1. Give a quantitative comparison of the trip reactivity insertion rates for Cycles 1 and 2. In your submittal you assert that the rod ejection and the rod withdrawal from subcritical events are controlled by the Doppler coefficient and are relatively unaffected by trip ractivity changes. Provide the differences in the total heat input to the limiting fuel rod associated with slower Cycle 2 reactivity rates for these events.

A quantitative comparison of the trip reactivity insertion rates used for Indian Point Unit 3, Cycle 1 and Cycle 2, safety analysis is given in Figure 1.

Rod ejection and rod withdrawal from subcritical are fast transients which are unaffected by changes in the trip reactivity insertion rate. For both of these transients, the peak nuclear power is limited by negative reactivity insertion due primarily to Doppler feedback and occurs prior to any rod insertion.

For the rod withdrawal from subcritical transient, sensitivity studies have shown that the trip reactivity insertion rate has a negligible effect on the transient results. An evaluation of the effects of the slower trip reactivity insertion rate for Indian Point Unit 3, Cycle 2, indicates no change in the peak neutron flux and only a slight increase in the peak thermal power (less than 1%). Though there would be a small increase in total energy release, the peak fuel average temperature would increase by less than 10°F, and the core water temperature would increase by less than 5°F. Thus, the conclusions presented in the FSAR are still valid.

8110240360

For the rod ejection incident, the average core transient analysis is performed using TWINKLE, a special kinetics computer code (see WCAP-7588, Rev. 1-A, for a description of the analysis methodology). Shutdown reactivity effects are calculated directly by the code as a result of dropping of a rod of the required worth into the core. Thus, the trip reactivity insertion rate curve, which was determined using very conservative static nuclear design methods, is applicable only to transient simulations employing point kinetics and is not an input to the rod ejection analysis. Any changes to the curve are, therefore, of no consequence for the rod ejection results.

2. What was the minimum value of the DNB ratio obtained in the reanalysis of the complete 4/4 pump loss of flow incident?

The results of the 4/4 pump loss of flow reanalysis show that the minimum value of the DNB ratio remains above 1.3; thus, the conclusions as presented in the FSAR for this incident are still valid. The minimum DNBR is less than 5% lower than the minimum value previously reported in "Fuel Densification - Indian Point Nuclear Generating Station Unit Number 3", WCAP-8746 (proprietary) and WCAP-8147 (non-proprietary), July 1973.

3. Show that the DNB ratio from the steamline break analysis, which assumes complete loss of offsite power and which is described in the reload submittal, is more limiting than the DNB ratio corresponding to the steamline break analysis with offsite power. Indicate whether the submitted analysis was performed for the break upstream or downstream from the flow measuring nozzle.

The steamline break accident was reanalyzed for Indian Point Unit 3, Cycle 2. All of the following hypothetical break cases (complete severence of a main steam pipe) were included in the reanalysis:

a. Break downstream of the steam flow measuring nozzle, with the plant initially at no load conditions, and offsite power available (full reactor coolant flow).

b. Break upstream of the steam flow measuring nozzle, with the plant initially at no load conditions, and with offsite power available.

c. Case (a) above with loss of offsite power simultaneous with the initiation of the safety injection signal. Loss of offsite power results in reactor coolant pump coastdown.

d. Case (b) above with loss of offsite power simultaneous with the initiation of the safety injection signal.

For all of the above cases, the minimum DNB ratio is greater than 1.3. Thus, the conclusions presented in the FSAR are still valid.

4. Describe in detail the tests being done to check for a misloaded assembly. What assurances are there that the core is as expected before going to powers >5% rated power?

Core power anomalies caused by a misloaded assembly would be discovered during the review of the low power (between 3 and 5%) flux map. Such anomalies would be addressed before increasing power above 5%.

5. Provide the details of the procedures for the critical boron concentration tests. What are the conditions when these measurements are made? Discuss how corrections are made to the measured data and how the measured data is compared to the predictions. What are the acceptance criteria and what are the procedures if the acceptance criteria are not met?

Procedures for critical boron concentration measurements, called Boron Endpoints, are detailed in Reactor Analysis Procedures R.A.-2, R.A.-4 and R.A.-5 (copies enclosed). Action to be taken in the event acceptance criteria are not met is described in R.A.-7 (copy enclosed).

6. Describe the procedures and methods used for the temperature reactivity coefficient tests, include the conditions at the time of measurement. Also provide the acceptance criterion and the procedures to be followed if the acceptance criterion is not met.

Procedures for temperature reactivity coefficient tests are described in R.A.-3 (copy enclosed). Action to be taken in the event acceptance criteria are not met is described in R.A.-7.

7. Provide the details of the control rod group reactivity worth tests. Give the predicted worth of each group to be measured, the stuck rod worth and the predicted total worth for all rods. What are the acceptance criteria for this test and what are the procedures to be followed if the acceptance criteria are not met?

Details of the control rod group reactivity worth tests are provided in R.A.-4 (copy enclosed). Action to be taken in the event acceptance criteria are not met is described in R.A.-7. It should be noted that the intent is to measure the worth of the two controlling banks and only measure additional banks if the above measurements fail the acceptance criteria.

8. Provide the details of the core power distribution tests. Describe in detail the methods used to predict the assembly power as well as the analyses of the data obtained during the measurements. What are the assembly by assembly acceptance criteria. What are the conditions when the power distribution test are made?

Details of the core power distribution tests are provided in Administrative Procedure AP-25.4-2 (copy enclosed) and in Westinghouse document WCAP-8492. The measurements will be considered acceptable if the measured $F_{\Delta H}$ for each assembly agrees with the predicted value to within 15%. Action to be taken in the event acceptance criteria are not met is described in R.A.-7.

9. Provide details of the power Doppler reactivity coefficient measurement near full power. What methods are used to compare measured values with prediction? What are the acceptance criteria for those test and what procedures are followed if acceptance criteria are not met.

Details of the power reactivity coefficient measurement are provided in R.A.-6 (copy enclosed). Action to be taken in the event acceptance criteria are not met is described in R.A.-7.

10. Discuss the changes to be made to the plant's computer prior to Cycle 2 operation. This should describe:

a. What elements change from Cycle 1 to Cycle 2: coefficients, constants, correlation, etc., and why they change.

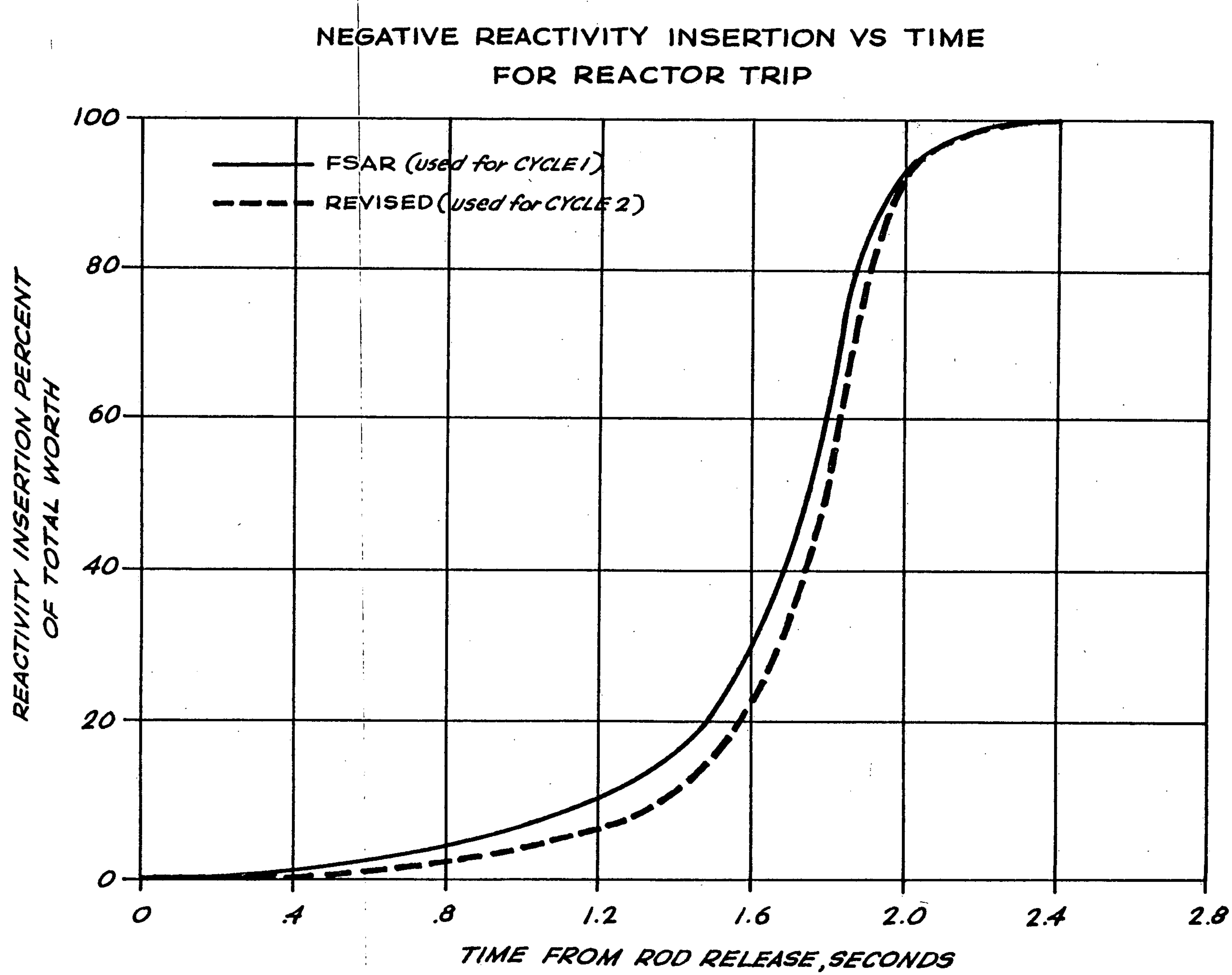
b. What codes and methods are used to establish the new values.

c. What quality assurance procedures (testing) are used at the site to verify that changes have been correctly made.

Comparison of plant computer data to plant data as measured from other sources is outlined in R.A.-1 and R.A.-8. The specific changes to computer coefficients and constants that this comparison requires will be detailed in the Cycle 2 Startup Report. All changes to constants and coefficients made to the plant computer are recorded on either hard copy output or tape which are maintained in the station. This hard copy or tape record provides adequate assurance that the changes have been made correctly.

11. Confirm that a written report of the startup tests results will be submitted to NRC within 45 days after completion of the tests.

A written report of the startup tests results will be submitted within 90 days after completion of the test as required by Technical Specification 6.9.1.2.


NEGATIVE REACTIVITY INSERTION VS TIME
FOR REACTOR TRIP
FSAR (used for CYCLE 1)
REVISED (used for CYCLE 2)
REACTIVITY INSERTION PERCENT
OF TOTAL WORTH
100
80
60
40
20
0
0
.4
.8
1.2
1.6
2.0
2.4
2.8
TIME FROM ROD RELEASE, SECONDS

POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT NO. 3 NUCLEAR POWER PLANT

R.A.-1 Rev. 0

INCORE THERMOCOUPLE AND WIDE RANGE RTD CALIBRATION

PRELIMINARY

Written by: N. Passman

Reviewed by: ____________

PORC Review ____________ Date ______

Approved by: ____________ Date ______

Effective Date ____________

1.0 PURPOSE

1.1 To determine isothermal correction factors as a function of temperature for individual thermocouples for analog and computer readout.

1.2 To determine isothermal correction factors as a function of temperature for wide range RTD's.

1.3 To determine which RTD's should not be used for reactor protection and processing.

2.0 REFERENCES

2.1 "Certificate of calibration and Testing" by Rosemount Engineering Company.

3.0 PRECAUTIONS AND LIMITATIONS

3.1 The addition of makeup water should be avoided while temperature measurements are made.

3.2 Honeywell indicator reading shall be taken in as short a time as possible to minimize effect of reactor coolant temperature change.

3.3 Do not take computer thermocouple maps while Honeywell readout indicator is being read.

3.4 Before removing in service RTD for measurement. Install 400Ωresistor at TCL and TML test input and put test/operator switch in test.

4.0 INITIAL CONDITIONS

4.1 Reactor is subcritical.

4.2 All available reactor coolant pumps are running.

4.3 Three direct reading digital voltmeters (DVM) with ohms converter (Hewlett Packard Model 3450A or equivalent) are available.

4.4 P-250 computer is working and available.

5.0 INSTRUCTION

5.1 Choose one spare narrow range Hot-leg RTD and one narrow range Cold-leg RTD from the same RC loop and record on data sheet 1 which RTD's are in service (✓) or spares (X).

5.2 Connect red and black wires to the DVM's to read lead, RTD and padded resistance.

NOTE: The following alternate wire combinations can be used at the discretion of the Test Supervisor:

WT-RD, GN-BK, and GN-RD

5.3 Record manufacturer, model number, and serial No. of DVM's used on Data Sheet No. 1.

5.4 Check and setup the P-250 computer according to Attachment 1.

5.5 When the reactor coolant temperature is approximately 300°F, obtain the following data:

CAUTION: RCS temperature must be above 280°F and the overpressurization protection system must be defeated to prevent inadvertent actuation whenever wide range RTD current measurements are made. Measurements will be taken at installed test points.

