POWER AUTHORITY OF THE STATE OF NEW YORK
INDIAN POINT 3, NUCLEAR POWER PLANT

CYCLE 2, STARTUP PHYSICS TEST REPORT

by

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1.0 INTRODUCTION

1.1 PLANT DESCRIPTION

The Indian Point Unit 3 Nuclear Plant is a four loop closed cycle pressurized light water moderated and cooled nuclear reactor operated by the Power Authority of the State of New York. The reactor core is designed to produce 3025 megawatts thermal power resulting in a gross electrical generating capacity of 1000 megawatts of electrical energy.

The Nuclear Steam Supply System was designed by Westinghouse Electric Corporation.

Plant construction and design were performed by United Engineers.

The plant is located on the east side of the Hudson River, 30 miles north of New York City.

1.2 TEST OBJECTIVES

This report documents the results of nuclear tests performed as part of the cycle 2 startup testing program:

The objectives of the nuclear tests were: (1) to verify that the operating characteristics of the core are consistent with design predictions, (2) to demonstrate that measured core parameters are consistent with values used in the Safety Analyses, (3) to demonstrate that the core can be operated at licensed thermal power safely and within the limits of the Technical Specifications, and (4) to provide data for nuclear and temperature instrumentation calibration.

1.3 RELEVANT DESIGN INFORMATION

Table 1.1 presents selected design information of the Indian Point Nuclear Plant. Figure 1.1 shows the core layout with control rods, sources, and enrichment locations. Figure 1.2 shows the core layout with individual control and shutdown bank locations.

1.4 SEQUENCE OF STARTUP EVENTS

Following core loading, June 30 - July 14, 1978, a series of pre-operational tests was performed both in the cold shutdown and hot shutdown conditions. Criticality was achieved on August 17, 1978 followed by a program of low power nuclear tests. The unit synchronized to the grid on August 25, 1978. Power escalation to maximum licensed power (100%) was accomplished by stopping at approximately 10% power level increments, for purposes of data collection and testing. Maximum power (100%) was achieved on September 10, 1978.

1.5 SUMMARY OF MEASURED AND PREDICTED CORE PARAMETERS

Presented in Table 1.2 is a summary of selected results of zero power nuclear tests and at-power distribution measurements. The results reported in this document, indicate that all acceptance criteria specified in the cycle 2 reload submittal were met.

TABLE 1.1

Core Design Information Parameters

Number of Fuel Assemblies	193
Region 1	1
Region 2 and 3	64
Region 4	64
Lattice Configuration	15X15
Number of fuel rods per assembly	204
Fuel loading, MTU	88.06
Number of Assemblies Containing RCC Full Length	53
Number of Absorber Rods per RCC Assembly	20
Number of Control Rod Assembly Guide Thimble per Assembly	20
Number of Instrumentation Thimbles per Assembly	1
Number of Grids in Active Core Height	7
Heat Output, MWth	3025
Percent Heat Generated in Fuel	97.4
Hot Zero Power Coolant Temperature, ^{o}F	547.0
Operating Pressure, psia	2250
Hot Channel Factors	
Heat Flux F_Q^T	2.17
Nuclear Enthalpy Rise, $F_{\Delta H}^N$	1.55
Average Clad Surface Heat Flux, BTu/hr-ft^2	193,000
Average Linear Power Density, kw/ft Fuel	6.24
Specific Power, kw/kg Uranium	33.2
Power Density, kw/liter of Core	91.8
Enrichments, w/o Uranium 235	
Region 1	2.28
Region 2	2.80
Region 3	3.29
Region 4	3.10

TABLE 1.2

Summary of Measured and Predicted Parameters

1. Reactivity Measurements

1.1 HZP Critical Boron Conc. (ppm)
(Acceptance Criteria: P ± 50 ppm)

Rod Position	Measured	Predicted	M-P
ARO	1446	1443	+3
D IN	1362	1364	-2
D+C IN	1255	1256	-1

1.2 Isothermal Temperature Coefficient (pcm/ F)
(Acceptance Criteria: P ± 3 pcm/°F

				Inferred MTC* (pcm/°F)
ARO	-0.50	+0.4	-0.90	+1.10
D IN	-2.14	-1.0	-1.14	-0.54
D+C IN	-4.07	-3.14	-0.93	-2.47

1.3 RCC/RCCA Worth Measurements (pcm)
(Accepance Criteria: P ± 15%)

D	721	750	-29
C(D IN)	1031	968	+63
B(D+C IN)	552	571	-19
A(D+C+B IN)	866	823	+43
Total	3170	3112	+58

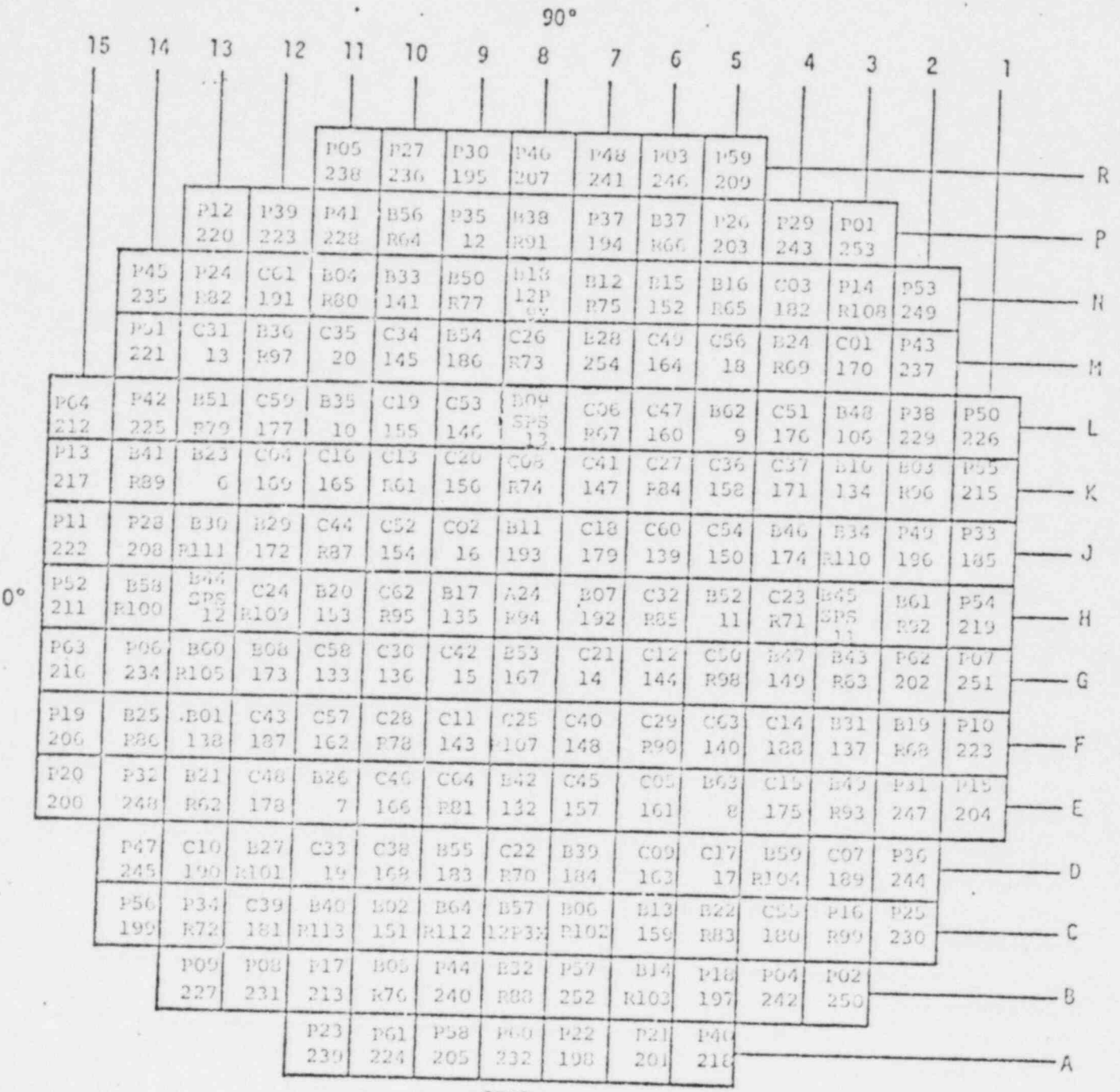
1.4 Differential Measured Power Defect -9.30 pcm/%
Predicted Power Defect -8.67 pcm/%

2. Power Distribution

Hot Zero Power (ARO)	Technical Specification Limit	Measured Value
$F^T_{\Delta H}$	1.85	1.64
F^T_Q	4.09	3.06
Hot Full Power (ARO)		
$F^T_{\Delta H}$	1.55	1.50
F^T_Q	2.08	1.83

* Assumes -1.6 pcm/°F for doppler temperature coefficient

Figure 1.1



Enrichments:

AXX - 2.28 w/o
BXX - 2.80 w/o
CXX - 3.29 w/o
PXX - 3.10 w/o

Inserts:

XXX - Plugging Device
RXX - Control Rod
SPSXX - Secondary Source
12PXX - Burnable Poison

2.0 MEASUREMENT TECHNIQUES

2.1 GENERAL

The methods for nuclear test data acquisition can be grouped into four distinct areas: (1) reactivity measurements, (2) measurements of core power distribution (3) collection of instrumentation calibration data, and (4) thermal pow r measurements.

The purpose of this section is to describe the methods used in each of these areas.

