U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-286/84-05

Docket No. 50-286

License No. DPR-64 Priority - Category C

Licensee: Power Authority of the State of New York

Facility Name: Indian Point Unit 3

Inspection At: Buchanan, New York

Inspection Conducted: April 2-6 1984

Inspectors: Peter C. Wen 5/10/84
P. C. Wen date
Reactor Engineer

Approved by: L. H. Bettenhausen 5/16/84
L. H. Bettenhausen date
Chief TPS

Inspection Summary: Routine, unannounced inspection of startup testing following refueling of Unit 3, Cycle 4. The inspection included the testing program, pre-critical tests, zero power physics tests and power ascension tests. The inspection involved 33 hours on site by one region based inspector.

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

DETAILS

1. Persons Contacted

	M. Albright	&C Superintendent
*	J. Anderson	Assistant Plant Engineer
*	J. C. Brons	Resident Manager
*	J. Cirilli	QA/QC Superintendent
	S. Davis	QA Engineer
	F. Gumble	Site Reactor Engineer
*	W. D. Hamlin	Assistant to Resident Manager
	L. Kelly	Performance & Reliability Superintendent
*	S. Munoz	Technical Services Superintendent
	T. Orlando	Performance & Reliability Engineer
*	J. Russell	Superintendent of Power
	B. Vangor	Assistant Shift Supervisor

USNRC

*	T. Kenny	Senior Resident Inspector
*	L. Rossbach	Resident Inspector

* Denotes those present at the Exit Interview, on April 6, 1984.

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

2. Cycle 4 Startup Physics Test Program

The startup physics test program was conducted according to Indian Point No. 3 Cycle 4 Startup Physics Test Program, RA-7, Revision 2, approved May 19, 1983. 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 4 was achieved on June 4, 1983. Upon completion of the Zero Power Physics Test, the unit experienced a turbine generator problem and was shut down for the period from June 18, 1983 to January 27, 1984. The unit went critical on January 27, 1984 and resumed the startup physics testing. The Power Ascension Tests were completed about March 5, 1984.

The inspector independently verified that the predicted values and acceptance criteria were obtained from "Plant Operations Package for the Indian Point Unit 3 Nuclear Power Plant Cycle 4", WCAP-10113, dated June, 1982. The inspector reviewed test results and documents described in this 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 Sections 3 and 4.

3. Cycle 4 Startup Physics Testing-Precritical Tests.

The inspector reviewed calibration and functional test results to verify the following:

-- Procedures were provided with detailed instructions;

-- Technical content of procedure was sufficient to result in satisfactory component calibration and test;

-- Instruments and calibration equipment used were traceable to the National Bureau of Standards;

-- Acceptance and operability criteria were observed in compliance with TS.

The following tests were reviewed:

3.1 Control Rod Checks and Tests

The rod drop measurement was performed in accordance with procedure, Full Length Rod Drop Time Test, 3 PT-R4, Rev. 3. The inspector verified by review of the test results performed on June 2, 1983 that Rod Cluster Control Assemblies (RCCA) were tested for drop times and the individual RCCA drop times were all less than 1.8 seconds as required by the TS. The inspector also reviewed several visicorder traces and verified that the drop times had been interpreted correctly.

Rod Position Indication System calibration was performed under procedure, Full Length Rod Position Indication System Calibration, 3PC-R6, Rev. 3. The calibration was completed on June 3, 1983. Due to long delay in the turbine generator outage, the licensee performed a second test on January 26, 1984.

No items of noncompliance were identified.

3.2 Reactor Thermocouple/RTD Cross Calibration

Reactor thermocouples were cross-calibrated against average of the RTD's reading on January 16-17, 1984 in accordance with procedure RA-1, Rev. 4.

No unacceptable conditions were identified.

3.3 Reactivity Computer Setup/Verification

The reactivity computer was set up and calibrated according to procedure STS-126, Rev. 2 on June 3, 1983. The reactivity computer was adjusted with the correct inputs of delayed neutron fractions (betas) and decay constants (lambdas). An exponential test signal

was fed into the reactivity computer. The dynamic response was then compared with predicted values which were derived from point reactor kinetics. The results of this calibration check were satisfactory.

The reactivity computer was further checked when reactor reached critical. Comparisons of predicted and measured reactivities based on doubling time measurement were acceptable.

No. unacceptable conditions were identified.

4. Cycle 4 Startup Physics Testing - Post-Critical Tests

The inspector reviewed selected test programs to verify the following:

-- The test programs were implemented in accordance with Cycle 4 Startup Physics Test Program

-- Step-wise instructions of test procedures were adequately provided including Precautions, Limitations and Acceptance Criteria in conformance with the requirements of the TS;

-- Provisions for recovering from anomolous conditions were provided;

-- Methods and calculations were clearly specified and the tests were performed 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:

4.1 Zero Power Physics Tests

4.1.1 Boron Endpoint Determination

The licensee measured the just critical boron concentration in accordance with procedure RA-2, Initial Criticality, Rev. 2. The inspector reviewed the data and noted the following results:

Rod Position	Predicted Value (PPM)	Test Result (PPM)
All Rods Out (ARO)	1456±50	1433
D IN	1322±50	1291
D+C IN	1246±50	1222
D+C+B IN	1177±50	1161
D+C+B+A IN	1039±50	1025

4.1.2 Isothermal Temperature Coefficient

Isothermal temperature coefficients were measured and documented in accordance with procedure RA-3, Isothermal Temperature Coefficient, Rev. 2. The inspector noted the following results.