5.5.1 Record start time and resistance reading for narrow range RTD's (Hot and Cold) on Data Sheet No. 2 from step 5.2.

5.5.2 From computer, obtain short-form 1 minute-old thermocouple map (Value 1=0, Value 2=20, Value 3=1).

5.5.3 Measure all primary coolant narrow range RTD lead wire resistances and record on Data Sheet 1. These measurements should be made when RCS temperature is constant. If desired, additional lead wire resistance reading may be made during and following heatup.

5.5.4 Obtain all narrow range RTD resistances and wide range RTD currents. Record on Data Sheet 3. It is important that the measurements be made in the order listed in the data sheet, that is left top to right bottom.

5.5.5 Obtain Honeywell indicator data on Data Sheet No. 2.

5.5.6 Obtain wide range temp. from Control Room Recorder on Data Sheet No. 2 and record finish time.

5.6 Repeat Step 5.5 for approximately every 50°F temperature increase until the last data is obtained at 547°F.

5.7 Disconnect DVM's and return all data sheets, trend typewriter output and programmer's console typewriter output to Reactor Analyst for data evaluation.

6.0 ACCEPTANCE CRITERIA

This test is acceptable when the Test Supervisor determines that the data requested in this procedure is obtained.

est Completed (Test Supervisor) ______________________
Signature/Date

Acceptance Criteria Met YES NO
(Circle One)

(Watch Supervisor) ______________________
Signature/Date

(Reactor Analyst) ______________________
Signature/Date

Comments:

____

DATA SHEET NO. 1

Step 5.5.3 Lead Wire Resistance Measurement

ATE: ________________

START: T0001A __________ °F
T0065A __________ °F
Time __________

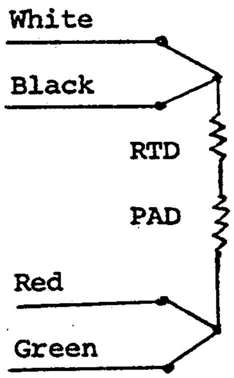


Figure 1

Lead Wire Resistance (Ω)

Loop A (Red) Rack A4

RTD#	In Service	RD-GN	WT-BK
410A			
411A			
412A			
410A			
411B			
412B			

Loop 3 (Blue) Rack B3

RTD#	In Service	RD-GN	WT-BK
430A			
431A			
432A			
430A			
431B			
432B			

Loop 2 (White) Rack A10

RTD#	In Service	RD-GN	WT-BK
420A			
421A			
422A			
420B			
421B			
422B			

Loop 4 (Yellow) Rack B10

RTD#	In Service	RD-GN	WT-BK
440A			
441A			
442A			
440B			
441B			
442B			

End Too01A __________ °F
Too65A __________ °F

Time __________

DVM's used:
Manufacturer:
Model No:
Serial No:

Step 5.3

1	2	3

✓ In Service X - Spare

DATA SHEET NO. 2

Honeywell Indicator Data

DATE: ______________________

START TIME: ______________________

Step 5.5.1

Hot Leg RTD (TE- A) ______ Ω

Cold Leg RTD (TE- B) ______ Ω

Step 5.5.5

T/C No.	Temp (°F)	T/C No.	Temp (°F)	T/C No.	Temp (°F)	T/C No.	Temp (°F)
1		17		33		49	
2		18		34		50	
3		19		35		51	
4		20		36		52	
5		21		37		53	
6		22		38		54	
7		23		39		55	
8		24		40		56	
9		25		41		57	
10		26		42		58	
11		27		43		59	
12		28		44		60	
13		29		45		61	
14		30		46		62	
15		31		47		63	
16		32		48		64	
						65	

Step 5.5.6

MCB WIDE RANGE RECORDER

Loop 21 Hot ___ (°F); Loop 22 Hot ___ (°F);
21 Cold ___ (°F); 22 Cold ___ (°F);
Loop 23 Hot ___ (°F); Loop 24 Hot ___ (°F);
23 Cold ___ (°F); 24 Cold ___ (°F)

FINISH TIME: ______________________

DATA SHEET No. 3

DATE ______________

START TIME ______________

STEP 5.5.4 NARROW RANGE RTD RESISTANCE (Ω)

Loop 1 (Red) Rack A4

RTD#	BK-RD
410A	
411A	
412A	
410B	
411B	
412B	

Loop 3 (Blue) Rack B3

RTD#	BK-RD
430A	
431A	
432A	
430B	
431B	
432B	

Loop 2 (White) Rack A10

RTD#	BK-RD
420A	
421A	
422A	
420B	
421B	
422B	

Loop 4 (Yellow) Rack B10

RTD#	BK-RD
440A	
441A	
442A	
440B	
441B	
442B	

WIDE RANGE RTD (MA)

Rack A6		
RTD #	TEST POINT	MA
TE413A	TP/TM413A	
TE423A	TP/TM423A	
TE433A	TP/TM433A	
TE433A	TP/TM433A	
TE443A	TP/TM443A	
Rack A5		
TE413B	TP/TM413B	
TE423B	TP/TM423B	
TE433B	TP/TM433B	
TE443B	TP/TM443B	

FINISH TIME ______________

ATTACHMENT 1

P-250 COMPUTER CHECK OUT SHEET

A-1 Verify that K5002 (T/C Prog perm) is 1: ______________

A-2 Verify that Date and Time is correct: ______________

A-3 Trend the following inputs in a trend block at the interval of 1 minute:

1. T0087A)
2. T0088A) Hot Junction Box Temp.
3. T0089A)
4. T0090A)

5. P0400A)
6. P0420A) SG press.
7. P0499A) RCS Press.

8. T0406A)
9. T0426A) Cold leg temp.
10. T0446A) Wide range
11. T0466A)

12. T0001A)
13. T0065A) T/C temp.

A-4 Verify that enough paper exists in trend and programmers typewriter: ____________

A-5 Verify that K5501 is 0: ____________ (See note below)

Date: __________________

Time: __________________

Verified By: ________________________

A-6 Verify that all inputs listed in A-3 are in "SCAN" mode.

Note: When K5501 = 0,

Ti (Cold = Measured in ith Loop Cold Leg Temp.

Ti (Hot) = Ave. In-Core T/C Temp.

POWER AUTHORITY OF THE STATE OF NEW YORK

INDIAN POINT NO. 3 NUCLEAR POWER PLANT

RA-2 Rev. 0

INITIAL CRITICALITY

PRELIMINARY

Written by: N. Passman

Reviewed by: __________

PORC Review __________ Date __________

Approved by: __________ Date __________

Effective Date __________

1.0 PURPOSE

1.1 To achieve initial criticality with the rod configuration as close to all-rods-out condition as possible.

1.2 To establish the upper limit of the neutron flux level for all zero power physics measurements.

2.0 REFERENCE

2.1 Nuclear Design Report - WCAP 9244

2.2 PEP-NI-1

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Plant operating status as specified in the Limiting Conditions for Operation, Unit 3 Technical Specification are satisfied.

3.2 The VCT makeup control system manual mode is available for operation.

3.3 During the performance of this procedure, especially during the boron dilution phase, the test supervisor will monitor the changing core conditions and keep the Watch Supervisor or his designated alternate informed of his evaluations. The expected "just critical" conditions are as follows:

1. Boron Concentration: 1456 ± 50 ppm

2. RCC Bank Configuration:

   Control Bank D at 228 steps
   All other banks at 228 steps

3. Tave: 547 $^{+0}_{-5}$ °F

4. RCS Pressure: 2235 ± 50 psig

Based on his evaluation of the existing boron concentration and inverse count rate ratio, the test supervisor will advise the Watch Supervisor or his designated alternate whether criticality will be achieved within the expected range. If it appears that criticality will be achieved outside the expected range, the test supervisor will determine whether the difference between the predicted critical point and the expected critical point constitutes a safety problem. If it appears that a safety problem may exist, the approach to criticality will be terminated until a complete evaluation of the situation can be conducted.

3.4 Startup rate limited to 1 decade per minute.

4.0 INITIAL CONDITIONS

4.1 Reactor Coolant System Pressure is at 2235 ± 50 psig.

4.2 Reactor Coolant System Temperature is at 547 $^{+0}_{-5}$ °F.

4.3 All RCC banks are fully inserted.

4.4 Low power range trip point set at ≤ 25% of full power.

4.5 Intitial RCS boron concentration is at least 1600 ppm.

4.6 Bank selector switch in shutdown bank A position.

4.7 All 4 reactor coolant pumps are in operation.

4.8 All source and intermediate range channels are operational. Audible and visual count rate are available from the audio count-rate channel and scaler-timer unit respectively for one source range channel. The nuclear instrumentation recorder is monitoring both source ranges or one source range and one intermediate range channel.

4.9 The reactivity computer has been installed and checked out in accordance with Westinghouse Procedure STS-126.

4.10 Individual signals from the top and bottom detectors of one power range channel have been hooked up to the reactivity computer to provide a flux signal for the reactivity measurements. The affected channel has been placed in the trip condition in accordance with Reference 2.2 (Instrument Fuses left in place to maintain power on channel).

4.11 Precriticality checkoff list has been completed.

5.0 INSTRUCTIONS

5.1 Prior to the initial approach to criticality, ensure that the manual reactor trip circuits function properly by depressing the reactor trip button on the Control Room console and verifying that the reactor trip breakers open.

5.2 Establishment of base line count rate

With all RCC banks in the fully inserted positions the test supervisor will establish a baseline count rate for the inverse count rate (ICRR) plots for both Source Range Channels (N31 and N32). Three-60 second counts should be obtained for each channel and the average of the three counts used as the baseline for each of the channels. Separate plots of the ICRR source range channel during the subsequent RCC bank withdrawals.

5.3 Shutdown RCC Bank Withdrawals

On request of the test supervisor through the Watch Supervisor or his designated alternate, begin withdrawing the shutdown banks in the sequence given below. Each of the shutdown banks will be stopped at

5.3 Continued -

approximately 50 step increments during the withdrawal and a 60 second count will be obtained for each source range channel and plotted on the ICRR plots.

5.3.1 Withdraw Shutdown Bank A to 228 steps in 50 step increments.

5.3.2 Withdraw Shutdown Bank B to 228 steps in 50 step increments.

5.3.3 Withdraw Shutdown Bank C to 228 steps in 50 step increments.

5.3.4 Withdraw Shutdown Bank D to 228 steps in 50 step increments.

5.4 RCC Control Bank Withdrawals

On request of the test supervisor, through the Watch Supervisor or his designated alternate, begin withdrawing the control banks in manual. The control banks will be stopped at approximately 50 step increments during the withdrawal and a 60 second count will be obtained for each source range channel and plotted on the ICRR plots.

5.5 Stop control rod withdrawal when Control Bank D reaches approximately 160 steps.

5.6 Switch pressurizer heaters from automatic to manual control. Actuate pressurizer heaters with pressurizer spray on automatic in order to adjust the pressurizer boron concentration to the reactor coolant loop boron concentration during and after boron dilution. Continue in this mode during and after boron dilution until the differential boron concentation between the pressurizer and reactor coolant loop is less than 10 ppm.

5.7 Establish New Baseline Count Rates prior to Starting Boron Dilution

Prior to beginning the boron dilution the test supervisor will establish a baseline count rate for the inverse count rate ratio plots (ICRR) for both source range channel. Three-60 second counts should be obtained for each source range channel and the average of these counts should be used as the baseline for each channel. Separate plots of the ICRR will be maintained for each source range channel as a function of the gallons of dilution water added to the system.

<u>Base Line Count Rate Determination</u>

<u>Channel 31</u>

60 second count rates	Avg.
____________	__________
____________	
____________	

Channel 32

60 second count rates   Avg.

____________________   _______________

____

____

Keithley Background __________________ Amps

After the boron dilution has been initiated, 60 second count rates will be obtained for each source range channel at approximately 15 minute intervals. After obtaining each count rate the test supervisor will plot the new inverse count rate value on the appropriate ICRR plot as a function of the total amount of dilution water added to the system. A continuous evaluation of the ICRR plots for both source range channels to determine the rate of approach to criticality and the extrapolated point of criticality will be made by the test supervisor.

5.8 After establishing the new baseline count rates, intiate the boron dilution by placing the boric acid mode selector switch in the Manual Makeup position with the setpoint for the boric acid flow control valve FCV-110A at the "O" gpm position (valve fully closed). Manually divert the letdown rate of 75 GPM. The makeup will consist only of primary water. Adjust the primary water makeup valve FCV-111A to obtain a dilution rate of between 75 and 100 gpm (this is between 850 and 1250 pcm/hr positive reactivity addition) dependent on the VCT level or as directed by the test supervisor. Reduce primary water flow to approximately 50 GPM when the ICRR plot equals 0.10.

NOTE: Ensure primary water flow from PWST is sufficient to maintain VCT level above emergency makeup from RWST but below level for high level diversion.

5.9 Samples of the pressurizer should be taken at approximately 60 minute intervals and RCS hot leg should be obtained at approximately 20 minute intervals for boron analysis during the system dilution. Dilution of the system should continue at the rate specified by the test supervisor until the inverse count rate ratio indicates that criticality can be achieved by rod withdrawal and system mixing, (approximately 0.05 on the ICRR plot) as determined by the test supervisor. When it appears that criticality can be achieved the test supervisor will request that the dilution be secured and the system allowed to mix. Sampling of the system will continue until it is determined by the test supervisor that the system is mixed and the boron concentration is constant.