2.2 REACTIVITY MEASUREMENTS

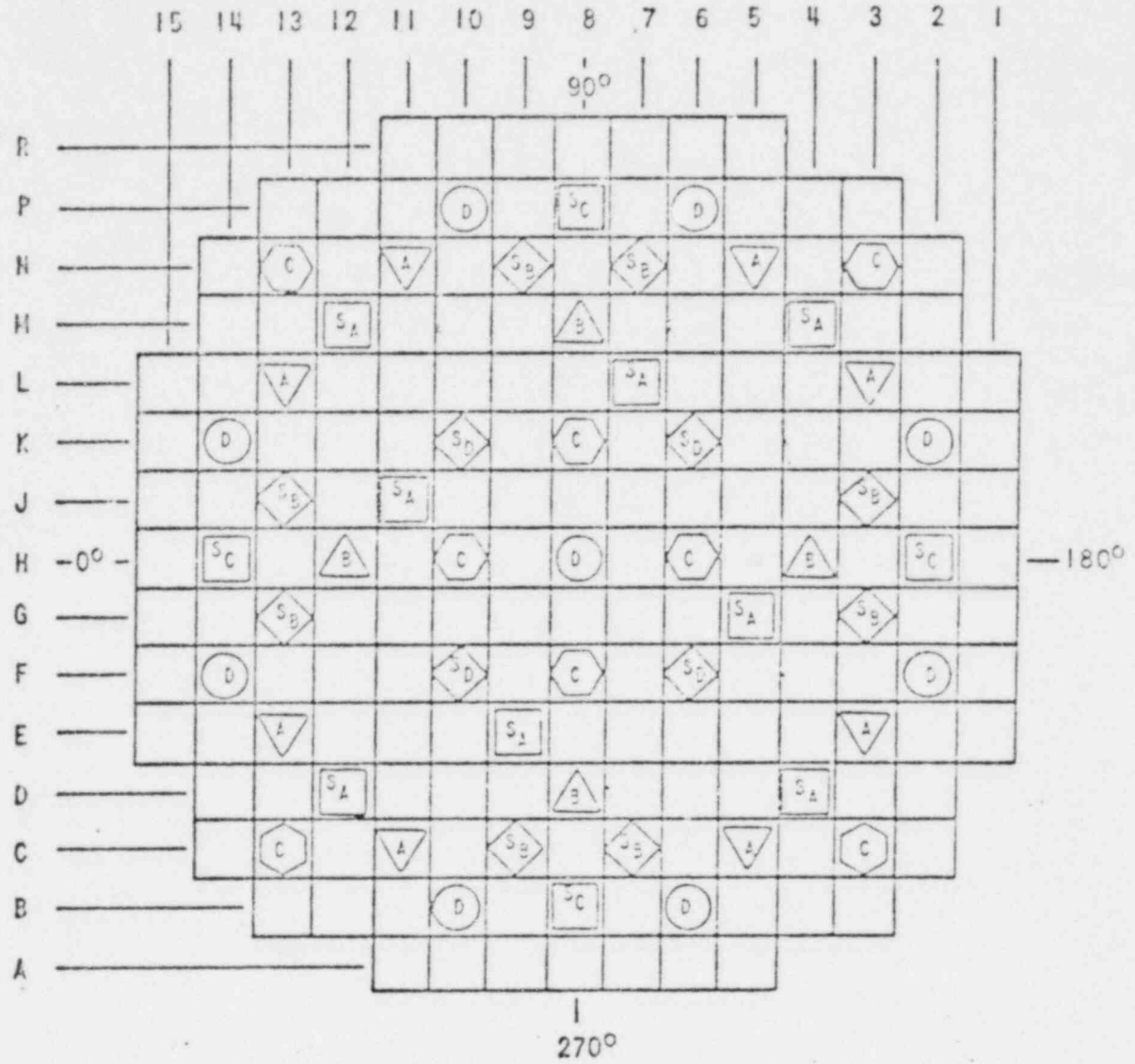
Measurements of core reactivity were performed both in subcritical and critical core conditions. In the subcritical mode, measurements were made during initial core loading and the approach to criticality. In the critical mode, measurements were made to determine core kinetics parameters.

2.2.1 Subcritical Measurements

During core loading, the core reactivity was monitored using the response of the two plant source range channels,. Monitoring was accomplished by observing the normalized inverse count rate ratio (ICRR) for each channel as the core was loaded.

During the approach to criticality, ICRR plots using data from the two plant source range channels were used to predict expected criticality. ICRR data were plotted as a function of rod position during rod withdrawal, and as a function of measured boron concentration during dilution.

Figure 1.2



BANK	SYMBOL	NUMBER OF ROD CLUSTERS
S_A	□	8
S_B	◇	8
S_C	□	4
S_D	◇	4
A	▽	8
B	△	4
C	⬡	8
D	○	9

Control Rod Locations

2.2.2 Critical Measurements

Small core reactivity changes were determined with the aid of an analog (reactivity) computer which provided an on-line solution to the point kinetics equations. Reactivity records were maintained on a continuous basis during a test via a strip chart recorder which logged the output from the reactivity computer.

The input signal to the reactivity computer was provided by the Nuclear Instrumentation System (NIS) power range channels. During zero power measurements, one NIS power range channel was taken out of plant service and used as input to the reactivity computer. Signals from the top and bottom section were summed, and the common signal was converted to voltage by a picoammeter for input to the reactivity computer. At power, the voltage output of the isolation amplifiers of all four NIS power range channels were summed and fed directly to the reactivity computer.

Differential and integral worth of individual rod control cluster assemblies (RCCA's) or rod control clusters (RCC) were obtained from the reactivity computer response to stepwise movement of the control element. During the measurement, the reactor was maintained, on the average, in the critical state.

Isothermal temperature coefficient data were obtained by measuring the reactivity computer response to small temperature changes, a few degrees below no load temperature.

Just critical boron concentration data were obtained from plant chemistry boron analyses of reactor coolant system samples (RCS) under equilibrium conditions. For boron concentration endpoints, corrections to the measured concentration utilized reactivity computer measurements of the reactivity difference between actual and design core configurations.

Power coefficient data were obtained by measuring the change in core reactivity resultant from a change in core power level. Under conditions of constant RCS boron concentration, the core power level was decreased and increased incrementally approximately 10% by controlling RCC bank motion. Changes in core reactivity resultant from RCC bank motion were measured using the reactivity computer. Changes in core power level were determined from secondary side calorimetric measurements made prior to and following the power level decreases and increases.

This method of measuring the power coefficient yielded poor results due to a very small signal to noise ratio on the signal coming from the power range instrumentation. The measurement method was revised to eliminate the use of the reactivity computer by using the change in Tavg as an indirect measurement of the power coefficient, Appendix A provides details of this measurement.

2.3 POWER DISTRIBUTIONS

The Moveable Detector (M/D) Flux Mappping System was used to collect power distribution data. The power distribution measurements were performed throughout the startup program with standard control bank positions to verify correct fuel loading patterns and design calculations to cross-calibrate the incore and thermocouple system; and to provide calibration data for the correlation of excore detector response. Data from the M/D system was input to the INCORE computer code to generate detailed three dimensional core power profiles. The INCORE code combines measured flux distributions with design calculated power flux distributions, to yeld specific fuel rod powers, local burnup, core power tilts, core average axial offset, etc.

2.4 INSTRUMENTATION CALIBRATION DATA COLLECTION

At each stable power level (statepoint) during the power escalation program (approximately each 10%) measurements were made of RCS loop temperatures (Tavg and Δ T), Steam Generator pressure and NIS power range detector currents. NIS currents were read from the power range current meters. Temperature and pressure data were obtained from the meters on the control board and from the P-250 process computer.

Correlations between incore axial power distribution and excore power range detector response were made through simultaneous measurement of core power level, excore detector currents, and core power distributions (flux Maps).

Calibration data for the incore thermocouple system were obtained during isothermal measurements prior to criticality and during simultaneous flux and thermocouple (T/C) maps taken at power levels of 100%.

2.5 THERMAL POWER MEASUREMENTS

Core thermal power was determined by performing a heat balance across each of the steam generators. This measurement required the accurate determination of steam generator pressure, feedwater inlet temperature, and feedwater flow. For each steam generator steam pressure was taken as the average of the three channel P-250 readings; feedwater temperature was taken from the resistance temperature detector (RTD), located in the feedwater header utilizing the PRODAC system; and feedwater flow was determined from Barton pressure gauges installed on a venturi tap of each feedwater loop.

3.0 TEST RESULTS - REACTIVITY MEASUREMENTS

3.1 CORE LOADING

Core loading was accomplished by adding fuel assemblies to the vessel following the prescribed sequence shown in Appendix B, ICRR data obtained from the NIS source range channels are presented in Figures 3.1 and 3.2. There were no unexpected changes in core reactivity during the loading of the fuel assemblies.

3.2 INITIAL CRITICALITY

The approach to criticality began on Augist 17, 1978 at 23:15 hrs. with the incremental withdrawal of shutdown and control banks. Primary System boron concentration during rod withdrawal was approximately 1760 ppm. Inverse count rate ratio data from the two source range channels during rod withdrawal are shown in Figure 3.3. Criticality was achieved with the addition of reactor makeup water at a rate of 60 gpm. Inverse count ratios during boron dilution are shown in Figure 3.4. Throughout the critical approach, count rates from the two source range channels were both adequate and consistent for good monitoring of core reactivity. Count rates at the beginning of rod withdrawal were 82.6 and 55.9 cps for N-31 and N-32 respectively.