Rod Position	Predicted Value (pcm/°F)	Measured Value (pcm/°F)
ARO	-3.15±3	-2.44
D IN	-4.21±3	-3.92
D+C IN	-6.35±3	-6.45

The isothermal temperature coefficient (ITC) is defined as the change in reactivity for a unit change in the moderator, clad and fuel pellet temperatures. Thus, the ITC can be interpreted as the sum of the moderator and Doppler coefficient. The Doppler coefficient is difficult to measure in normal operation. A value of -1.90 pcm/°F was obtained from Westinghouse report, "The Nuclear Design and Core Management of the Indian Point Plant Unit No. 3, cycle 4" WCAP-10051. Thus, during zero power physics testing, the ARO Moderator Temperature Coefficient (MTC) was determined to be -0.54 pcm/°F. This result met the TS requirement.

4.1.3 Control Rod Worth Measurement

The control rod reactivity worth measurements were performed in accordance with procedure RA-4, Control Rod Worth Measurements, Rev. 2. The following results were noted:

Configuration	Predicted Worth (pcm)	Measured Worth (pcm)
Control Bank D	1172±176	1249
Control Bank C (D IN)	659±99	671
Control Bank B (D+C IN)	610±92	561
Control Bank A (D+C+B IN)	1212±182	1257
Total	3653±365	3738

No unacceptable conditions were identified.

4.2 Power Ascension Tests

4.2.1 Core Power Distribution

The procedure and method used by the licensee to verify that the plant is operating within the power distribution limits defined in TS were reviewed and discussed with cognizant licensee personnel. The

data taken by the Moveable Incore Detector System was digitized and stored by the plant computer. This information was then fed into a large scale CDC-7600 computer at Corporate Headquarters which performed the core power distribution calculation using the licensee's version of the Westinghouse "Incore" code.

Flux maps taken and analyzed to support the Cycle 4 startup and power operation are tabulated below. The inspector reviewed computer input and incore flux data and verified that engineering and nuclear uncertainties were applied in the results.

Date (Flux Map)	Power Level (%)	F_Q Calculated Value	F_Q TS Limit	$F^N_{\Delta H}$ Calculated Value	$F^N_{\Delta H}$ TS Limit
6-5-83 (4FCFM1)	0.03	2.487	3.991	1.621	1.860
2-16-84 (4FCFM2)	89.9	1.867	2.270	1.435	1.581
2-16-84 (4QCFM1)	89.9	1.861	2.270	1.440	1.581
2-16-84 (4QCFM2)	89.9	1.874	2.270	1.410	1.581
2-16-84 (4QCFM3)	89.9	1.885	2.270	1.400	1.581
2-16-84 (4QCFM4)	89.9	1.952	2.270	1.429	1.581
2-29-84 (4FCFM3)	99.0	1.877	2.160	1.438	1.553

No items of noncompliance were identified.

4.2.2 Core Thermal Power Evaluation

The licensee's procedure SOP-RPC-6, Reactor Thermal Power Calculation, Rev. 4 was reviewed for technical adequacy. The inspector reviewed the data from the measurements performed for the month of February, 1984, and verified that the frequency of evaluation and excore power range

channel calibrations were performed within the requirements as prescribed by the TS and plant operation procedure.

No unacceptable conditions were identified.

4.2.3 Power Coefficient

Power coefficient measurements were made in accordance with test procedure RA-9, Power Coefficient Measurement, Rev. 2. The measurement was made at 65% power level. Test result is summarized in the following.

Predicted Value (pcm/% power)	Measured Value (pcm/% power)
-12.22±2.0	-12.10

The test result met acceptance criteria. While reviewing the calculations, the inspector noted that calculations were performed on an engineering calculation sheet, but a clear, stepwise calculational method was not included in the procedure. The licensee representative stated that the need for detailed procedure had been recognized and the detailed stepwise procedure for calculating the power coefficient would be completed before the next refueling startup test.

4.2.4 Incore-Excore Calibration

Incore-excore calibration was performed at 90% power level. Five (5) axial flux differences obtained from five flux maps (1 full core map and 4 quarter core maps) were analyzed and compared to responses of the excore detectors to develop a calibration curve for each power range detector. Reasonably good linear relationship for all eight detectors were observed. The excore detectors were then calibrated by I&C personnel according to procedure 3PC-M1, Nuclear Power Range Channel Axial Offset Calibration, Rev. 14, on February 21, 1984, prior to reaching full power level.

No unacceptable conditions were identified.

4.2.5 Target Axial Flux Difference Determination

Target Axial Flux Difference Determination was performed by the methods detailed in the test procedure RA-10, Rev. 3. The inspector reviewed the latest calculation performed on March 21, 1984 and verified that this new delta flux target was entered into the plant process

computer. The inspector toured the control room and noticed that this revised information was in use by the reactor operators.

No discrepancies were identified.

5. QA Role in Cycle 4 Startup Testing

The inspector discussed the subject of QA's role in Cycle 4 startup testing with cognizant licensee QA personnel. The inspector was told that QA has a surveillance program for verifying (i) TS requirements are being met, and (ii) activities associated with the maintenance, inspection, testing and operation of plant equipment are being conducted safely. The inspector reviewed QA surveillance report SR 4-06, "Equipment Status Operability Prior to Start-up", and QA audit report 83-23, "TS, Appendix A, Section 4, Surveillance Requirements" and noted the QA verification of these activities. Leading Edge Flow Meters (LEFM's) were installed in the feedwater lines during past outage to provide more accurate measurement of feedwater flow. Based on the records reviewed, the inspector noted that QA was actively involved in this modification activity. 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.

No items of noncompliance were identified.

6. 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. Inspection tours of the Turbine/Generator areas were conducted.

No unacceptable conditions were identified.

7. 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 April 6, 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.