If criticality is achieved during mixing, adjust the SUR if necessary by movement of control bank D. Observe the 1 DPM startup rate limit at all times. Continue to step 5.12.

Record flux level at just critical condition:

Keithly __________________ Amps

	NI Rack	NI Recorder
N31 (CPS)	________	____________
N32 (CPS)	________	____________
N35 (AMPS)	________	____________
N36 (AMPS)	________	____________
RCC Position	________________	

Tavg ______________________ ^{o}F

Przr. Press. ________________ psig

5.10 If criticality is not achieved after mixing is complete, begin withdrawal of control bank D stopping at intervals of approximately 15 steps until criticality is achieved. If criticality is not achieved with control bank D at 228 steps, continue to step 5.11. If criticality is achieved at or before this position, continue to step 5.12.

5.11 If criticality is not achieved with control bank D at 228 steps, insert control bank D to 160 steps. Initiate boron dilution at approximately 25 GPM (approximately 300 pcm per hour) as per 5.9 . On request from the test supervisor, stop dilution and allow the reactor coolant system to mix. Repeat steps 5.10 and/or 5.11.

5.12 Nuclear Heating

5.12.1 On achieving criticality, move the rods (Control Bank D) in the following sequence:

5.12.1.1 Withdraw 4 steps.

5.12.1.2 Insert 8 steps.

5.12.1.3 Withdraw 4 steps.

5.12.2 Record the flux level scale, RCC positions, and time on the reactivity flux recorder.

5.12.3 Insert positive reactivity by withdrawal of rods to achieve flux level 1/2 decade above the initial criticality flux level.

5.12.4 Insert control rods to the original position of Step 5.12.1.

5.12.5 Repeat stops 5.12.1.1 through 5.2.1.3.

5.12.6 Repeat steps 5.12.2 through 5.12.3, each time increasing flux by 1/2 decade until nuclear heat is observed.

5.12.7 When nuclear heating is observed (as evidence by an exponential decay of the reactivity trace or increase in ΔT or Tave), adjust control bank D to the just critical position and record the reactivity flux level and the response of the intermediate channels.

N35 ________________

N36 ________________

Keithly ________________

5.12.8 Reduce the flux level to the decade below which nuclear heating was observed but still at least a decade above the gamma noise region. Consult test supervisor for the determination of Zero power physics test flux level. Gamma noise region can be determined by plotting differential rod worth obtained in Steps 5.12. 1 through 5.12.6 as a function of flux. When the differential rod worth increases and stabilizes, the flux range where the differential rod worth is constant is the zero power physics flux level range.

Upper limit (Keithly) ______________

N35 ____________

N36 ____________

5.13 Establish a steady state condition. This is defined as follows:

a. Pressure 2235 $\pm$ 25 psig.

b. Tavg. 547 + 0°F - 5°F with a rate change of less than + 0.1 F/min.

c. Difference of pressurizer and reactor coolant boron concentrations is less than 10 ppm.

d. A maximum variation of $\pm$ 5 ppm between successive RCS samples.

NOTE: If those conditions are not attainable they may relaxed by mutual agreement of the responsible operations supervisor and the test supervisor.

5.14 Establish upper limit of the neutron flux level for all zero power physics measurements as per Appendix A.

5.15 Perform a checkout of the reactivity computer as per Appendix B.

5.16 Boron Endpoint Measurement

NOTE: Retain boron endpoint samples until released by the test supervisor.

5.16.1 Withdraw RCC (Bank D) as much as possible by boration.

5.16.2 Stabilize system boron and obtain RCS and pressurizer boron is within ± 10 ppm of RCS boron.

5.16.3 Place reactivity computer in operation.

5.16.4 Withdraw rods to 228 steps to bring super critical.

5.16.5 Insert rods to just critical position.

5.16.6 Repeat steps 5.16.4 and 5.16.5 two more times.

5.16.7 Obtain RCS boron sample.

5.16 Establish the initial RCC configuration required for the next step of the startup sequence or maintain normal plant operation at the existing power level as directed.

6.0 ACCEPTANCE CRITERIA

6.1 Initial criticality is achieved.

6.2 Critical Boron all rods out is 1456 ± 50 ppm. (Ref. 2.1).

6.3 Upper limit for neutron flux level for zero power physics measurements has been established.

Test Completed (Test Supervisor) ______________________
Signature/Date

Acceptance Criteria Met YES NO
(Circle One)

(Watch Supervisor) ______________________
Signature/Date

(Reactor Analyst) ______________________
Signature/Date

Comments:

APPENDIX A

Upper Limit of Neutron Flux For Zero Power Physics Measurements

A.1 Initial Conditions

The initial conditons for this test are that the flux level and control bank D position are those as established in step 5.12. Steady state conditions as specified in step 5.12. Steady state conditions as specified in step 5.13.

A.2 On request of the test supervisor, withdraw control bank D until either control bank D is at 228 steps or a positive reactivity insertion of approximately 40 to 60 pcm occurs, whichever occurs first. (The SUR will be less than 0.3 DPM).

A.3 On achieving super criticality, allow the flux level (indicated on the reactivity computer) to increase until the test supervisor determines that nuclear heating has begun to affect the indicated reactivity signal. Nuclear heating will be observed as an exponential decay of the reactivity trace.

A.4 On request of the test supervisor insert control bank D to the just critical position. Record the reactivity computer flux signal and the response of the intermediate range channels.

A.5 Establish a just critical configuration at a lower flux level by adjustment of control bank D. Repeat steps A.2 through A.4 until the upper flux limit for nuclear heating is established. Record in step 5.14.

A.6 Adjust control bank D until the reactor is just critical at a flux level which is within a decade below the flux limit determined in step A.5. This decade defines the range for all zero power physics testing with the exception of the M/D maps.

APPENDIX B

Operational Checkout of Reactivity Computer

B.1 Precautions

This test must be performed at a flux level below that at which nuclear heating effects are observed. The startup rate shall be limited to less than 1 DPM.

B.2 Initial Conditions

The initial conditions for this test are that the control bank D position is that established in step 5.12, steady state conditions as specified in step 5.13, and zero power flux level as established in step A.6 of Appendix A. The flux level should be at the low end of the decade prior to each reactivity insertion to allow for the resulting flux increase. This should be no lower than 2 on the reactivity computer flux signal.

B.3 Instructions

B.3.1 On request from the test supervisor, withdraw control bank D until a reactivity gain at approximately 25 pcm (0.11 DPM) is indicated by the reactivity computer. The test supervisor will determine the amount of reactivity increase from the reactivity computer and the corresponding rate of change of flux level.

B.3.2 On request of the test supervisor insert control bank D to below the starting position in order to reduce the flux level to that established as the initial condition. When this level is reached, obtain a just critical condition.

B.3.3 Repeat steps B.3.1 and B.3.2 for reactivity insertions of approximately 50 pcm (0.24 DPM) and 75 pcm (0.40 DPM). Those values of reactivity insertion may be reduced if there is an insufficient amount of rod worth available.

B.3.4 The test supervisor will convert the rate of change of flux level or doubling time to reactivity. This will be compared with the corresponding reactivity insertion as obtained by the reactivity computer.

LOG OF BORON CONCENTRATION

Page _____ of _____

		INTEGRATOR HEADINGS		PPM NATURAL BORON		
DATE	TIME	BORIC ACID	WATER	RCS	PRESS	COMMENTS

ICRR DATA SHEET

DATE: ______________________

BASE COUNT RATES: N-31 __________ CPM, N32 ______________ CPM

Page ____ of ____

TIME	BANK POSITIONS (STEPS)								COUNT RATE (CPM)		ICRR		PRIMARY WATER INTEGRATOR (GAL)	COMMENTS
	SA	SB	SC	SD	CA	CB	CC	CD	N-31	N-32	N-31	N-32		

DATA SHEET

BORON ENDPOINT MEASUREMENTS

RCC Positions:

DATE: ____________________ Control Bank D ______________

TIME: ____________________ Control Bank C ______________

Control Bank B ______________

	Initial	Final
RCS Boron	______	______
Pressurizer Boron	______	______

	Initial Bank Position	Final Bank Position	$\Delta\rho$
1			
2			
3			
4			
4			
6			

POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT NO. 3 NUCLEAR POWER PLANT

RA-3 Rev. 0

ISOTHERMAL TEMPERATURE COEFFICIENT

PRELIMINARY

Written by: N. Passman

Reviewed by: ______

PORC Review ______ Date ______

Approved by: ______ Date ______

Effective Date ______

1.0 PURPOSE

1.1 To determine the isothermal temperature coefficient of reactivity.

2.0 REFERENCES

2.1 Nuclear Design Report, WCAP-9244.

2.2 PEP-NI-1

3.0 PRECAUTIONS AND LIMITATIONS

3.1 The startup rate is administratively limited to 1 DPM (Decade Per Minute).

3.2 RCS water/boric acid makeup should be avoided during the performance of this test.

4.0 INITIAL CONDITIONS

4.1 Reactor Coolant System (RCS) pressure at 2235 ± 50 psig. During the test maintain RCS pressure within ± 25 psig of established pressure.

4.2 RCS temperature at 547^{+0}_{-3} °F or 542 ± 2°F.

4.3 The reactor is just critical with the control rod configuration as specified in the acceptance criteria, Section 6.0.

4.4 Control of the RCS temperature is established via secondary steam bypass to the condenser or steam dump to the atmosphere.

4.5 Pressurizer spray control on manual, with spray flow established at the maximum rate consistent with pressurizer heater capacity.

4.6 Low power range trip point set at ≤ 25% of full power.

4.7 RCC control selector on bank control.

4.8 The flux signal to the reactivity computer will be taken from the individual top and bottom detectors of one power range channel.

The affected channel has been placed in the trip condition in accordance with Reference 2.2 (Instrument fuses left in place to maintain power on channel).

4.9 All reactor coolant pumps must be operating.

4.10 An "X-Y" recorder is available for these measurements. The reactivity computer output and average Tave signals should be connected to the "X-Y" recorder.

4.11 The pressurizer boron concentration is within ± 10 ppm of the RCS boron concentration.

5.0 INSTRUCTIONS

5.1 Obtain a sample of the reactor coolant system boron concentration immediately before the temperature swing and immediately after the temperature swing.

5.2 If the RCS temperature is at the lower portion of the temperature range:

5.2.1 Adjust the flux level by movement of the controlling bank to the higher level of the reactivity computer scale in anticipation of the expected flux change during heatup.

5.2.2 On request of the test supervisor, establish a RCS heatup rate of approximately 10°F/hr via the secondary system steam dump control.

5.2.3 When the moderator temperature has increased approximately 5°F or has reached 547°F whichever occurs first, establish a cooldown rate of approximately 10°F/hr until the temperature has decreased approximately 5°F.

5.3 If the RCS temperature is initially at the higher portion of the temperature range:

5.3.1 Adjust the flux level by movement of the controlling bank to the lower level of the reactivity computer scale in anticipation of the expected flux change during cooldown.

5.3.2 On request of the test supervisor, establish a RCS cooldown rate of approximately 10°F/hr until the temperature has decreased approximately 5°F.

5.3 If the RCS temperature is initially at the higher portion of the temperature range:

5.3.1 Adjust the flux level by movement of the controlling bank to the lower level of the reactivity computer scale in anticipation of the expected flux change during cooldown.

5.3.2 On request of the test supervisor, establish a RCS cooldown rate of approximately 10°F/hr until the temperature has decreased approximately 5°F.

5.3 If the RCS temperature is initially at the higher portion of the temperature range:

5.3.1 Adjust the flux level by movement of the controlling bank to the lower level of the reactor cavity computer scale in anticipation of the expected flux change during cooldown.

5.3.2 On request of the test supervisor, establish a RCS cooldown rate of approximately 10°F/hr via the secondary system steam dump control.

5.3.3 When the moderator temperature has decreased approximately 5°F, establish a heatup rate of approximately 10°F/hr until the temperature has increased approximately 5°F.

5.4 The test supervisor will monitor flux and reactivity response via the reactivity computer and may request periodic control bank movement in order to maintain acceptable flux levels.

5.5 Steps 5.2.2 and 5.2.3 or 5.3.2 and 5.3.3 may be repeated depending on the assessment by the test supervisor regarding the quality of data obtained.

5.6 Record the information given in Attachment 1 on the X-Y recorder graph.

5.7 When measurements are complete, maintain a just critical control bank position and a constant temperature when the temperature is in the range 547 + 0°F, -5°F.

5.8 The test supervisor will have available an X-Y recorder, and will record reactivity versus temperature during the heatup and cooldown. Over this temperature change, the plot of reactivity versus temperature is approximately linear. The temperature co-efficient will be determined by the slope of the curve (i.e, $\Delta p/\Delta T$). Record data as follows:

	RC TEMPERATURE		REACTIVITY			
TIME/DATE	BEFORE	AFTER	BEFORE	AFTER	$\Delta p/T$	C_B

6.0 ACCEPTANCE CRITERIA

6.1 All Rods Out Condition;

Isothermal Temperature Coefficient = +0.10 ± 3 pcm/^{o}F at 1456 ppm critical boron for HZP, Bol & ARO Condition) Ref. 2.1.