3.3 LOW POWER PHYSICS TESTS

3.3.1 Preliminary Measurements

Immediately following criticality, the upper limit of flux level for zero power testing was established as about one decade below which detectable nuclear heat was added to the coolant. An increasing T_{avg} was observed at a flux level

of 1.3×10^{-6} amps on power range N-41 (connected to the reactivity computer) and about 6×10^{-6} amps on both intermediate range channels. All reactivity measurements were performed below 3×10^{-7} amps on channel N-41. This testing was also about three decades above the gamma background level of 4×10^{-10} amps on N-41.

Next a check of the reactivity computer performance was made by measuring three values of reactivity and comparing the value with that inferred from the resultant reactor period from parameters given in the core design report. The results of this test, given in Table 3.1, indicate proper operation of the reactivity computer.

TABLE 3.1

REACTIVITY COMPUTER CHECKOUT RESULTS

Doubling Time (sec^{-1})	Period (sec^{-1})	Inferred Reactivity (pcm)	Measured Reactivity (pcm)	Difference (Meas. - Inferred) (pcm)
143.8	207	28.8	29.0	+0.2
5.5	94.5	55.2	55.0	-0.2
39.5	57.0	80.3	80.5	+0.2

3.3.2 Boron Endpoints

The just critical boron concentration was measured for three rod configurations. The test results were summarized in Table 1.2 along with design predications.

3.3.3 Isothermal temperature coefficient measurements were performed at three core conditions as summarized in Table 1.2. As seen in Table 1.2 the all-rods-out moderator-only temperature coefficient (MTC) is positive

and therefore rod withdrawal limits had to be imposed to insure a negative MTC as required by technical specifications. This calculation is presented in Appendix C.

3.3.4 RCC Bank Worths

Bank worth measurements were performed over the four individual control banks (i.e.: non-overlap mode). Measured and predicted integral worths of these four banks are summarized in Table 1.2. Also the differential and integral worth of each bank is shown as a function of bank position in Figures 3.5, 3.6, 3.7 and 3.8.

3.4 AT POWER TESTS

3.4.1 Power Coefficient Measurement

See Appendix A

3.5 Movable Detector Flux Maps

One movable detector flux map was taken at low power (≈4%) in the all-rods-out configuration. The results of this map are shown in Figure 3.9 and 3.10 with the measured $F^N_{\Delta H}$ compared to predicted $F^N_{\Delta H}$ for each assembly. In general Figures 3.9 and 3.10 shows that the measurements are consistently larger than the predictions around the core periphery while the opposite is true in the core interior. However all values are within the acceptance criteria of ± 15%.

Additional flux map results are summarized in Table 3.2.

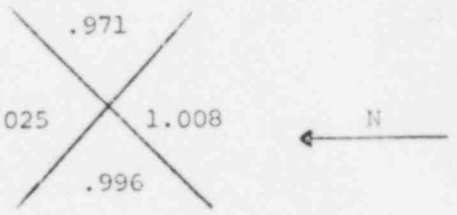
TABLE 3.2

FLUX MAP SUMMARY

HOT ZERO POWER - ALL RODS OUT

Tilts

.996	.986
1.018	1.000



Core Avg. Axial Offset: +46.46%

Peak $F^N_{\Delta H}$: 1.642 at location J-14 DJ

Most limiting F^N_Q : 3.0614 at location G-11 El, axial point 8

A second full core flux map was taken at full power (99%) in the all-rods-out configuration. The results of this map are shown in Figures 3.11 and 3.12. All values are within the acceptance criteria of ±15%.

Additional flux map results are summarized in Table 3.3.

