a liner on the inner surface of the Zircaloy-2 cladding and was designed to reduce cladding failures due to pellet-cladding interaction. The safety evaluation of the Cycle 7 reload along with the required Technical Specification (TS) Changes were submitted to the NRC for review. This reload submittal was found acceptable (Letter from P. H. Leech (NRC) to W. D. Harrington (BECO), dated September 4, 1984).

The inspector reviewed the GE reports 23A1694, "General Electric Boiling Water Reactor Supplemental Reload Licensing Submittal for Pilgrim Nuclear Station, Unit 1 Reload 6", and 23A1695, "Pilgrim Cycle 7, Cycle Management Report", to verify the following:

- Overall plant safety margin;
- Consistency of the operational parameters, and
- Implementation of the revised TS changes in station procedures.

Shutdown margin(SDM) was calculated for a full core from the cold K_{eff} with all-rods-out (ARO) and all-rods-in (ARI) configurations. The results show that a minimum SDM of 0.0137 ΔK occurs at the cycle exposure about 6000 MWD/ST and the SDM at beginning of cycle (BOC) is 0.0248 ΔK . These results indicate that the reactor can be made subcritical in the most reactive condition during the operating cycle with the strongest control rod in its full-out position and all other operable rods fully inserted. The required SDM demonstration test will be discussed in the Section 3.2.

The Standby Liquid Control System SDM was calculated under cold, xenon-free, ARO conditions. The calculated SDM of 0.048 ΔK indicates that a complete shutdown from the most reactive condition at any time in cycle life can be accomplished by injecting boron solution.

The inspector reviewed the station operating procedure 9. series (reactor engineering) and noted that the operational limits changes associated with the new fuel loading has been incorporated in the procedures. Further, the information used for Cycle 7 startup physics testing was found to be consistent with the values derived from the safety analyses and the appropriate TS sections.

The inspector reviewed Procedure No. 4.5, Reactor Core Fuel Verification, Revision 7, dated November 18, 1984. The purpose of the procedure is to assure that core alterations are properly completed and are documented by a signed off reactor core fuel verification sheet and a set of video tapes for Cycle 7. The required final core loading pattern for Cycle 7 was transmitted by General Electric to Mr. R. G. Clough of Boston Edison Company by letter dated September 19, 1984. The inspector selectively compared this required configuration to the signed-off reactor core fuel verification sheet and the video tapes for Cycle 7.

No unacceptable conditions were identified.

During pre-critical control rod exercise, rod 42-39 was not able to be fully withdrawn and thus control rod coupling integrity with its drive could not be verified. The licensee plans to insert this rod completely along with three other symmetric rods (42-15, 10-15, and 10-39) for the Cycle 7 operation. Although this intended operational strategy has no effect on SDM calculation, the target rod patterns later in the cycle may be different from the ones used for the safety analyses. This may render the previously performed safety analyses invalid. The licensee acknowledged the inspector's finding. The licensee and its fuel vendor (GE) are currently conducting an investigation and evaluation as to the cause of problems and impact upon cycle predictions of rod 42-39. This is an unresolved item. (293/84-47-01).

3. Cycle 7 Startup Testing

Startup is planned for mid-December, 1984 after a 12-month maintenance and modification outage. During this inspection period, December 10-13, 1984, the unit was still in preparation for startup.

The restart test program will be conducted according to test procedure TP84-257, Restart Test Program Following Recirc Pipe Changeout. This procedure outlined the steps in the test program. The detailed tests and data collections are referenced in separate test procedures.

The inspector reviewed selected test programs and available results to verify the following, where applicable:

- 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;
- 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 and procedures were reviewed:

3.1 Control Rod Drive Performance and Friction Test

The control rod drive performance and friction test was performed according to test procedure 3.M.2-8, Revision 4. By using a differential pressure transducer and read-out device, observations of drive piston differential pressure were made and recorded. All 145 control rods were tested. No control rod exhibited excessive friction between the control rod blade and fuel cell components. The inspector reviewed selected differential pressure traces and noted that rod 42-39 successfully passed the friction test. The inspector was told that the problem with rod (42-39) surfaced after the completion of friction test.

The inspector had no further questions.

3.2 Shutdown Margin Demonstration

The SDM demonstration will be conducted according to test procedure 9.16.1, "In Sequence Critical for Shutdown Margin Demonstration", Revision 2. The inspector reviewed the test procedure for its technical adequacy.

The licensee is required to demonstrate SDM by at least $R+0.25\% \Delta K$. The value of R is the maximum decrease in SDM from BOC. An R value of $1.11\% \Delta K$ is planned to be used in the procedure. This value is

consistent with GE's report 23A1695, "Pilgrim Cycle 7, Cycle Management Report".

No discrepancies were identified.

3.3 Reactivity Anomalies Check

During the startup test program and startups following refueling outages, the critical rod configurations will be compared to the expected configurations at selected operating conditions. These comparisons will be used as base data for reactivity monitoring during subsequent power operation throughout the fuel cycle. The inspector reviewed the test procedure 9.8 for its technical adequacy. The inspector informed the licensee that the following items had not been incorporated in test procedures 9.8.

- The reactivity anomalies calculation did not include the correction factors for core thermal power, core flow rate, core coolant inlet subcooling and reactor pressure.
- The predicted reactivity anomalies curve must be recalculated due to changes in rod sequence as a result of the rod 42-39 problems (See unresolved items 84-40-01).

The licensee stated that the above items will be incorporated in the next procedure revision. The inspector had no further questions.

3.4 Core Flow Evaluation and Jet Pump Calibration

Core flow evaluation and jet pump calibration will be performed at appropriate power levels in accordance to approved test procedure 9.17, Revision 5. The inspector reviewed the test procedure for technical adequacy. The inspector had no questions.

3.5 CRD SCRAM Discharge Volume Hydrotest

During the refueling outage, modifications were performed on the control rod drive (CRD) scram discharge volume. The objective of the modifications was to improve the reliability of the system by eliminating the potential for the presence of undetected water and a failure-to-scram condition as described in IE Bulletin 80-17. The modifications included the replacement of the existing single scram discharge instrument volume with two individual scram discharge volumes located along the east and west sides of the reactor building at E1.23 feet.

The inspector reviewed test procedure #TP 84-14D, CRD Scram Discharge Modification Flush and Hydro, dated October 10, 1984, and the test results.

No unacceptable conditions were identified.

3.6 Process Computer Readiness

The inspector reviewed Procedure 9.28, Process Computer New Cycle Update, Revision 3, and the Pilgrim Process Computer Manual, Section 2-60, Refueling Update Monitor (OD-20). The purpose of these procedures is to outline the steps and documentation required to update the process computer after a refueling outage.

The inspector verified that important end-of-cycle data had been collected from the previous cycle, new cycle data from General Electric and been received and entered in the process computer, and that program OD-20 (Option 1) had been run for data verification.

No unacceptable conditions were identified.

4. Quality Assurance/Quality Control Participation in Refueling

The inspector reviewed Audit Report No. 84-41, Refueling, dated November 28, 1984 performed by the licensee's QA department. The scope of the audit included fuel handling, Technical Specification requirements, reactor core fuel verification, special nuclear material inventory and transfer control, and source range monitor (SRM) operability check. One minor deficiency identified during the audit was corrected by the licensee at the time of the audit.

No unacceptable conditions were observed.

5. 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 December 13, 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.