6.2 Control Bank D at 0 step, all other banks at 228 steps.

Isothermal Temperature Coefficient = -0.85 ± 3 pcm/^{o}F at 1372 ppm (critical boron for HZP, BoL & Control Bank D In Condition) Ref. 2.1.

6.3 Control Banks D and C at 0 step, all other banks at 228 steps.

Isothermal Temperature Coefficient =-2.02 ± 3 pcm/^{o}F at 1269 ppm (critical boron for BoL, BZP and Control Banks D & C In Condition) Ref. 2.1.

Test Completed (Test Supervisor) ______________________
Signature/Date

Acceptance Criteria Met YES NO
(Circle One)

(Watch Supervisor) ______________________
Signature/Date

(Reactor Analyst) ______________________
Signature/Date

Comments:

ATTACHMENT 1

Record the following information on the X-Y recorder graph.

(1) Data and Time

(2) Procedure No.

(3) Control Rod Position

(4) Critical Boron Concentration

(5) Scale (Moderator Temperature vs. Reactivity)

(6) Whether the line is a cooldown or heatup curve.

(7) Initials of Test Supervisor

LOG OF BORON CONCENTRATION

Page _____ of _____

		INTEGRATOR HEADINGS		PPM NATURAL BORON		
DATE	TIME	BORIC ACID	WATER	RCS	PRESS	COMMENTS

POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT NO. 3 NUCLEAR POWER PLANT

RA-4 Rev. 0

CONTROL ROD WORTH MEASUREMENT

PRELIMINARY

Written by: N. Passman

Reviewed by: ______________________

PORC Review ______________________ Date __________

Approved by: ______________________ Date __________

Effective Date ______________________

1.0 PURPOSE

1.1 To determine the differential and integral worth of the controlling RCC bank.

The minimum requirements for the rod worth determination are the following bank worths:

1.1.1 Control Bank D worth, all other banks out.

1.1.2 Control Bank C worth, with Control Bank D at 0 step, all other banks out.

1.1.3 Control Banks D,C (Bank overlap configuration).

1.2 To determine the differential boron worth over the range of the controlling RCC bank.

2.0 REFERENCE

2.1 Nuclear Design Report, WCAP 9244.

2.2 PEP-NI-1

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Administratively limit the startup rate to 1 decade per minute.

4.0 INITIAL CONDITIONS

4.1 Reactor Coolant system pressure at 2235 ± 50 psig. Maintain RCS pressure within ± 25 psig of established pressure during the test.

4.2 Reactor Coolant System temperature at 547 +0 F.
5

4.3 Control of the Reactor Coolant System temperature is established via secondary steam bypass to the condenser or steam dump to the atmosphere.

4.4 Pressurizer spray control on manual, with spray flow established at the maximum rate consistent with pressurizer heater capacity.

4.5 Low power range trip point set at - 25% of full power.

4.6 The reactor is just critical at zero power with the neutron flux in the range established for zero power physics tests.

4.7 RCC control selector on bank control.

4.8 All four reactor coolant pumps are in operation.

4.9 The flux signal to the reactivity computer will be taken from the individual top and bottom detectors of one power range channel.

The affected channel has been placed in the trip condition in accordance with Reference 2.2 (Instrument fuses left in place to maintain power on channel).

Both the flux and reactivity response should be input to a two pen Mosely strip chart recorder or equivalent. The Tavg signal should be input to a second Mosely strip chart recorder or equivalent.

4.10 All rods are fully withdrawn except Control Bank D which is positioned above 215 steps and controlling the neutron flux.

5.0 INSTRUCTIONS

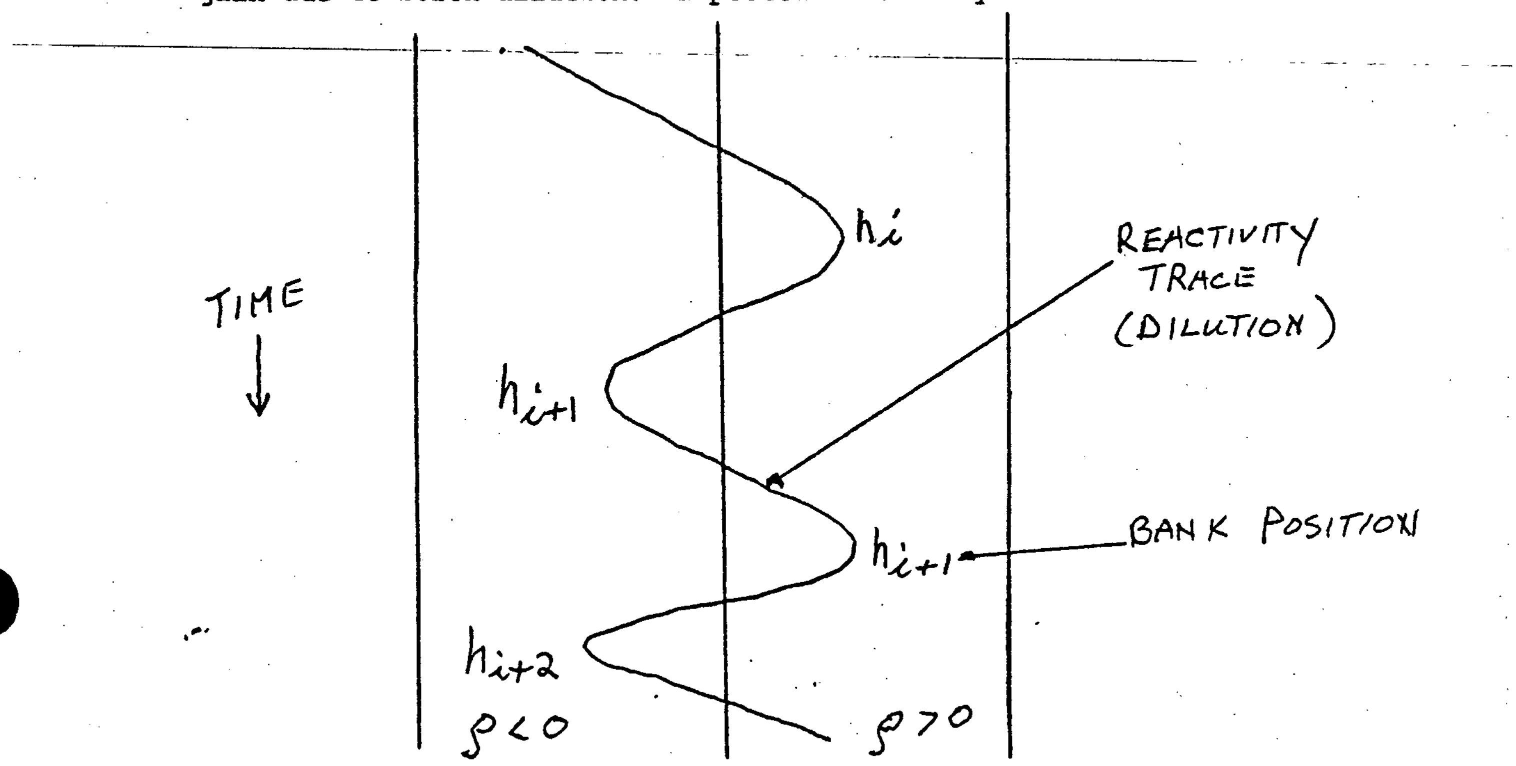
5.1 Samples of pressurizer should be taken at 60 minute intervals and RCS Hot Leg should be taken at approximate 20 minute intervals for boron analysis and the results recorded on Data Sheet 1 as soon as they are available. For boron end point measurements this sample rate should be continued after dilution until the Reactor Coolant System is adequately mixed, approximately 30 minutes, and the samples are representative of the RCS soluble Boron Concentration.

Each sample for boron end-point measurements will be identified as to time, date and sampie point. Sample analysis results will be logged, and will include this information as part of the log entry.

5.2 Establish boron dilution (boration) at rate requested by test supervisor.

NOTE: Boron addition and concurrent rod withdrawal may be used as an alternate during worth measurement.

5.3 On request from the test supervisor, insert (withdraw) the controlling RCC bank the requested number of steps. The test supervisor will monitor, via the reactivity computer, flux and reactivity response, and will request periodic control bank insertion in order to compensate for the reactivity gain due to boron dilution. Expected reactivity trace:



5.4 Terminate the dilution (boration) on request by the test supervisor.

5.5 Boron End Point Measurement

NOTE: Retain boron endpoint samples until released by the test supervisor.

5.5.1 Insert (withdraw) the controlling bank as much as possible by dilution (boration).

5.5.2 Stabilize system boron and obtain RCS and pressurizer boron samples (Verify pressurizer boron is within ± 10 ppm or RCS boron).

5.5.3 Insert (withdraw) the controlling bank to the fully inserted (withdrawn) position.

5.5.4 Return the controlling bank to the just critical position.

5.5.5 Repeat steps 5.5.3 and 5.5.4 two more times.

5.5.6 Obtain RCS boron sample.

6.0 <u>ACCEPTANCE CRITERIA</u>

6.1 Integral Rod worth of each bank is ± 15% of design value (Referenced 2.1).

Control Bank "D" Design - 790 pcm
Control Bank "C" Design - 980 pcm

6.2 The sum of the worth of D and C control banks is ± 10% of the design value (Reference 2.1).

Sum of control banks D and C design - 1770 pcm

6.3 Differential boron worth is within ± 15% of design value for HZP, no xenon, BOL (Reference 2.1).

Test Completed (Test Supervisor) ______________________
Signature/Date

Acceptance Criteria Met YES NO
(Circle One)

(Watch Supervisor) ______________________
Signature/Date

(Reactor Analyst) ______________________
Signature/Date

Comments:

LOG OF BORON CONCENTRATION

Page _____ of _____

DATE	TIME	INTEGRATOR HEADINGS		PPM NATURAL BORON		COMMENTS
		BORIC ACID	WATER	RCS	PRESS	

POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT NO. 3 NUCLEAR POWER PLANT

R.A.-5 Rev. 0

MINIMUM SHUTDOWN MARGIN VERIFICATION

PRELIMINARY

Written by: N. Passman

Reviewed by: ____________________

PORC Review ____________________ Date ________

Approved by: ____________________ Date ________

Effective Date ____________________

1.0 PURPOSE

1.1 To establish minimum shutdown boron with the most reactive RCC unit fully withdrawn and all other full length RCC units fully inserted.

2.0 REFERENCE

2.1 Nuclear Design Report (WCAP 9244).
2.2 PEP-NI-1
2.3 PEP-CVCS-3

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Administratively limit the startup rate to 1 decade per minute.

3.2 Do not dilute past the all rods in minus most reactive rod configuration. Exercise caution when diluting to near this configuration.

3.3 Any operation which produces a sudden change in reactor coolant temperature or sudden redution in boron concentration must be avoided during this test.

3.4 Be prepared to add, if needed, 12% boric acid directly to the charging pump suction manifold in accordance with Reference 2.3.

3.5 The Technical Specification requirements for the Chemical and Volume Control System (Section 3.2) have been met.

3.6 All four reactor coolant pumps are in operation.

4.0 INITIAL CONDITIONS

4.1 Reactor coolant system pressure at 2235 ± 50 psig. Maintain RCS pressure with ± 25 psig of established pressure during the test.

4.2 Reactor coolant system temperature at 547 $^{+0}_{-5}$ °F.

4.3 The reactor is just critical at zero power with the flux level in the range established for zero power physics tests. The control banks A,B,C, and D are fully inserted. The shutdown banks A,B,C, and D are fully withdrawn.

4.4 Control of the reactor coolant system temperature is established via secondary by-pass to the condenser or steam dump to the atmosphere.

4.5 Pressurizer spray control on manual, with spray flow established at the maximum rate consistent with pressurizer heater capacity.

4.6 Low power range trip point set at ≤ 25% of the full power.

4.7 RCC control selector on bank control.

4.8 The flux signal to the reactivity computer will be taken from the individual top and bottom detectors of one power range channel.

The affected channel has been placed in the trip condition in accordance with Reference 2.2 (Instrument fuses left in place to maintain power on the channel). Both the flux and reactivity response should be input to a two pen Mosely strip chart recorder or equivalent.

4.9 Tave will be connected to a second strip chart recorder.

5.0 INSTRUCTIONS

5.1 Boration Path Verification

5.1.1 Secure both boric acid pumps.

5.1.2 Momentarily open the Emergency Boration M.O. Valve (333), verify valves open and immediately reclose. Verify the Emergency Boration Valve is closed.

Valve Opens YES NO Time _____ Date _____

Valve Reclosed YES NO Time _____ Date _____

5.1.3 Place the desired boric acid pumps back in service.

5.1.4 Obtain sample of the reactor coolant system to determine the RCS boron concentration.

RCS Boron _______ ppm

Time _______ Date _______

Initial Control Bank Position ____________________

5.1.5 Notify test supervisor and Watch Supervisor that the RCS boron concentration will be increasing.

5.1.6 Initiate normal boration at maximum rate and add 20 gals. of boric acid.

Initiation Time ____________________ Date ________________

5.1.7 During the after boron addition look for decrease in reactivity. If the reactor is critical maintain criticality by withdrawing appropraite control bank as required.