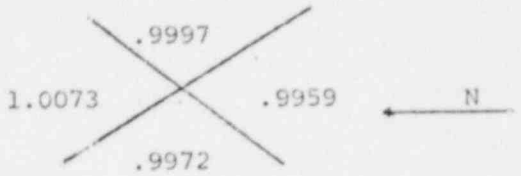
TABLE 3.3

FLUX MAP SUMMARY

HOT FULL POWER - ALL RODS OUT

Tilts

1.0085	1.0003
1.0023	.9890



Core Avg. Axial Offset: + 4.932 %

Peak F^N : 1.503 at location N-13 JL

Most limiting $F^N_{\Delta H}$: 1.826 at location E-07 LK, axial point 10

Figure 3.1

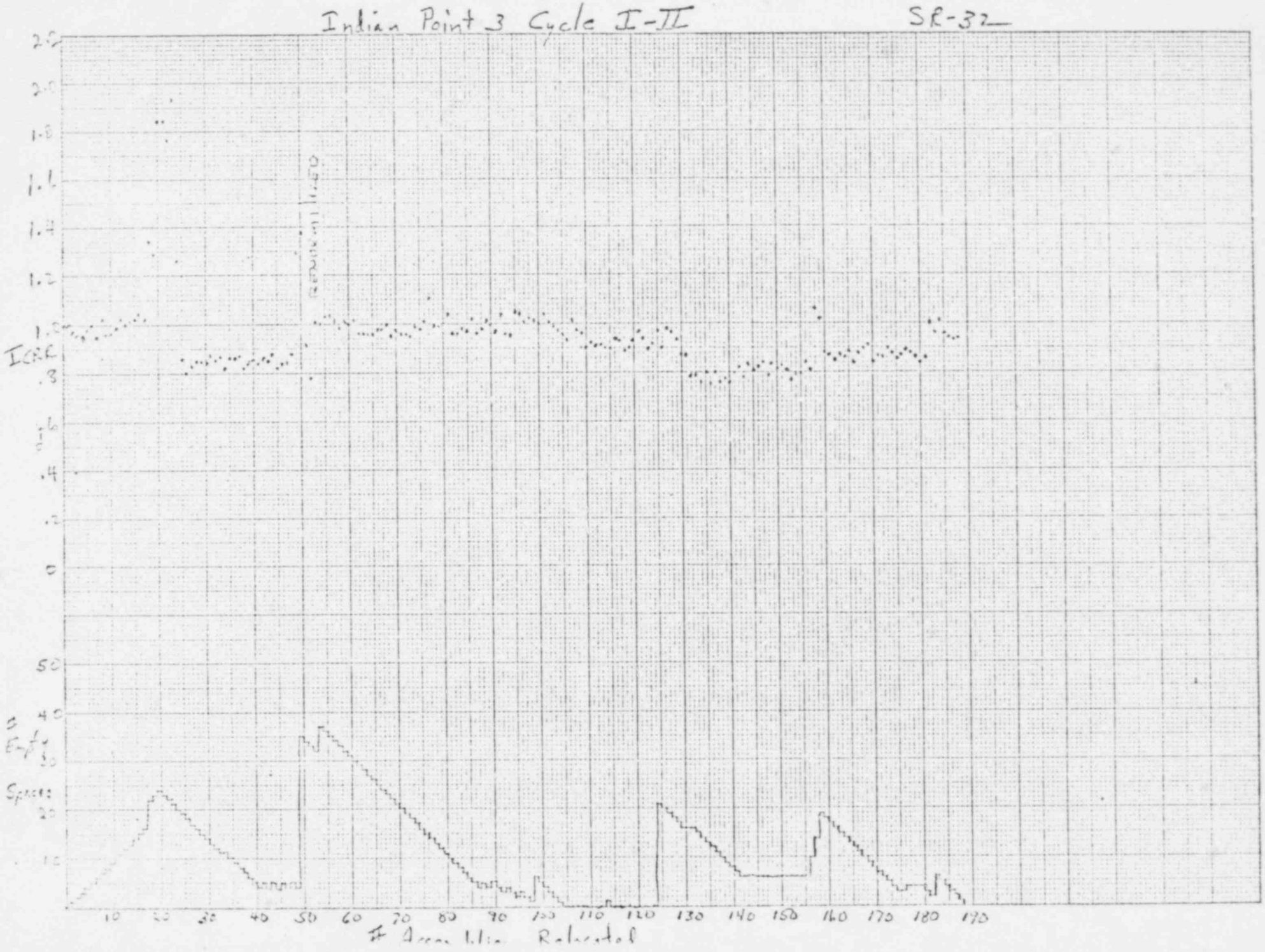


Figure 3.2

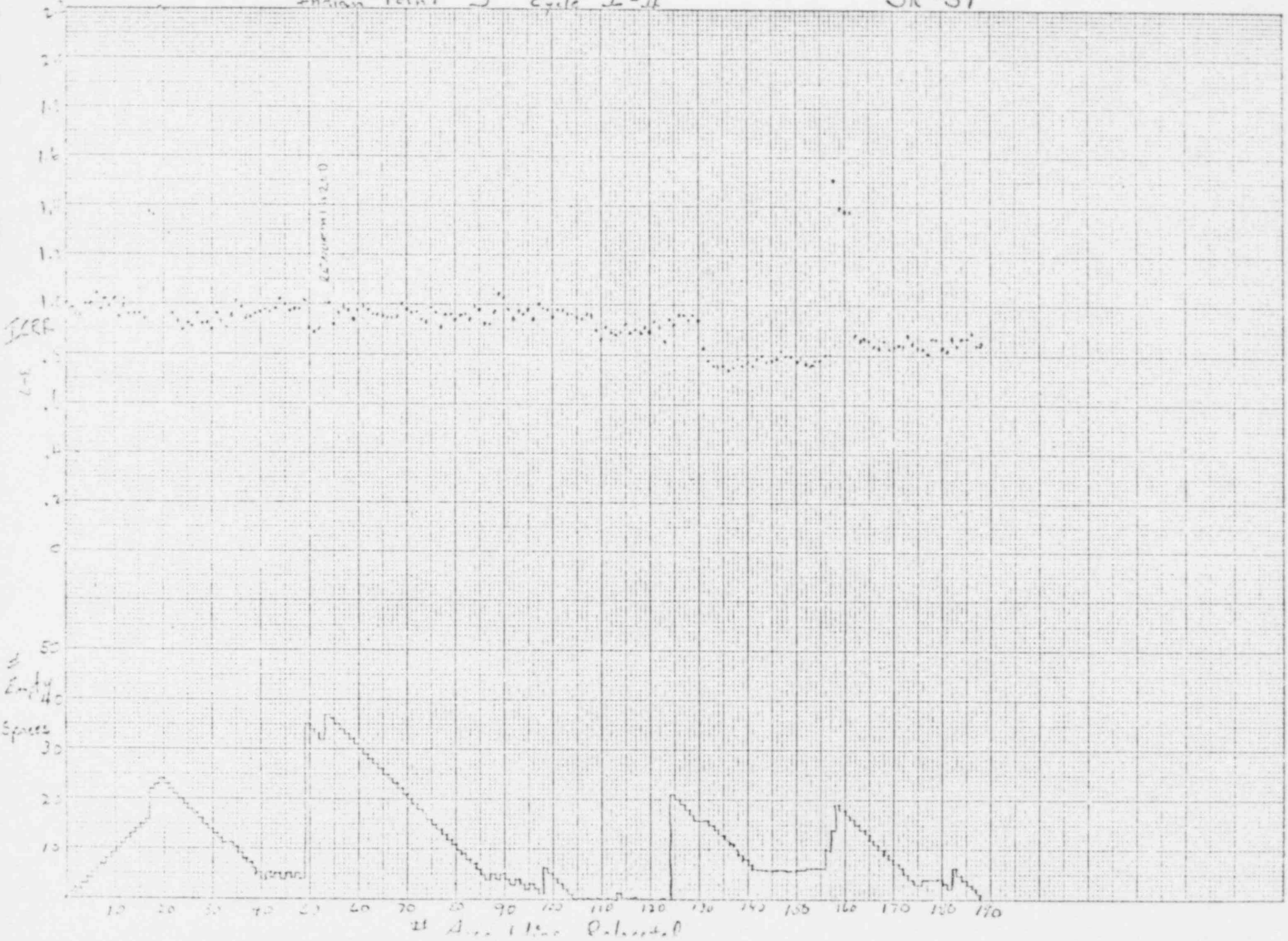


Figure 3.3

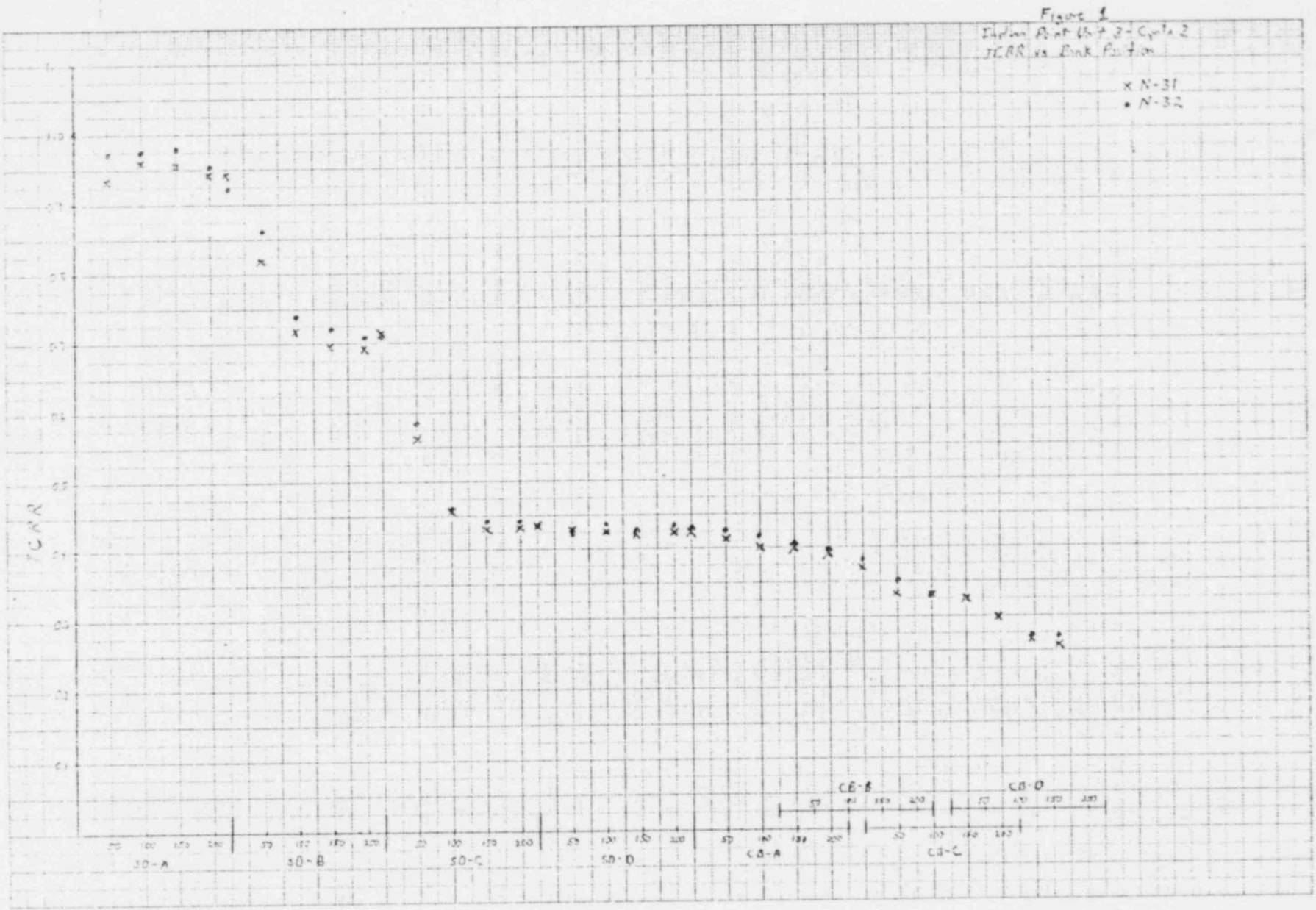


Figure 1
Elapsed Pt at Ub + 2 - Cycle 2
ICBR vs Bank Position
× N-31
• N-32
ICBR
SD-A
SD-B
SD-C
SD-D
CB-A
CB-B
CB-C
CB-D

Figure 3.4

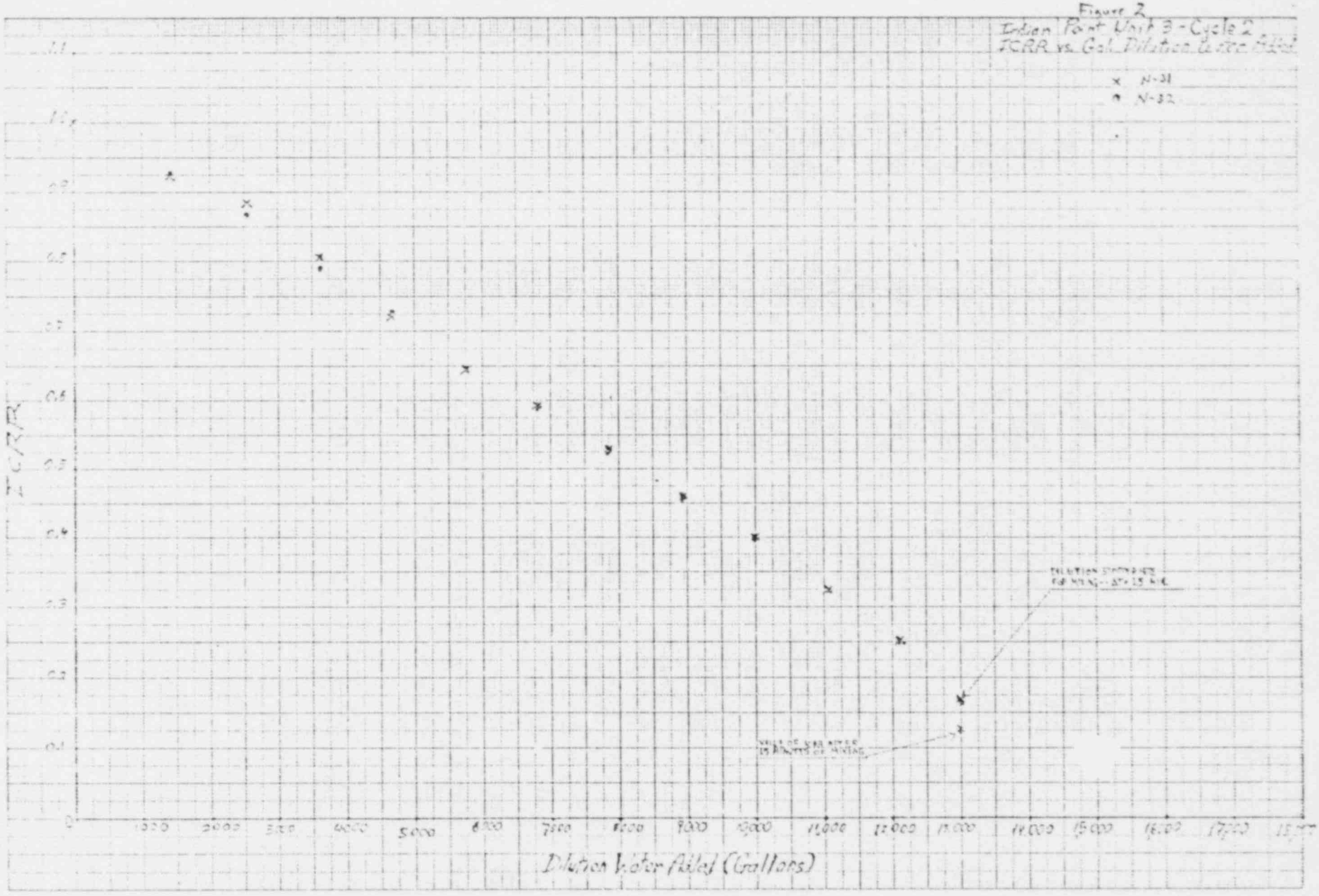


Figure 2
Indian Point Unit 3 - Cycle 2
ICRR vs. Gal. Dilution Water Added
N-31
N-32
1-ICRR
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1000
2000
3000
4000
5000
6000
7000
8000
9000
10,000
11,000
12,000
13,000
14,000
15,000
16,000
17,000
Dilution Water Added (Gallons)