5.1.8 Terminate the boric acid addition as soon as 20 gals. of boric acid have been added and flush the piping.

Termination Time ________________ Date ____________________

5.1.9 Allow the boron concentration to mix and then sample the RCS for boron concentration.

RCS Boron ____________ ppm

Time ________________ Date _______________

Final Control Bank Position ______________________________

5.1.10 If the normal and emergency boration paths have been shown to be operable, continue with Step 5.2.

5.2 Minimum Shutdown Verification and Endpoint Measurements

5.2.1 Samples of pressurizer should be taken at approximately 60 minutes intervals and RCS Hot Leg should be obtained at approximately 20 minute intervals for boron analysis during this measurement.

5.2.2 Initiate boron dilution by injection of primary water into the reactor coolant system at approximately 40 GPM. Using the boric acid mode selector switch, select Manual makeup, and a dial setpoint of "O" gpm (valve fully closed, no flow) on the boric acid flow control valve, FCV-110A.

NOTE: Closely monitor VCT level since in this manually initiated mode nothing will automatically stop blended makeup on high VCT level. Ensure that Diversion valve LCV-112A diverts on High VCT level. Makeup may be stopped by moving the makeup control switch to STOP.

5.2.3 Compensate for dilution by insertion of shutdown bank D. The test supervisor will monitor the flux and reactivity response via the reactivity computer and recommend shutdown bank movements.

5.2.4 Repeat steps 5.2.2 through 5.2.3 for shutdown banks C and B, using the normal insertion sequence. The final rod configuration after step 5.2.4 will be:

a. All banks fully inserted with the exception of shutdown bank B near the fully inserted position and shutdown bank A withdrawn.

or

b. All banks fully inserted with the exception of shutdown bank A
near the fully withdrawn position.

5.2.5 Disconnect all the lift coils on control bank C with the exception of RCC unit N-13.

5.2.6 Commence withdrawal of RCC unit N-13 compensating for the reactivity gain by inserting shutdown bank B (if not fully inserted) and shutdown bank A until N-13 is fully withdrawn.

NOTE: If RCCA N-13 if not fully withdrawn when shutdown Bank A is near fully inserted, borate until N-13 is fully withdrawn.

5.2.7 If Shutdown Bank A is not sufficiently near the fully inserted position to perform a reasonable boron endpoint, adjust the boron concentration observing Precaution 3.4.

6.0 ACCEPTANCE CRITERIA

6.1 Expected value of critical boron of N-1 is 874 ± 100 ppm (Ref. 2.1).

Test Completed (Test Supervisor) ______________________
Signature/Date

Acceptance Criteria Met YES NO
(Circle One)

(Watch Supervisor) ______________________
Signature/Date

(Reactor Analyst) ______________________
Signature/Date

Comments:

LOG OF BORON CONCENTRATION

Page _____ of _____

DATE	TIME	INTEGRATOR HEADINGS		PPM NATURAL BORON		COMMENTS
		BORIC ACID	WATER	RCS	PRESS	

POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT NO. 3 NUCLEAR POWER PLANT

R.A.-6 Rev. 0

POWER COEFFICIENT MEASUREMENT

PRELIMINARY

Written by: N. Passman

Reviewed by: __________

PORC Review __________ Date __________

Approved by: __________ Date __________

Effective Date __________

1.0 PURPOSE

1.1 To measure the differential power coefficient of reactivity and to obtain the integral power defect.

2.0 REFERENCES

2.1 Nuclear Design Report, WCAP 9244

2.2 SOP-RPC-6

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Avoid primary system makeup during the power change, or any other action which has the potential of changing the RCS boron concentration.

3.2 Observe overpower ΔT setpoint closely while control rods are inserted. When difference between overpower ΔT and actual ΔT becomes less than 3°F, pull rods out to reduce negative delta-flux.

4.0 INITIAL CONDITIONS

4.1 The plant is stable load at a power level of 90%.

4.2 RCC selector on manual control.

4.3 RCC banks positioned for the anticipated load change.

4.4 Control of subsystems which affect overall plant transient response should whenever possible be left in automatic (pressurizer level, steam generator level and steam dump).

4.5 The flux signal to the reactivity computer will be taken from the sum of all four power range channels through the isolation amplifiers. Both the ΔT and reactivity response should input to a two pen Mosely Strip chart recorder. The Tavg signal and Tref should input to a second Mosely strip chart recorder.

4.6 Boron concentration in Reactor Coolant Loop and Pressurizer is within 10 ppm boron.

4.7 Stable xenon is achieved prior to power change.

4.8 P-250 trend block is set up according to attachment 1.

4.9 P-250 Thermal Output (U1109 or U1118) is displayed on P-250 Console (Use digital display).

5.0 INSTRUCTIONS

5.1 Establish a reactor coolant sampling program from chemical data (boron concentration Data Sheet 1). Samples of RCS Coolant and Pressurizer should be obtained at the following intervals:

1) Prior to reducing power

2) At the new lower power level

3) Prior to increasing power

4) At the original power level

5.2 Obtain calorimetric data (as per Reference 2.2) and plant channel detector currents prior to the start of the power change.

5.3 Change the generator electrical load at a steady rate of approximately 1% per minute. Adjust the reactor power manually (via Tavg) to match the generator load (Tref) by moving the controlling RCC banks. Reactivity changes must be anticipated and recorded for each rod movement. The reactor operator must inform the Test Supervisor prior to moving the RCC bank so that the Test Supervisor can increase the recorder speed. It is necessary to record bank movement on very fast recorder speeds (0.2 inches per second) because of the nature of the feedback mechanisms effecting the reactivity. Mark the recorder chart as to changes in speed and time changes were made.

5.4 Move the controlling bank as required to maintain the desired Tavg. This is accomplished by adjusting the bank position in order to keep Tavg on or close to Tref.

5.5 During the power change, the ΔT, reactivity, Tavg and Tref will be continuously recorded. The power change will be halted and the MWe, ΔT, excore detector currents, % power, bank position and steam generator calorimetric data will be recorded at intervals of approximately 10% power. Also record time, rod position, thermal output periodically on both the charts.

5.6 Continue steps 5.1, 5.2, 5.3, 5.4, and 5.5 until the reactor has achieved the desired power levels.

5.7 Note and record scale factors, chart speeds, settings, etc., on both recorders. Frequent time checks should be noted on both recorders to aid in subsequent correlation of events.

5.8 The test Supervisor will determine the power coefficient of reactivity from ratios of $(\Delta p/\Delta T) / (\Delta Q/\Delta T)$.

6.0 ACCEPTANCE VALUE

Measured Power Coefficient is within ± 2 pcm/% power of predicted power coefficient values derived from Figure 5.7 from Reference 1.1.

Test Completed (Test Supervisor) ______________________
Signature/Date

Acceptance Criteria Met YES NO
(Circle One)

(Watch Supervisor) ______________________
Signature/Date

(Reactor Analyst) ______________________
Signature/Date

Comments:

ATTACHMENT 1

	TREND	1 Minute Interval
1.	U0311	Steam Header Pressure
2	T0496A	Tref
3.	T0499A	Tavg
4.	U0484	Tavg
5.	P0398A	1st State Turbine Pressure
6.	Q0340A	MWe Output
7.	U1169	NIS Power
8.	T0497A	ΔT
9.	U0485	ΔT
10.	U1163	Axial Tilt

DATA SHEET

_______ No. _______
Date _______
Location _______

Prepared by _______________

Subject

	Unit	Source								
Time		Drawer								
N-41										
Top	μa									
Bot	μa									
Q	μ%									
N-42										
Top	μa									
Bot	μa									
Q	%									
N-43										
Top	μa									
Bot	μa									
Q	%									
N-44										
Top	a									
Bot	a									
Q	%									
Loop 21		MCB								
Tave	°F									
Δ T	°F									
Loop 22										
Tave	°F									
Δ T	°F									
Loop 23										
Tave	°F									
Δ T	°F									
Loop 24										
Tave	°F									
Δ T	°F									
Δ Flux										
N41	%									
N42	%									
N43	%									
N44	%									
C/D	Step									
Mwe	Mwe									
Tave	°F	Recorder								
Tref	°F	Recorder								
U1118	MWt	P-250								

LOG OF BORON CONCENTRATION

Page _____ of _____

		INTEGRATOR HEADINGS		PPM NATURAL BORON		
DATE	TIME	BORIC ACID	WATER	RCS	PRESS	COMMENTS

POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT NO. 3 NUCLEAR POWER PLANT

R.A.-8 Rev. 0

PRIMARY AND SECONDARY PLANT PARAMETER MEASUREMENTS

PRELIMINARY

Written by: N. Passman

Reviewed by: ______________________

PORC Review ______________________ Date __________

Approved by: ______________________ Date __________

Effective Date ______________________

PURPOSE

1.1 To obtain plant operating data at various power levels.

2.0 REFERENCE

None

3.0 PRECAUTIONS AND LIMITATIONS

3.1 Keep primary and secondary plant conditions as constant as possible during this test.

4.0 INITIAL CONDITIONS

4.1 The plant has reached the steady state equilibrium condition (e.g., system temperature, pressure, and levels are steady for at least 30 minutes).

4.2 Bring Tave to within ± 5^{o}F of Tref. While the data are being collected, keep Tave within ± 1%F of Tref.

5.0 INSTRUCTION

5.1 At or about the power levels specified below, obtain parameters listed in the data sheet 1 through 5.

A - Hot shutdown

B - 35% power

C - 50% power

~~D - 60% power~~

E - 70% power

F - 80% power

G - 90% power

H - 100% power

6.0 ACCEPTANCE CRITERIA

6.1 This test is acceptable when all the data are collected.

Test Completed (Test Supervisor) ______________________
Signature/Date

Acceptance Criteria Met YES NO
(Circle One)

(Watch Supervisor) ______________________
Signature/Date

(Reactor Analyst) ______________________
Signature/Date

Comments:

IP ______________ OPERATING PLANT DATA

I & C GROUP DATA

DATE:
TIME: START TIME ________________ FINISH TIME ________________
Data Taken By;

MEASURING PARAMETERS	DATA SOURCE	UNITS	VALUE	COMMENTS
FW FLOW	TRANSDUCER			RACK NO.
Loop 21/31	FT418A	ma	______	A 3
	FT418B	ma	______	A 11
Loop 22/32	FT428A	ma	______	A 3
	FT428B	ma	______	A 10
Loop 23/33	FT438A	ma	______	A 2
	FT438B	ma	______	A 11
Loop 24/34	FT448A	ma	______	A 2
	FT448B	ma	______	A 10
FIRST STAGE TURB. PRESS.	TRANSDUCER			
	PT412A	ma	______	A 10
	PT412B	ma	______	A 1
STEAM HEADER PRESSURE	TRANSDUCER			
Loop 21/31	PT418A	ma	______	A 3
	PT419B	ma	______	A 11
	PT419C	ma	______	B 9
Loop 22/32	PT429A	ma	______	A 3
	PT429B	ma	______	A 10
	PT429C	ma	______	B 2
Loop 23/33	PT439A	ma	______	A 2
	PT439B	ma	______	A 11
	PT439C	ma	______	B 2
Loop 24/34	PT449A	ma	______	A 2
	PT449B	ma	______	A 10
	PT449C	ma	______	B 9

MEASURING PARAMETERS	DATA SOURCE	UNITS	VALUE	COMMENTS
STEAM FLOW	TRANSDUCER			
Loop 21/31	FT419A	ma		A 3
	FT419B			A 11
Loop 22/32	FT429A			A 3
	FT429B			A 10
Loop 23/33	FT439A			A 2
	FT439B			A 11
Loop 24/34	FT449A			A 2
	FT449B			A 10
REACTOR COOL. TEMPERATURES				
T_{hot} Loop 21/31	Foxb. TE-411A	V		A 4
22/32	TE-421A			A 12
23/33	TE-431A			B 3
24/34	TE-441A			B 10
T_{cold} Loop 21/31	Foxb. TE-411B	V		A 4
22/32	TE-421B			A 12
23/33	TE-431B			B 3
24/34	TE-441B			B 10
ΔT Loop 21/31	Foxb. TP-411F	V		A 4
22/32	TP-421F			A 12
23/33	TP-431F			B 3
24/34	TP-441F			B 10
T_{ave} Loop 21/31	Foxb. TP-412R	ma		A 4
22/32	TP-422R			A 12
23/33	TP-432R			B 3
24/34	TP-442R			B 10
Ave T_{ave}	Foxb. TM-412S	ma		D 10
Ave T	TM-411E			B 8

MEASURING PARAMETERS	DATA SOURCE	UNITS	VALUE	COMMENTS
RC FLOW	TRANSDUCER			
Loop 21/31	FC414		______	A 1
	FC415		______	A 9
	FC416		______	B 1
Loop 22/32	FC424		______	A 1
	FC425		______	A 9
	FC426	mV	______	B 1
Loop 23/33	FC434		______	A 1
	FC435		______	A 9
	FC436		______	B 1
Loop 24/34	FC444		______	A 1
	FC445		______	A 9
	FC446		______	B 1

OPERATING PLANT DATA

PERFORMANCE GROUP DATA

DATE

TIME: START TIME ______________ FINISH TIME ____________

Data Taken By:

MEASURING PARAMETERS	DATA SOURCE	UNITS	VALUE		COMMENTS
			RAW DATA AVG.	ZERO VALUE	
FW FLOW					
Loop 21/31	Barton		____	____	
22/32			____	____	
23/33			____	____	
24/34			____	____	
AMBIENT TEMP	THERMOMETER	°F	____		
			VALUE	COMMENTS	
FW TEMP 26 HEATER OUTLET (or #36) 26-A/36-A				REF JCN TEMP ________	
26-B/36-B	THERMOCOUPLE	mV	____	COMPENSATED? ___YES___	
26-C/36-C			____	THERMOCOUPLE TYPE ________	
W HEADER	THERMOMETER INDICATED TEMP				
	AMBIENT TEMP	°F	____		
	IMMERSION TEMP		____		
FIRST STATE TURB. PRESS	GAGE (TEST)	PSIG	____		
TURB INLET PRESS	GAGE (TEST)	PSIG	____		
STEAM HEADER PRESS. Loop 21/31			____		
22/32	LOCAL GAGE	PSIG	____		
23/33			____		
24/34			____		
TURB CONTROL OIL PRESS.	LOCAL GAGE	PSIG	____		

MEASURING PARAMETERS	DATA SOURCE	UNITS	VALUE	COMMENTS
MAIN BOILER FEED PUMPS				
21/#31				
DISCHARGE PRESS		PSIG	____	
SUCTION PRESS.	LOCAL GAGE		____	
SPEED		RPM	____	
22/#32				
DISCHARGE PRESS.		PSIG	____	
SUCTION PRESS	LOCAL GAGE		____	
FEED		RPM	____	
CONDENSER				
VACUUM		INCHES	____	
21/#31	HEISSE GAGE	Hg	____	
22/#32			____	
23/#33				
21/31		INCHES	____	
22/#32	LOCAL GAGE	Hg	____	
23/#33			____	
BAROMETER	GAGE		____	
AMBIENT TEMP	THERMOMETER			
GROSS MW OUTPUT CLOCKED	DISC	SEC/10REV		
TURB. GOV.	VALVE STEM			
VALUE POSITION	POSITION LIFT			
	21/31		____	
	22/32	INCH	____	
	23/33		____	
	24/34		____	

IP ________________ OPERATING PLANT DATA

NUCLEAR GROUP DATA

DATE:
TIME: START TIME ______________ FINISH TIME ______________
Data Taken By:

MEASURING PARAMETERS	DATA SOURCE	UNITS	VALUE	COMMENTS
TURB. CONTROL OIL PRESS.	MCB	PSIG	______	
MAIN BOILER FEED PUMPS DISCHARGE PRESS. SUCTION PRESS. #21 SPEED #22 SPEED	MCB	PSIG RPM	______ ______ ______ ______	
CONDENSER VACUUM #21 #22 #23	CONTROL CHART	IN. Hg	______ ______ ______	
GROSS MW OUTPUT	MCB	MWe	______	
~~T_{ave}~~ T_{ref}	MCB RECORDER	°F	______	
REACTOR COOL. TEMPERATURES T_{cold} Loop 21/31 22/32 23/33 24/34 T_{hot} Loop 31 32 33 34	WIDE RANGE RECORDER	°F	______ ______ ______	

MEASURING PARAMETERS	DATA SOURCE	UNITS	VALUE	COMMENTS
NI				
N-41	DRAWER TOP CURRENT	μa		
	BOT CURRENT	μa		
	% POWER	%		
N-42	DRAWER TOP CURRENT	μa		
	BOT CURRENT	μa		
	% POWER	%		
N-43	DRAWER TOP CURRENT	μa		
	BOT CURRENT	μa		
	% POWER	%		
N-44	DRAWER TOP CURRENT	μa		
	BOT CURRENT	μa		
	% POWER	%		
$\Delta\phi$				
N-41	MCB	%		
N-42				
N-43				
N-44				
CONTROL ROD	BANK D POSITION	STEPS		
SG Blowdown				
Loop 21/31	Blowdown Valve Position	TURNS		FLASH EVAPORATO IN SERVICE? Yes ___ No ___
22/32				HOGGER JETS IN SERVICE? Yes ___ No ___
23/33				
24/34				

IP ______________________ OPERATING PLANT DATA

NUCLEAR GROUP DATA

DATE:
TIME: START TIME __________ FINISH TIME __________
Data Taken By:

P-250 COMPUTER

U0411 ________	Q0340A ________	F0400A ________
U0431 ________	T0496A ________	F0401A ________
U0451 ________	U1118 ________	F0402A ________
U0471 ________	U1109 ________	F0420A ________
T0418A ________	T0406A ________	F0421A ________
T0438A ________	T0426A ________	F0422A ________
T0458A ________	T0446A ________	F0440A ________
T0478A ________	T0466A ________	F0441A ________
P0398A ________	T0403A ________	F0442A ________
P0399A ________	T0423A ________	F0460A ________
U0414 ________	T0443A ________	F0461A ________
U0434 ________	T0463A ________	F0462A ________
U0454 ________	T0400A ________	N0049A ________
U0474 ________	T0420A ________	N0050A ________
U0311 ________	T0440A ________	N0051A ________
U0413 ________	T0460A ________	N0052A ________
U0433 ________	T0499A ________	U1169 ________
U0453 ________	T0497A ________	
U0473 ________		
P0300A ________		
U 0482 ________		
U 0052 ________		
P0403A ________		
P0423A ________		
P0443A ________		
P0463A ________		

POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT NO. 3 NUCLEAR POWER PLANT
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TELEPHONE: 914-739-8200

AP-25.4-2 Rev. 0

POWER DISTRIBUTION AND HOT CHANNEL FACTOR DETERMINATION

Written by

Reviewed by

PORC Review 2/16/7_ Date

Approved by 2/16/7_ Date

Upon Receipt of Operating License
Effective Date

1.0 PURPOSE

To describe the preparations and procedures required in the determination of power distribution and hot channel factors by means of the movable incore detector system and the Prodac 250 Computer.

2.0 DISCUSSION

Following initial core loading, subsequent reloading and at regular effective full power monthly intervals thereafter, power distribution maps, using the movable detector system, shall be made to confirm that the hot channel factor limits of Technical Specification 3.10 are satisfied.

3.0 PROCEDURE

A. References

1. Technical Specifications Sections 3.10, 3.11.
2. SOP-NI-2
3. P-250 Operator's Console Reference Manual.

B. INITIAL CONDITIONS

1. The movable incore detector system is operational.
2. RCC selector is on manual bank control.
3. Tave is within ± 1 F of Tref.
4. Equilibrium xenon has been established at the desired reactor power level.
5. Part length rods are the fully withdrawn position.
6. The strip chart recorder potentiometer is set at 2.0 for high power flux maps to avoid unnecessary ranging of the strip chart output.

C. INSTRUCTIONS

1. Prepare the Prodac 250 for data collection.

a. Verify the values of the following constants:

K0900 = 0	(Flux Map Pass Number)
K0904 = 23	(Output Device)
K0905 = 5	(Scan Delay Time)
K0906 = 1000	(Deviation Limit)
K5510 = 1	(Tape Output Code 1 - ASCI 1)
K5002 = 1	(Incore TC Program)

NOTE: Conditions may warrant the use of other constants (e.g. different pass number, different output device, etc.). This is to be left up to the discretion of the operator. Values given are the Normal values used, but not necessarily the only values possible for successful completion of this procedure.

Procedure
Print Value
(K0900) or as appropriate
Address
Start

b. If any constant is not as specified, enter the correct value as follows:

Procedure
Enter Value
(K0900) or as appropriate
Address
(Correct Value)
Value 1
Start

c. Verify that enough tape and computer paper are available for data collection.

d. Set up the trend typewriter to collect heat balance data at ten minute intervals.

NOTE: Ascertain on which trend block the requied data are entered.

Procedure
Digital Trend
(Desired Block Number)
Value 1
10 (Time in minutes)
Value 3
Start

e. Obtain a short form TC Map on the programmers typewriter and tape as follows:

Procedure	Incore TC Map
	0
	Value 1
	23
	Value 2
	1
	Value 3
	Start

f. Upon completion of the TC Map printout on the programmer's typewriter and tape, disable the Incore TC Program as follows:

Procedure	Enter Value
	K5002
	Address
	0
	Value 1
	Start

2. Obtain a full core flux map in accordance with the instructions contained in SOP-NI-2. Record all data required by Attachments A and B.

NOTE: If practical, incore data for all 50 separate paths should be obtained during the performance of this procedure. At least 38 separate paths (75%) should be obtained for analysis of hot channel factors. If conditions (e.g., inoperable drives, etc.) preclude obtaining particular paths, an attempt should be made to obtain the required data using another means (emergency mode, common mode, etc). The exact number of paths obtained is left to the discretion of the personnel performing the operation, and must be weighed against such factors as possible changing plant conditions and the time required to take the additional data. Should less than 38 separate paths be available, contact the Reactor Analyst further for guidance and proceed as directed.

3. At the completion of the programmer's typewriter and tape printout, request an additional tape output as follows:

Procedure	Enter Value
	K0904
	Address
	30
	Value 1
	Start
	Incore Movable Detector Data
	1
	Value 1
	Start

4. At the completion of the tape output, request a summary map as follows:

NOTE: This is desireable but not mandatory.

Procedure	Enter Value
	K0904
	Address
	20
	Value 1
	Start
	Incore Movable Detector Data
	21
	Value 1
	Start

5. Collect all data obtained:

   a. Trend Typewriter output
   b. Programmer's Typewriter output
   c. Tapes
   d. Data sheets
   e. Flux traces
   f. Heat balance data (if obtained)

6. Restore trend blocks to intervals prior to flux mapping procedure. (Refer to step C.1.d).

7. Enable the Incore TC program as follows:

Procedure	Enter Value
	K5002
	Address
	1
	Value 1
	Start

8. Transmit one copy of all data obtained to Reactor Analyst for evaluation and determination of hot channel factors.

   NOTE: Any of the following (tape output, computer printout, or flux traces) May be used to satisfy the requirements of Tech. Spec. 3.10, if incore system conditions preclude obtaining all three. Thermocouple maps and heat balance data are desireable, but not required to perform the required analysis.

D. ACCEPTANCE CRITERIA

1. This test is considered acceptable when all the data necessary to determine power distribution and hot channel factors have been obtained.

ATTACHMENT A

FLUX MAP DATA SHEET A

Map No. ____________ Shutdown Bank Positions: A ______ B ______ C ______ D ______

Date ____________ Control Bank Positions: A ______ B ______ C ______ D ______ P/L ______

Power ____________

Pass	Time	Thimble Identification						Scale						Comments
		A	B	C	D	E	F	A	B	C	D	E	F	
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														

Detector	A	B	C	D	E	F
Potentiometer Setting						
Detector Voltage						

ATTACHMENT B

EXCORE DETECTOR DATA

te ____________________ Shutdown Bank Positions: A ______ B ______ C ______ D ______

wer ____________ MWe Control Bank Positions: A ______ B ______ C ______ D ______ P/L

ron Cont. ________ Initial ______ Final

Page _____ of _____

	RCC	N-41			N-42			N-43			N-44			DELTA FLUX			
ass	POS	TOP	BOT	PWR	TOP	BOT	PWR	TOP	BOT	PWR	TOP	BOT	PWR	41	42	43	44
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
0																	
1																	
2																	
3																	
4																	
5																	
6																	

POWER AUTHORITY OF THE STATE OF NEW YORK
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AP-25.4-3 Rev. 0

INCORE-EXCORE DETECTOR CALIBRATION

Written by: [signature]

Reviewed by: [signature]

PORC Review: [signature] 2/16/78 Date

Approved by: [signature] 2/16/[illegible] Date

Upon Receipt of Operating License
Effective Date

Incore-Excore Detector Calibration

1.0 PURPOSE

A. To obtain the relationship between excore and incore axial offset.

B. To determine the full power currents for top and bottom excore detectors.

2.0 DISCUSSION

This procedure should be performed at the beginning of each cycle, and whenever the results of a monthly flux map indicates a 2 percent or greater discrepancy between incore and excore axial offset valves.

3.0 PROCEDURE

A. REFERENCES

1. Technical Specifications, Section 3.11 and Table 4.1-1

2. PC-M1, Power Range Channels Axial Offset Calibration.

B. PRECAUTIONS AND LIMITATIONS

1. Except during physics tests, during excore calibration procedures and except as modified by Section 3.10 of the Technical Specifications, the indicated axial flux difference shall be maintained within a ± 5% band about the target flux difference (defines the band on axial flux difference).

2. The indicated axial flux difference may not exceed an envelope bounded by -11 percent and +11 percent at 90% power and increasing by -1 percent and +1 percent for each 2 percent of rated power below 90% power.

3. A minimum of two thimbles per quadrant and sufficient movable in-core detectors shall be operable during recalibration of the excore axial offset detection system.

4. Monitor Delta-T setpoints during the xenon oscillation and insure that sufficient margin exists between the actual Delta-T and the Delta-T setpoint for turbine runback.