Figure 3.5

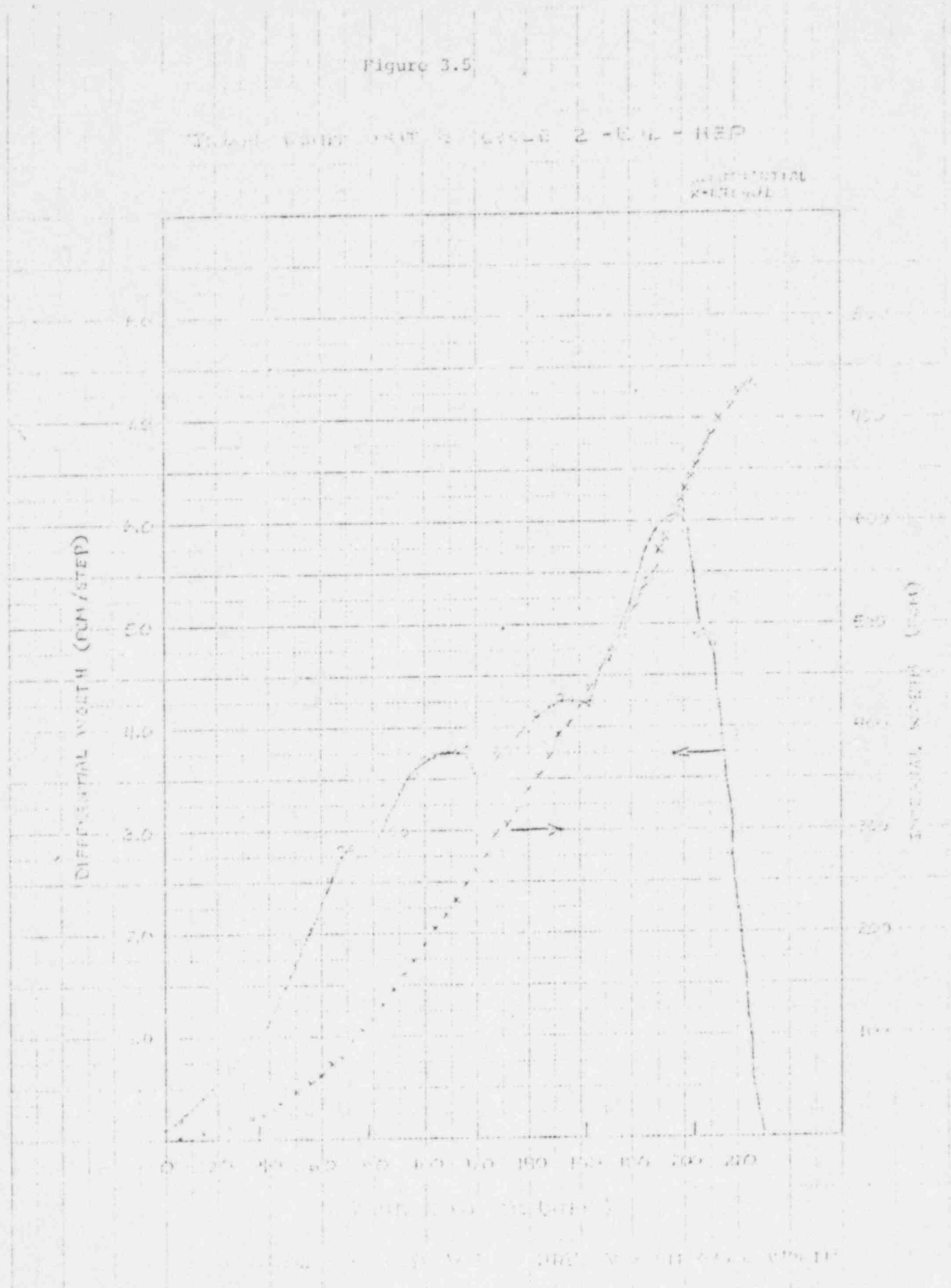

DIFFERENTIAL WIDTH (mA/STEP)
4.0
3.0
2.0
1.0
0
20
40
60
80
100
120
140
160
180
200
220

Figure 3.6

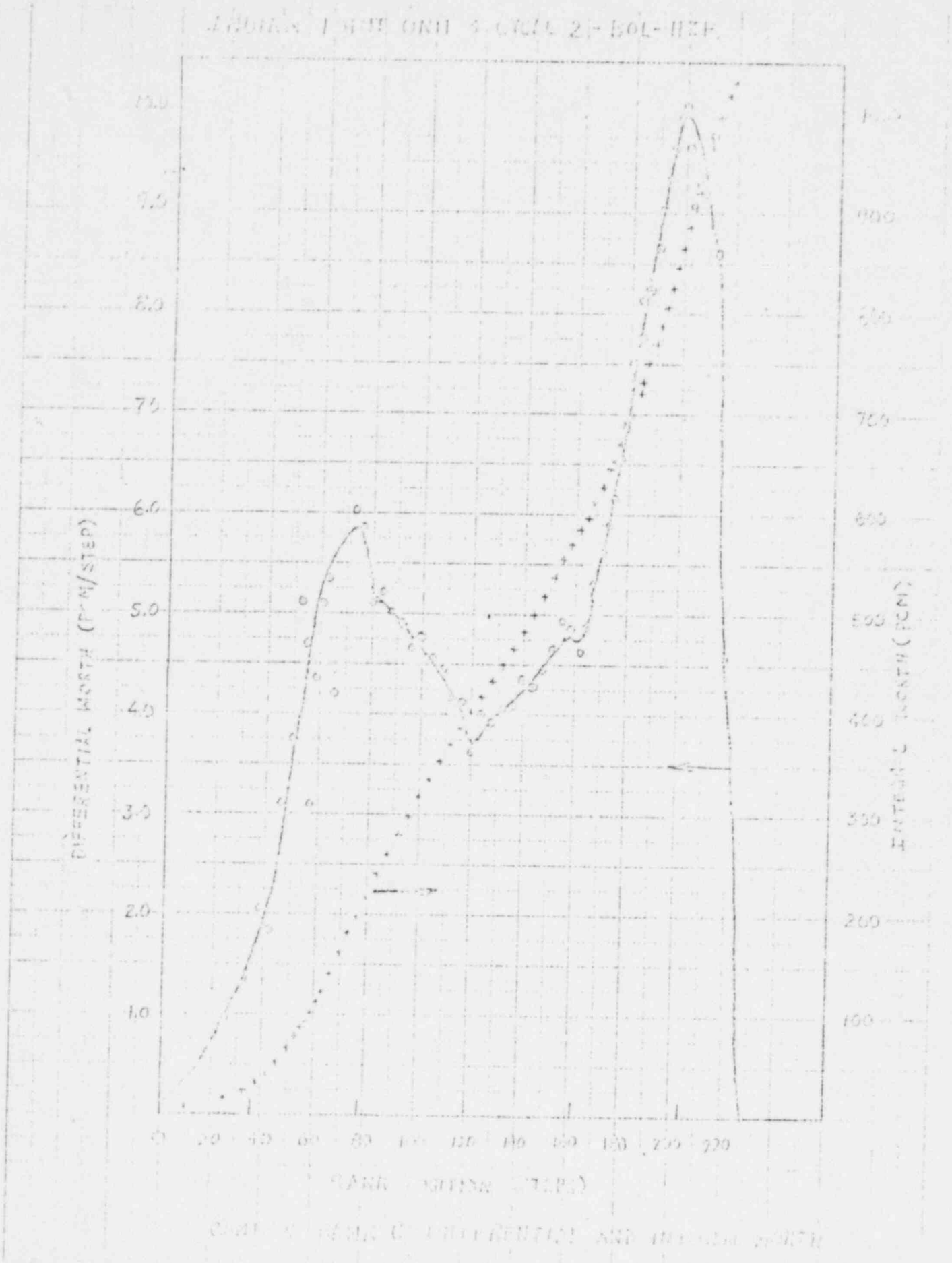

DIFFERENTIAL WIDTH (PM/STEP)
12.0
7.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
1000
900
800
700
600
500
400
300
200
100
0
20
40
60
80
100
120
140
160
180
200
220