C. INITIAL CONDITIONS

1. Equilibrium xenon has been established at a reactor power level between 70% and 90%.

2. RCC selector on manual bank control.

3. Control Bank D is positioned above 210 steps (215-220 steps is the preferred position).

4. Part-length rods are at the fully withdrawn position.

5. The incore moveable detector system is operational.

D. INSTRUCTIONS

1. Establish the conditions as specified in Section C.

2. Obtain a full core flux map and complete the following:

   a) Flux map and flux map data. (Use Attachments A & B)

   b) Excore data, average Delta T, average Tavg and computer thermal output data. (Use Attachment B and P-250 Trend Output)

   c) Incore thermocouple map.

   d) Calorimetric data on P-250 trend block during or reasonably close to the time of the map.

   e) Reactor coolant system boron samples during or reasonably close to the time of the map.

3. When the required data has been obtained, initiate RCS boron dilution and compensate for the reactivity addition by insertion of Control Bank D.

4. Stop the insertion of Control Bank D before the indicated axial flux difference reaches the Technical Specification envelope limit, or the actual Delta-T approaches the turbine runback setpoint. Maintain delta-flux approximately constant by maneuvering Control Bank D via boration/dilution.

5. Keep this condition for approximately 2 to 5 hours until xenon is built up in the upper half of the core.

6. Initiate RCS boration and compensate for the reactivity loss by withdrawal of Control Bank D.

7. Stop borating such that a mixed RCS boron concentration is achieved with Control Bank D at its initial position.

8. Maintain Control Bank D at approximately this position until completion of data collection. Compensate for reactivity changes by adjusting RCS boron. Maintain temperature and power as constant as practical. (If possible, maintain reactor power within ± 1% of desired and Tavg within ± 1 F of Tref).

9. Obtain Quarter Core Flux Map (QCFM) at intervals determined by the Reactor Analyst. The attached Table I lists suggested thimbles and passes. These may be rearranged, deleted or alternate thimbles substituted if conditions require.

10. Maintain a plot of axial flux difference vs. time. (See sample plot) Near the first positive peak of the oscillation, obtain a full core map (See Step D.2).

11. At the negative peak of oscillation, obtain a full core map. (See Step D.2).

12. When sufficient data has been collected, suppress the xenon oscillation by inserting control bank D near the positive peak in accordance with plant operating procedures.

13. Transmit one copy of all required data to the Reactor Analyst for analysis.

E. ACCEPTANCE CRITERIA

This test is considered acceptable when all the data necessary to determine the parameters listed in Section D have been obtained.

TABLE 1

M/D Measurement Thimbles for QCFM

DETECTOR	A	B	C	D	E	F
PASS 1	P-4	N-14	J-14	L-13	J-8	N-6
PASS 2	H-6	K-6	H-11	D-3	M-7	G-12
PASS 3	D-12	A-11	G-9	B-8	F-14	D-8

ATTACHMENT A

FLUX MAP DATA SHEET A

Map No. ______________ Shutdown Bank Positions: A ______ B ______ C ______ D ______

Date ______________ Control Bank Positions: A ______ B ______ C ______ D ______ P/L ______

Power ______________

Pass	Time	Thimble Identification						Scale						Comments
		A	B	C	D	E	F	A	B	C	D	E	F	
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														

Detector	A	B	C	D	E	F
Potentiometer Setting						
Detector Voltage						

ATTACHMENT B

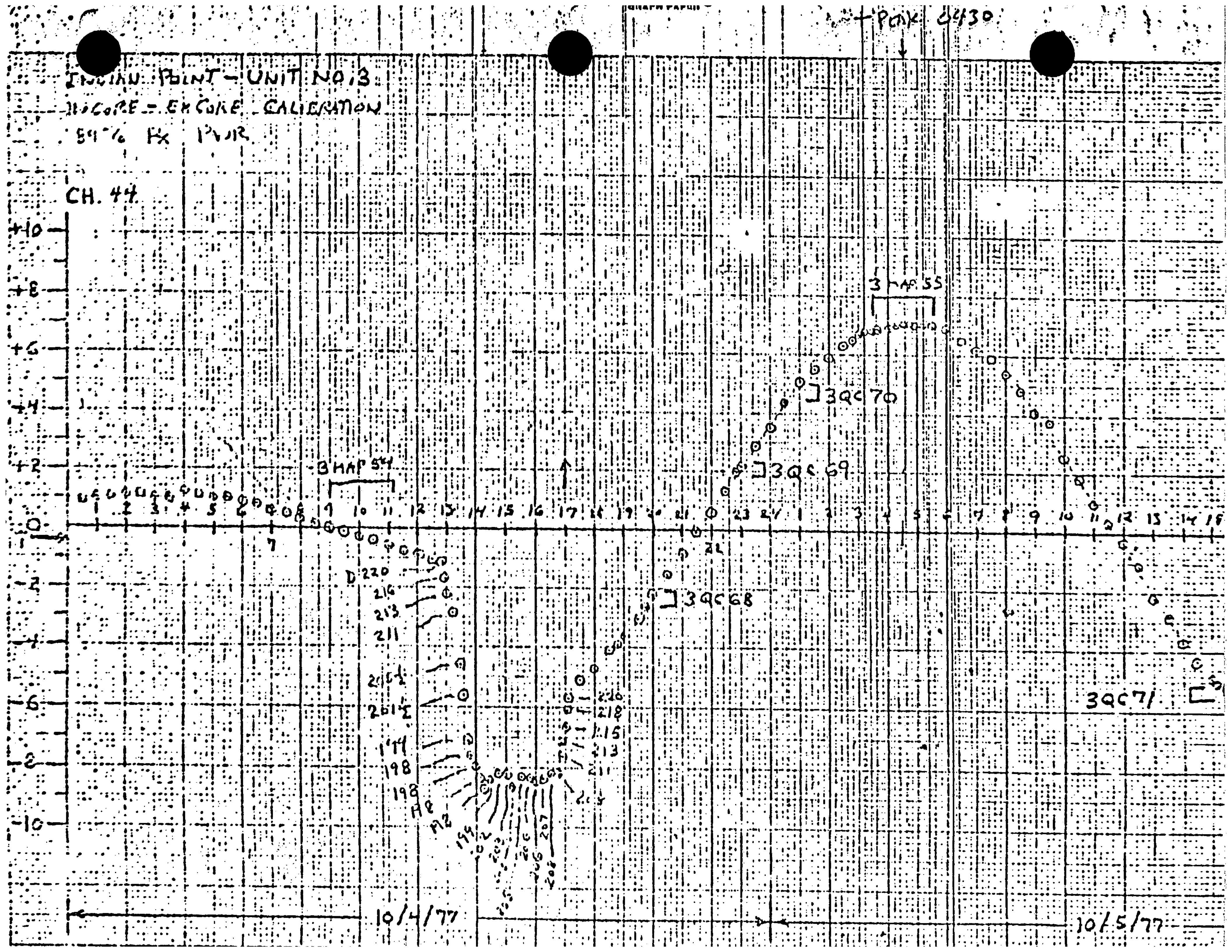
EXCORE DETECTOR DATA

Date ______________________ Shutdown Bank Positions: A ______ B ______ C ______ D ______

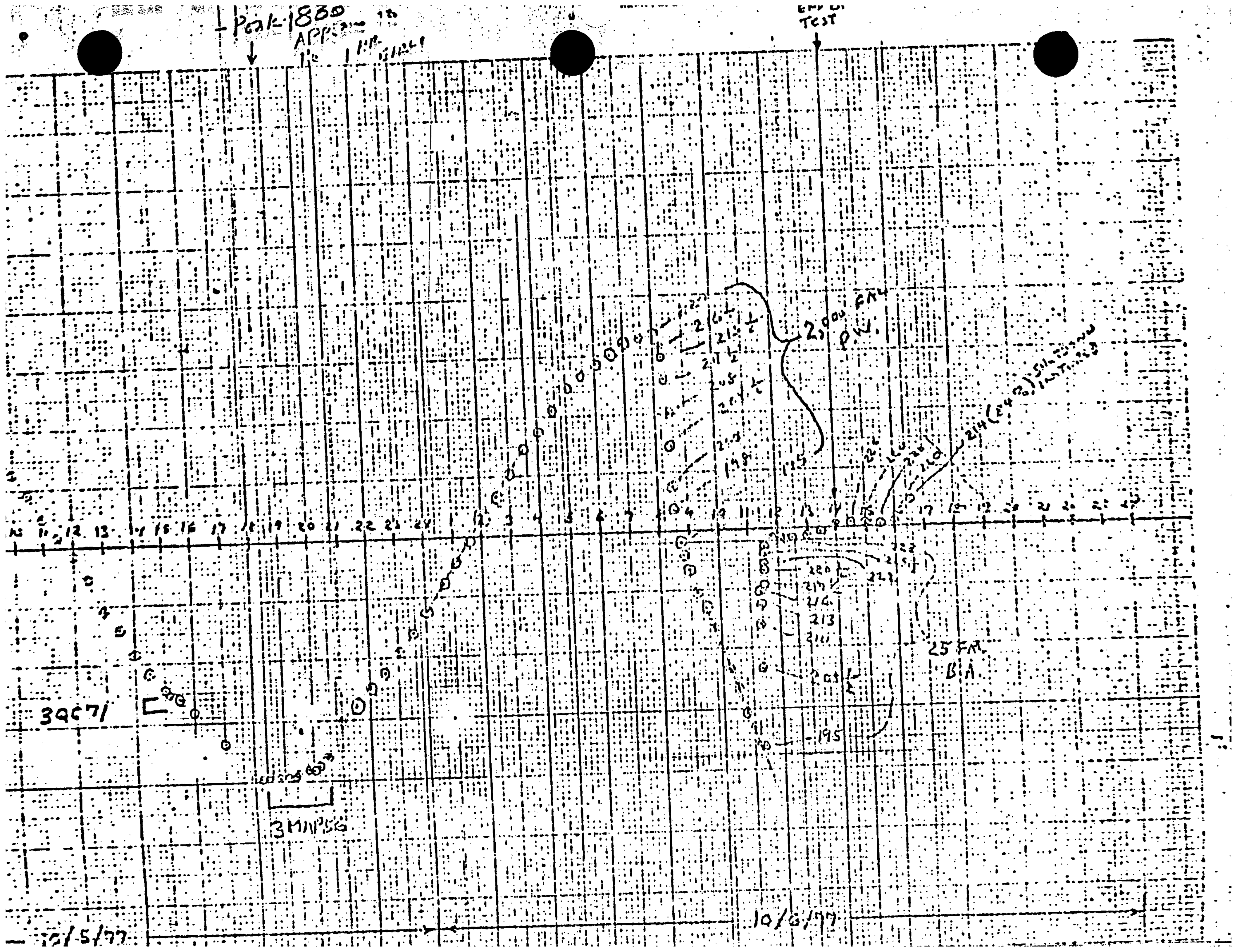
Power __________ MWe Control Bank Positions: A ______ B ______ C ______ D ______ P/L

Page ______ of ______

	RCC	N-41			N-42			N-43			N-44			DELTA FLUX			
Pass	POS	TOP	BOT	PWR	TOP	BOT	PWR	TOP	BOT	PWR	TOP	BOT	PWR	41	42	43	44
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	



INDIAN POINT - UNIT NO. 3
INCORE - EXCORE CALIBRATION
59% RX PWR
CH. 44
PCAK 0430
3 HAP 54
3 HAP 55
3QC68
3QC69
3QC70
3QC71
10/4/77
10/5/77
+10
+8
+6
+4
+2
0
-2
-4
-6
-8
-10


Peak 1880
TEST
2,000 FRH
P.W.
25 FRH
B.A.
10/5/77
10/6/77

POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT NO. 3 NUCLEAR POWER PLANT

R.A.-7 Rev. 0

STARTUP PHYSICS TEST PROGRAM

Written by: N. Passman

Reviewed by: ______

PORC Review ______ Date ______

Approved by: ______ Date ______

Effective Date ______

1.0 PURPOSE

To specify those additional administrative controls which are applicable during the startup physics testing of Unit 3 Cycle 2.

REFERENCES

2.1 Cycle 2 Startup Physics Test Program Description (Attachment No. 1).

2.2 Cycle 2 - Zero Power Startup Physics Testing Sequence (Attachment No. 2).

2.3 Cycle 2 - Power Ascension Program Sequence (Attachment No. 3).

2.4 WCAP-9244, The Nuclear Design and Core Management of the Indian Point Plant No. 3, Cycle 2.

3.0 PRECAUTIONS AND LIMITATIONS

3.1 A power level increase above that required to perform low power testing (approximately 5%) is contingent upon receiving approval from the Reactor Analyst.

3.2 A power level increase above 90% power is contingent upon receiving approval from the Reactor Analyst having completed recalibration of the power range channels using the revised incore-excore curves and having satisfied the target band requirements (T.S. 3.10).

4.0 INITIAL CONDITIONS

4.1 The procedures applicable to the startup physics testing program have received necessary approval.

4.2 Conditions necessary for the performance of each phase of the testing program are as specified in the initial conditions section of each separate procedure.

5.0 INSTRUCTIONS

5.1 The Startup Physics Test Program Description (Attachment NO. 1) establishes the test program for Cycle 2. Testing will be performed using the indicated Reactor Analysis procedures.

5.2 The sequence of Zero Power Startup Physics Testing and Power Ascension (Attachments Nos. 2 and 3) are provided for guidance.

5.3 The test program will be implemented by Operations and Westinghouse personnel under the technical direction of the Reactor Analyst and his representatives.