Figure 3.7

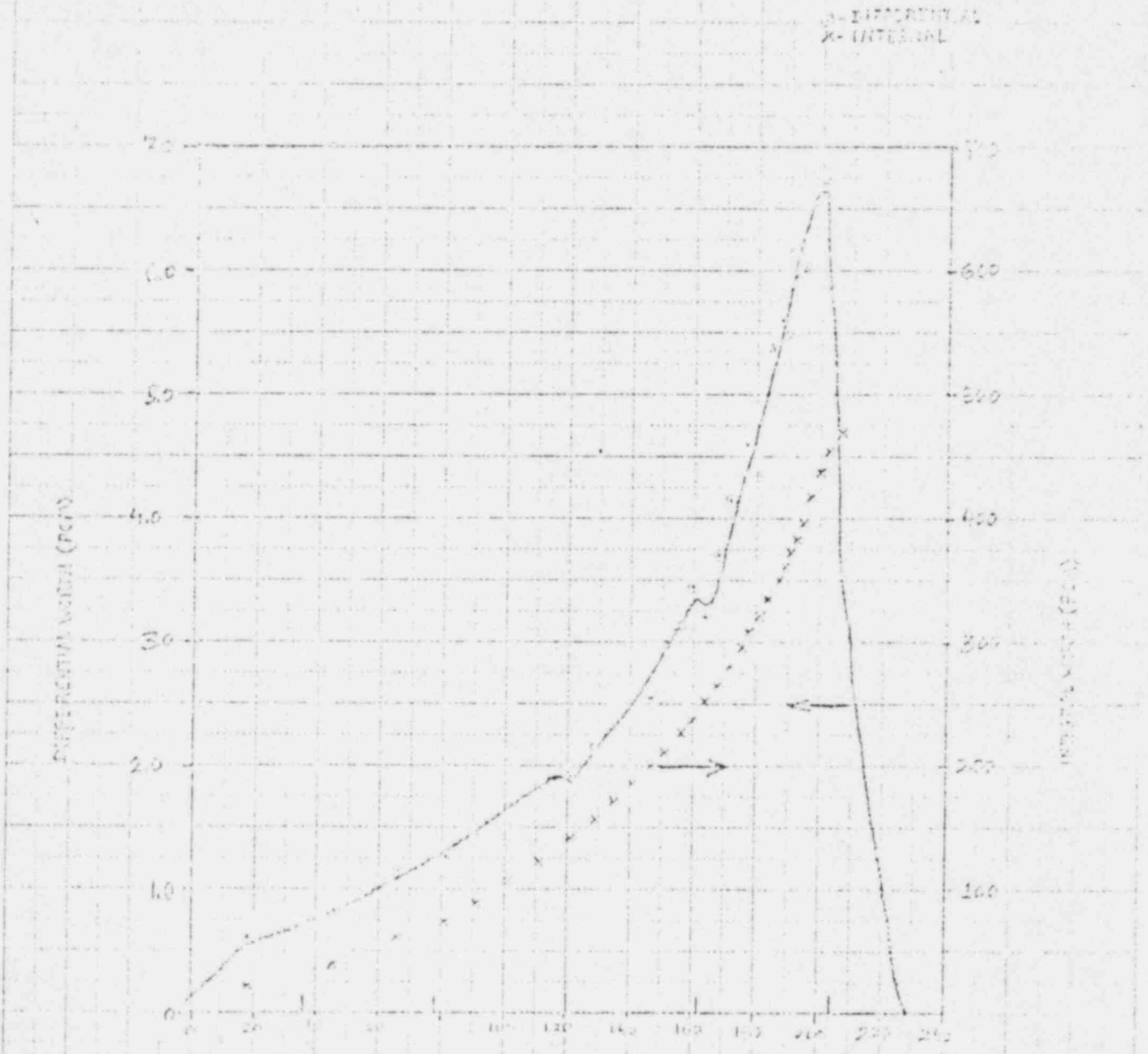


Figure 3.8

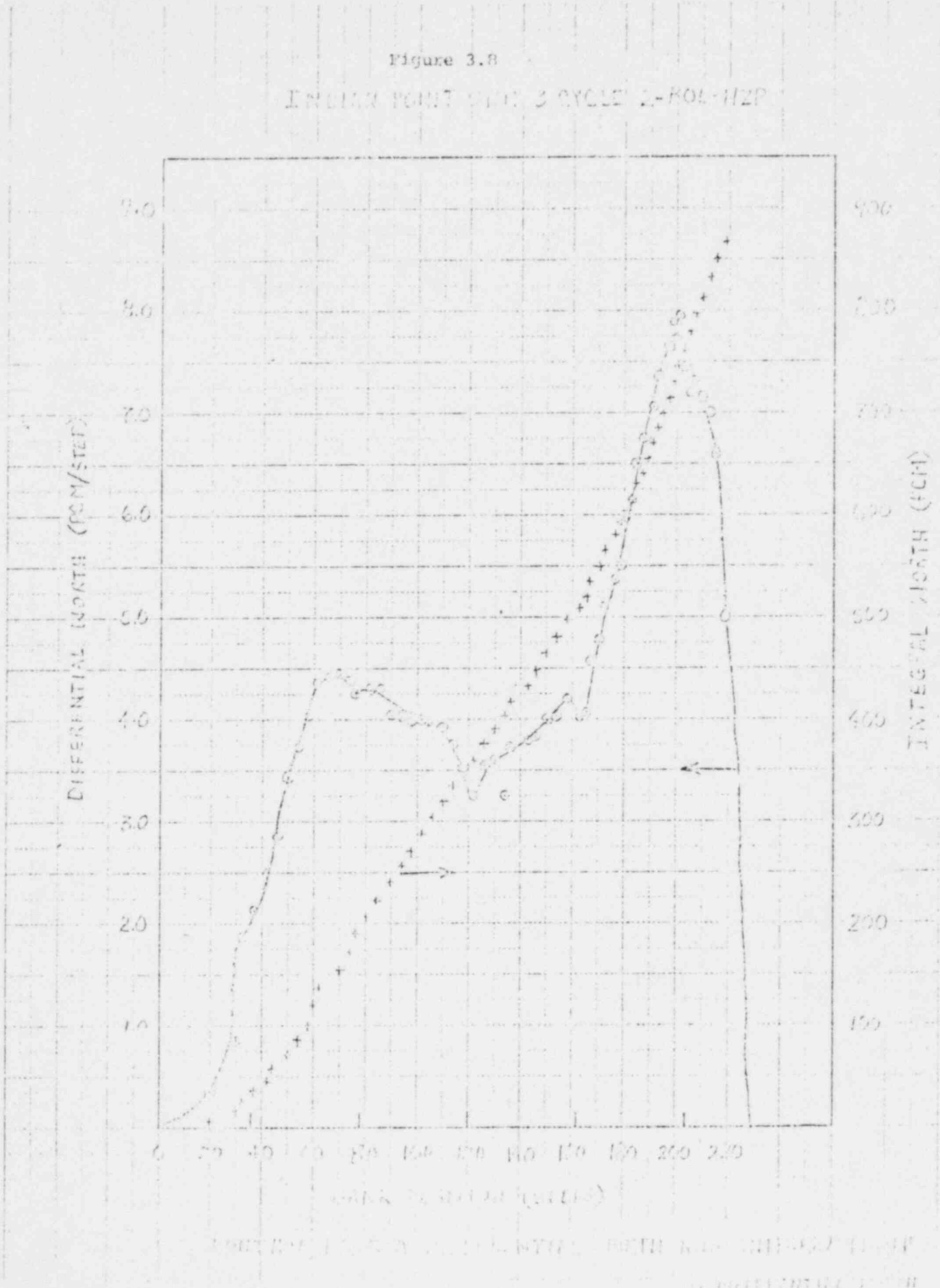

DIFFERENTIAL WIDTH (RPM/STEP)
TANGENTIAL WIDTH (RPM)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
900
800
700
600
500
400
300
200
100

Figure 3.9


MEASURED AND EXPECTED FORM IPS CYCLE 2 FORM 1, B=10-78, D/228, 4.0, 0.0BU, 1940A
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
P
O
N
M
L
K
J
H
G
F
E
D
C
B
A
MEAS
EXP

Figure 3.10


MEASURED AND PERCENT DIFF OF FOHN IP3 CYCLE CFM 1 A-18-78 07228 4.0 0 U 18008
13 12 11 10 9 8 7 6 5 4 3 2 1
B
G
N
M
L
K
J
H
F
E
D
C
B
A
MEAS
DIFF

Figure 3.11

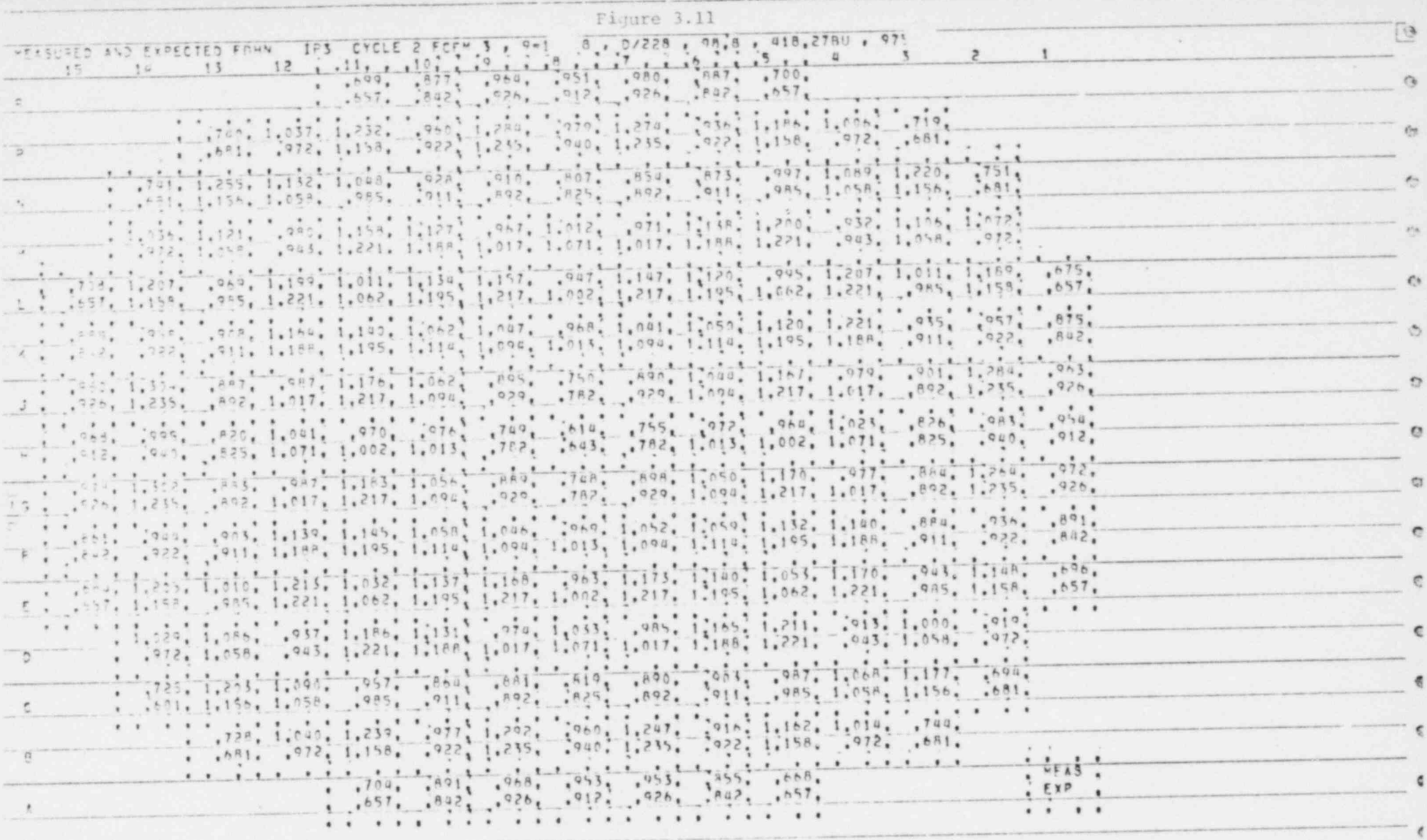
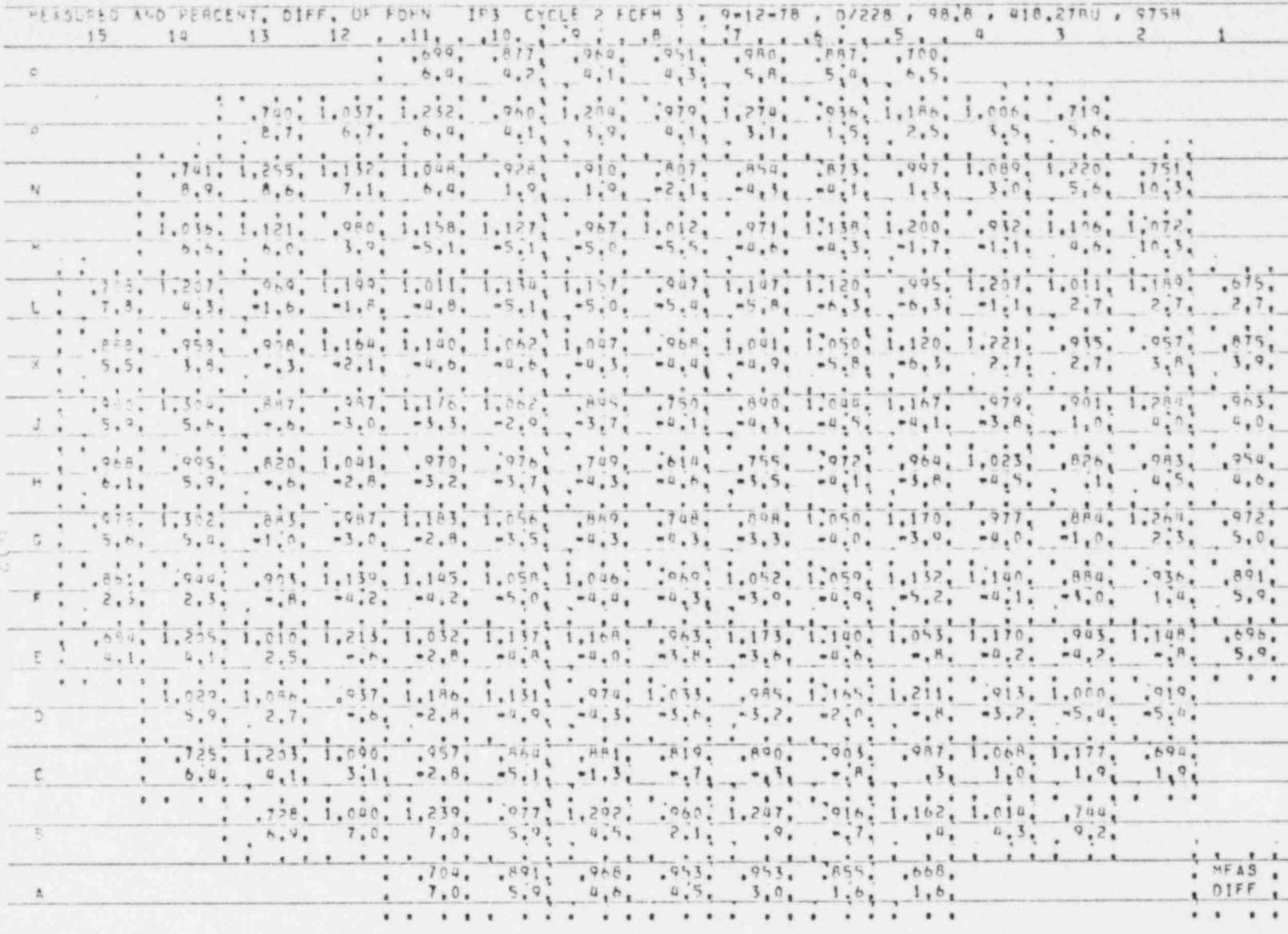

MEASURED AND EXPECTED POWER IP3 CYCLE 2 BOW 3 , 9=1 8 , 0/228 , 98.8 , 418.27BU , 97%
MEAS
EXP

Fig. 3.12


MEASURED AND PERCENT DIFF. OF FDHN IP3 CYCLE 2 FCFM 3 , 9-12-78 , 0/228 , 98.8 , 418.27RU , 9758
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
P
O
N
M
L
K
J
H
G
F
E
D
C
B
A
MEAS
DIFF

4.0 INSTRUMENT CALIBRATIONS

4.1 Incore - Excore Detector Calibration

One full-core map and 8 quarter core maps were taken at 90% power to obtain calibration data for the excore instrumentation. These maps covered a range in axial offset from -4.7% to 11.9% generated by insertion of control bank D and the resultant axial xenon oscillation produced upon withdrawl. INCORE analyses provided a measured value of the core average axial offset which was used as the basis for excore calibration. The results of the calibration are listed in Table 4.1.

4.2 Incore Thermocouple and Wide Range RTD calibration

The primary purpose of this test was to determine isothermal correction factors as a function of temperature for individual thermocuples.

During the heatup of the reactor subsequent to the refueling, reactor temperature was held constant at plateaus of approximately 290°F, 440°F and 544°F, where individual thermocouples readings were compared to the average of the narrow range RTD reading. Table 4.2 lists the results of these measurements including the isothermal correction factors for each operable thermocouple.

New calibration curves based on these correction factors where entered into the plant P-250 computer.

UNIT NO 3 , INCORE-EXCORE CALIBRATION , (02/27/73)

CALIBRATION CURVES

TABLE 4.1

DETECTOR	DEVIATION
41-T	363.3 2.36 (AI)
41-B	403.3 -2.39 (AI)
42-T	404.5 2.56 (AI)
42-B	436.2 -2.56 (AI)
43-T	409.7 2.75 (AI)
43-B	451.9 -2.75 (AI)
44-T	350.0 2.12 (AI)
44-B	429.3 -2.12 (AI)