5.4 Plant operation during the test program will be controlled by the plant operating procedures except for operations specifically required by the Startup physics test procedures and for deviations permitted by the Technical Specifications for physics testing.

5.5 Test results will be reviewed and acceptance criteria signed off by a representative of Operations, Westinghouse and the Reactor Analyst. This provides an independent verification of the testings and results.

5.6 The Reactor Analyst shall be responsible for resolving discrepancies between test results and acceptance criteria.

ATTACHMENT 1

Cycle 2 - Startup Physics Test Program

Indian Point Unit No. 3

1. Precriticality Measurements (Procedure R.A.-1

(a) Description - To develop correction factors for incore thermocouples and to verify the calibration of RTD's.

(b) Condition - Reactor coolant temperatures from approximately 300°F to hot shutdown.

2. Criticality and Hot Zero Power (HZP) Tests

2.1 Boron Endpoints (Procedure R.A.-2, R.A.-4 and R.A.-5)

(a) Description - To determine the critical boron concentration for control rod configurations given below.

(b) Condition - Reactor at HZP

(i) All rods out (initial criticality)
(ii) Control Bank D in
(iii) Control Banks D & C in
(iv) (N-1) configuration (See note 1)

2.2 Isothermal Temperature Coefficients (Procedure R.A.-3)

(a) Description - To determine isothermal temperature coefficient at control rod configurations given below

(b) Conditions - Reactor at HZP

(i) All rods out
(ii) Control Bank D in
(iii) Control Banks D & C in
(iv) (N-1) Configuration (See note 1)

2.3 Control Rod Worth Measurements (Procedure R.A.-4)

(a) Description - To measure integral and differential worths of the following control rods

(i) Control Bank D
(ii) Control Bank C with Control Bank D in
(iii) Control Bank D, and C in overlap

(b) Condition - Reactor at HZP

2.4 Movable Incore Detector Flux Map (Procedure AP-25.4-2, See Note 2)

(a) Description - To obtain flux map for power distribution and hot channel factor determinations with the movable incore detectors

(b) Condition - Reactor at approximately 3% to 5% power and approximately all rods out

3.0 Power Ascension Tests

3.1 Power Coefficients Measurements (Procedure R.A.-6)

(a) Description - To measure power coefficients at following conditions

(b) Conditions - (i) Equilibrium xenon at start of test
(ii) Power changes between 50% and 90%

3.2 Excore/Incore Calibration (Procedure AP-25.4-3)

(a) Description - To calibrate excore power range channels using the movable incore detectors

(b) Condition - Equilibrium xenon and reactor power at ~90%.

3.3 Movable Incore Detector Flux Maps (Procedure AP-25.4-2)

(a) Description - To obtain flux maps for power distribution and hot channel factor determinations at elevated power levels using the movable incore detectors at following conditions.

(b) Condition - (i) Any reactor power levels as required by The Reactor Analyst
(ii) Reactor power at approximately 90%.
(iii) Reactor power at approximately 100%.

4.0 Plant Data Acquisition (procedure R.A.-8)

(a) Description - To obtain operating plant data for the purpose of instrument calibrations and coolant flow determination.

(b) Condition - Reactor Power levels stable at approximately:

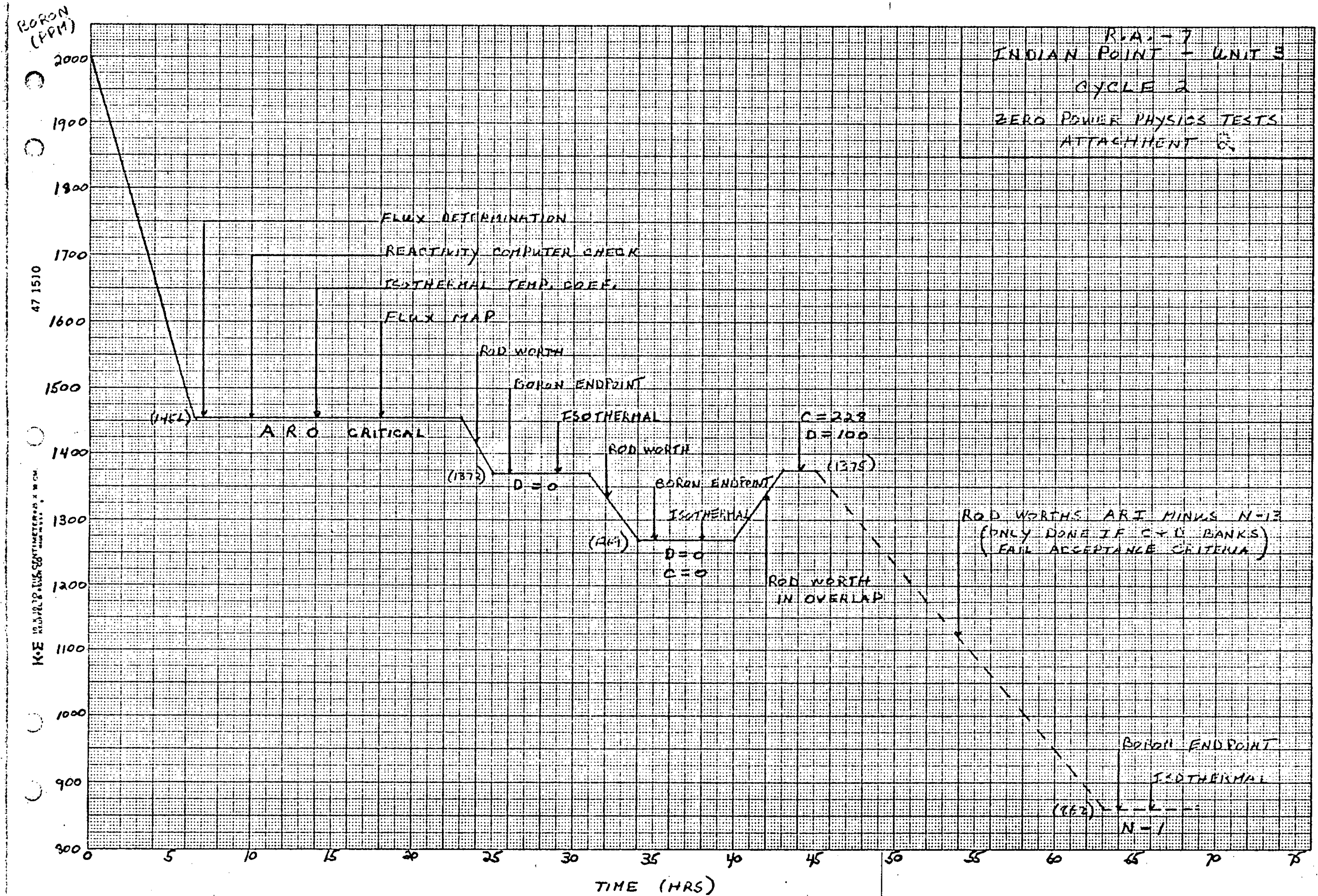
(i)	Hot Shutdown
(ii)	35%
(iii)	50%
(iv)	60%
(v)	70%
(vi)	80%
(vii)	90%
(viii)	100%

NOTES

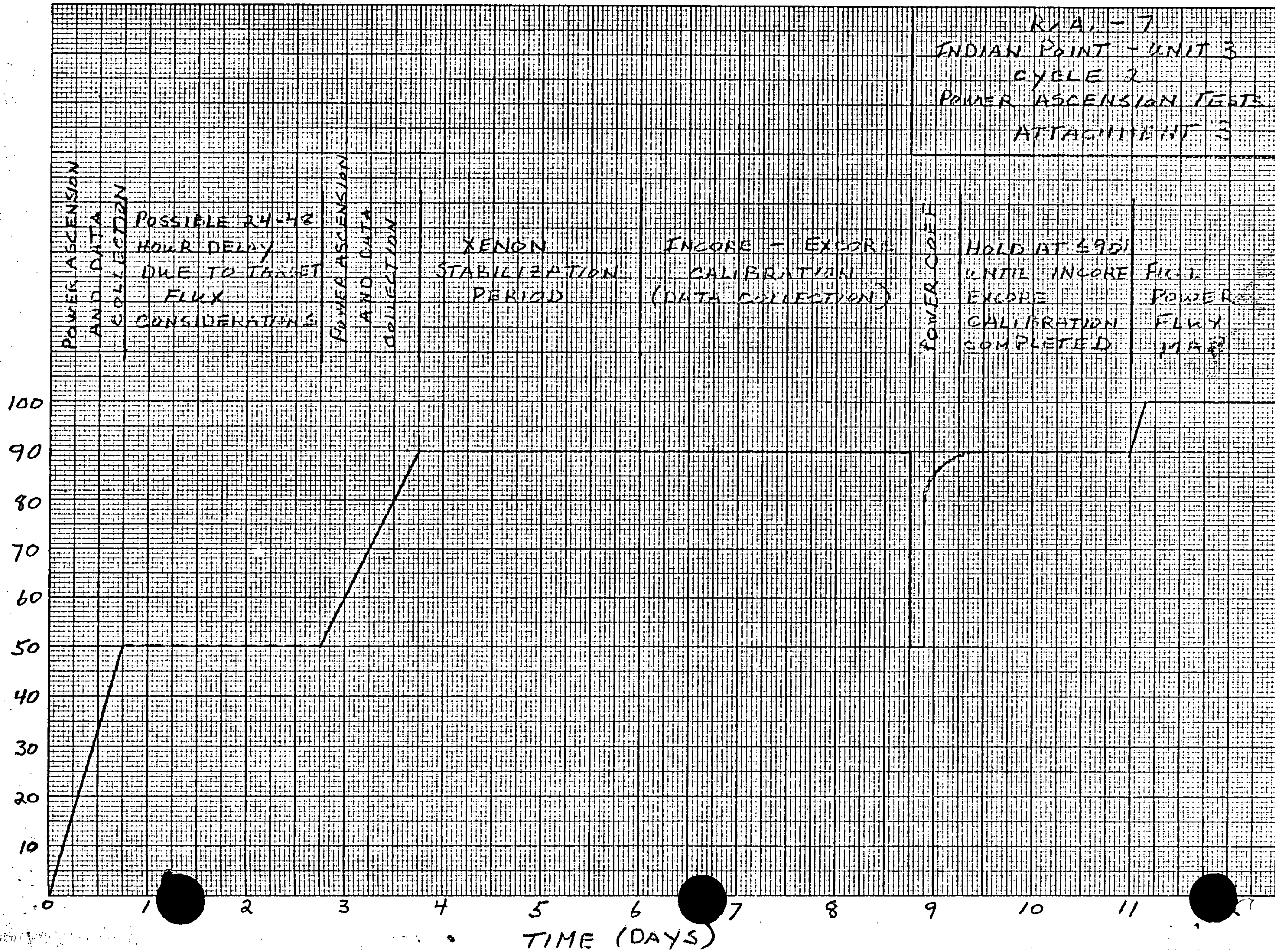
1 - Minimum shutdown verification (boron end point at N-1 rod configuration) needs not be done if the measured integral rod worths of Bank D and C (Step 2.3(a) (i) and (ii)) are within ± 15% of the design values and the sum of the worths is within 10% of the design value.

2 - Procedural requirement of AP-25.4-2 for equilibrium xenon may not be met for all maps performed as part of the Low Power and Power Ascension testing. Moveable detector potentiometers will have to be adjusted for low power conditions. The requirement for thermocouple maps and heat balance is not applicable to the low power map. Specific conditions and measurements to be made will be determined by the Test Supervisor.

3 - The power levels and rod positions mentioned above are appropriate values. Exact values will be determined by the Test Supervisor within the limitations of the appropriate test procedure.



R.A.-7
INDIAN POINT - UNIT 3
CYCLE 2
ZERO POWER PHYSICS TESTS
ATTACHMENT
BORON (PPM)
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
FLUX DETERMINATION
REACTIVITY COMPUTER CHECK
ISOTHERMAL TEMP. COEF.
FLUX MAP
ROD WORTH
BORON ENDPOINT
ISOTHERMAL
ROD WORTH
BORON ENDPOINT
ISOTHERMAL
(1456)
A R O CRITICAL
(1372)
D = 0
D = 0
C = 0
C = 228
D = 100
(1375)
ROD WORTH IN OVERLAP
ROD WORTHS ARI MINUS N-1
(ONLY DONE IF C + D BANKS FAIL ACCEPTANCE CRITERIA)
BORON ENDPOINT
ISOTHERMAL
(862)
N-1
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
TIME (HRS)


R.A. - 7
INDIAN POINT - UNIT 3
CYCLE 2
POWER ASCENSION TESTS
ATTACHMENT 3
POWER ASCENSION AND DATA COLLECTION
POSSIBLE 24-48 HOUR DELAY DUE TO TARGET FLUX CONSIDERATIONS
POWER ASCENSION AND DATA COLLECTION
XENON STABILIZATION PERIOD
INCORE - EXCORE CALIBRATION (DATA COLLECTION)
POWER
HOLD AT ≤90% UNTIL INCORE EXCORE CALIBRATION COMPLETED
FULL POWER FLUX MAP
100
90
80
70
60
50
40
30
20
10
0
1
2
3
4
5
6
7
8
9
10
11
TIME (DAYS)

28-4 (3)