SUMMATION OF EXCORE DETECTOR DATA AND CALCULATIONS

TAP ID	INCORE AXIAL OFFSET	POWER LEVEL	DETECTOR	AVERAGE CURRENT	POWER RANGE CURRENT	TOTAL POWER CURRENT	COMP. CURRENT	PERCENT DIFF.
3001	-4.693	.922	41-T	325.0	352.5	353.1	352.2	.25
			41-B	340.7	412.9	413.5	414.4	-.21
			42-T	352.0	392.6	392.5	392.5	.01
			42-B	413.3	448.3	448.2	448.2	-.01
			43-T	365.3	396.2	397.3	396.8	.13
			43-B	427.0	463.1	464.3	464.8	-.11
			44-T	321.3	343.5	344.9	345.3	.17
			44-B	408.0	442.5	440.5	441.1	-.14
3003	-1.927	.918	41-T	329.3	358.3	359.6	359.7	.26
			41-B	372.7	406.0	407.0	407.9	-.23
			42-T	366.3	399.1	400.0	399.6	.10
			42-B	403.7	439.7	440.7	441.1	-.09
			43-T	371.3	404.5	404.8	405.4	.10
			43-B	419.0	456.4	456.8	457.2	-.09
			44-T	325.3	354.4	360.2	353.2	.18
			44-B	398.7	434.3	433.6	434.2	-.15
3005	1.112	.925	41-T	326.7	365.0	365.6	365.9	-.06
			41-B	369.3	407.4	401.0	400.7	.08
			42-T	353.7	406.3	406.6	407.3	-.19
			42-B	398.3	433.2	433.1	433.4	.18
			43-T	356.3	409.3	411.3	412.8	-.35
			43-B	401.0	448.0	450.3	444.8	.32
			44-T	333.0	360.2	360.3	360.8	-.14
			44-B	333.0	427.9	427.2	426.7	.12
3006	2.390	.898	41-T	330.3	367.2	368.0	368.9	-.22
			41-B	396.0	396.4	397.6	397.7	-.01
			42-T	346.3	407.2	409.7	410.4	-.21
			42-B	395.3	429.1	431.0	430.1	.20
			43-T	374.0	416.5	416.3	416.3	.00
			43-B	428.0	445.4	443.3	443.3	-.00
			44-T	326.7	353.3	363.0	364.0	-.26
			44-B	382.0	423.4	421.5	423.5	.23
	4.101	.917	41-T	341.3	382.2	383.7	378.0	-1.13
			41-B	368.3	401.7	397.9	393.7	1.08
			42-T	380.3	414.8	414.5	415.0	.37
			42-B	397.3	422.4	424.2	425.7	-.36
			43-T	396.7	421.7	421.2	421.0	.03
			43-B	404.3	440.9	440.4	440.6	-.03
			44-T	337.3	367.9	367.8	368.2	-.12
			44-B	395.0	419.8	419.7	419.3	.11
3007	5.908	.911	41-T	344.3	378.0	377.6	377.2	.12
			41-B	384.7	392.3	392.0	392.4	-.12
			42-T	383.0	420.4	419.3	419.5	-.07
			42-B	395.0	422.6	421.4	421.2	.07
			43-T	398.3	426.3	426.7	426.0	-.07
			43-B	427.7	436.5	435.9	435.6	.08
			44-T	339.7	372.9	372.5	372.7	-.03
			44-B	378.3	415.3	414.9	414.8	.03
3002	7.609	.900	41-T	343.8	382.0	382.6	381.2	.16
			41-B	385.1	393.4	394.0	395.4	-.15
			42-T	382.3	424.8	424.3	423.9	.08
			42-B	395.2	416.9	416.4	416.8	-.08
			43-T	399.8	432.0	431.2	430.7	.12
			43-B	408.1	431.2	430.4	430.9	-.12
			44-T	333.3	375.9	376.2	376.9	-.01
			44-B	398.6	409.6	410.6	410.5	.01
3004	9.909	.907	41-T	360.3	396.3	396.4	396.7	-.06
			41-B	344.7	380.8	380.2	379.9	.06
			42-T	390.7	430.7	429.1	429.8	-.16
			42-B	374.7	413.1	411.6	410.9	.17
			43-T	396.7	437.3	436.2	437.1	-.20
			43-B	395.7	426.2	425.1	424.5	.25
			44-T	346.0	380.3	382.2	382.6	-.10
			44-B	395.2	416.2	414.5	414.8	-.10
3009	11.660	.901	41-T	353.7	392.5	392.4	391.3	.28
			41-B	387.3	399.4	398.2	397.3	.25
			42-T	393.3	435.5	434.1	433.8	.07
			42-B	396.7	417.1	416.6	416.9	-.07
			43-T	408.5	446.0	445.1	443.5	.36
			43-B	398.3	414.9	414.1	414.2	-.02
			44-T	358.0	396.2	396.2	395.5	.17
			44-B	401.0	427.4	426.3	426.8	-.12

TABLE 4.2

Incore Thermocouple Isothermal correction Factors

Tavg (from narrow range RTD) = 295.72°F

Correction factor = Tavg - T.C

Correction factors for each thermocouple in ascending order (all values in °F):

-0.58	-1.03	-0.83	-0.18	-0.93	-1.28
-	-0.73	-	0.02	-	-0.83
-0.23	-1.03	-0.68	-0.23	-0.88	-0.78
-0.08	-0.43	-0.73	-0.38	-0.23	-0.83
-0.03	-0.93	-0.88	-0.93	-0.78	-1.13
-0.68	-0.63	-1.08	-0.08	-.1.43	-
-0.63	-1.08	-0.98	-0.88	-0.68	-1.48
0.12	-0.93	-0.93	-0.73	-068	-
-0.28	-0.33	-0.98	-0.43	-0.43	-1.18
-0.18	-0.73	-1.03	-0.28	-0.83	-0.68
-0.48	-0.98	-0.63	-0.52	-0.83	

Tavg = 449.76 F

Correction Factors:

3.16	2.61	2.91	3.61	2.76	1.96	- 3.21	
-	4.11	-	2.86	3.87	2.36	3.81	3.36
2.41	3.11	4.11	2.86	3.11	3.01	3.71	2.61
3.86	2.76	2.56	2.71	3.17	2.36	3.41	2.96
2.41	4.16	1.96	-	2.96	2.56	2.86	3.21
-	2.01	4.46	2.76	2.61	3.26	3.01	-
3.66	2.81	2.41	3.66	3.41	2.21	4.16	2.51
2.91							

$T_{avg.} = 543.90^{\circ}F$

Correction Factors:

1.90	1.35	1.85	2.80	1.65	1.10	-	2.35
-	3.30	-	1.60	3.05	1.15	7.90	2.55
1.50	2.45	2.40	1.35	2.30	1.70	3.00	1.55
2.40	1.55	0.80	1.70	2.20	1.10	2.50	1.90
1.40	3.65	0.60	-	1.80	1.35	1.75	2.30
-	0.85	3.65	1.90	1.60	2.20	1.95	-
2.65	1.90	1.40	2.70	2.75	1.15	3.65	1.40
1.20	2.40	1.40	-	2.80	1.40	2.25	3.45
2.15							

APPENDIX A

Measurement of the Power Coefficient

1.0 INTRODUCTION

A measurement of the power coefficient was performed at the beginning of cycle 2 of Indian Point Unit 3 on September 19, 1978. The method utilized, involved exchanging power for RCS temperature while maintaining constant rod position and boron concentration. Power level was monitored via the core ΔT since no other power signal is either accurate enough or unaffected by the changing RCS temperature. Specifically, calorimetrics are not accurate enough because of the small power changes involved (2%) and the NIS are also inaccurate due to the RCS temperature deviating from the programmed temperature. The purpose of this report is to present the measurement results and the data analysis.

2.0 MEASUREMENT RESULTS

RCS temperature (Avg Tavg) and core average ΔT were hooked up to a two-pen stripchart recorder and scaled to 1°F/inch. After observing the average ΔT signal for about an hour, it was clear that the signal was too noisy to allow an accurate ΔT reading. It was decided to look at an individual loop ΔT rather than the core average ΔT. The ΔT signals from loops 1 and 2 were found to be stable whereas the signals from loops 3 and 4 were considerably noisy. The measurement was therefore performed with loop 1 ΔT input to the stripchart recorder and then repeated using loop 2 ΔT.

The conditions of the plant at the time of the measurement were as follows:

Power = 92%
Boron Conc. = 953 ppm
Tavg = 565.35°F
D position = 220 steps

Temperature results from both measurements are summarized in Table 1.

TABLE 1

Summary of Temperature Data from
Power Coefficient Measurement

Indian Point Unit 3 - Cycle 2

	T_{avg}^{i}	T_{avg}^{f}	ΔT_i	ΔT_f	Q	Q (From calorimetrics)
#1	565.35	566.50	46.10	45.55	92.42	90.51
	566.50	565.06	45.55	46.22	90.51	92.18
#2	565.	566.32	47.50	46.88	92.18	-----
	566.32	565.22	46.88	47.40	-----	-----

For measurement #1, loop 1 ΔT was used.
For measurement #2, loop 2 ΔT was used.

Note: i = initial
f = final
Q = power

3.0 DATA ANALYSIS

The analysis of the power coefficient data is somewhat involved and is presented in flow chart form in Figure 1. Note that even though the RCS temperature changed during the experiment, the final power level (P_f) is evaluated using the initial RCS temperature. This is done in order to insure that the final answer is in the form of the ratio of the isothermal temperature coefficient to the doppler-only power coefficient. That is, the doppler-only power coefficient is defined as a change in power at constant RCS temperature, therefore in the analysis no RCS temperature change should be used.

Results of these calculations are shown in Table 2.

TABLE 2

Results of Data Analysis

	T_{avg_i} (^oF) ($T_{avg_f} - T_{avg_i}$)	P_i (%)	P_f (%)	$P_i - P_f$ (%)	Power Coef. ($\Delta T_{avg}/\Delta P$)	Afg Tavg (^oF)	Avg P (%)
#1	-1.15	92.18	91.04	1.14	-1.009	565.93	91.61
	1.44	91.16	92.55	-1.39	-1.036	565.78	91.85
#2	-1.32	92.42	91.17	1.25	-1.055	565.66	91.79
	1.10	91.30	92.35	-1.05	-1.046	565.77	91.83
				Averages	-1.036	565.78	91.77

4.0 SUMMARY

The power coefficient calculated in Table 2 has the units of ^{o}F per percent power that is: -1.036 $^{o}F/\%$. To arrive at a doppler-only power coefficient in terms of the more familiar pcm per percent power a calculated isothermal temperature coefficient must be used. This value can be obtained from WCAP-9244, Figure 5.1 using the measured conditions of 565.78°F Tavg and 953 ppm boron concentration. Using linear interpolation in Figure 5.1 (BOL) the expected isothermal temperature coefficient is -8.48 pcm/°F.

During the zero power physics testing it was found that the predicted isothermal temperature coefficients in Figure 1 are biased more positive that the measured values by 0.50 pcm°F. That is, the measured isothermal temperature coefficent is 0.50 pcm/°F more negative than predicted. Therefore, the proper isothermal temperature coefficient to be used in this analysis should be the predicted value biased 0.50 pcm/°F more negative:

$$\overline{\frac{\partial \rho}{\partial T}}_{iso} = 8.48 - 0.50 = -8.98 \text{ pcm/}^{o}F$$

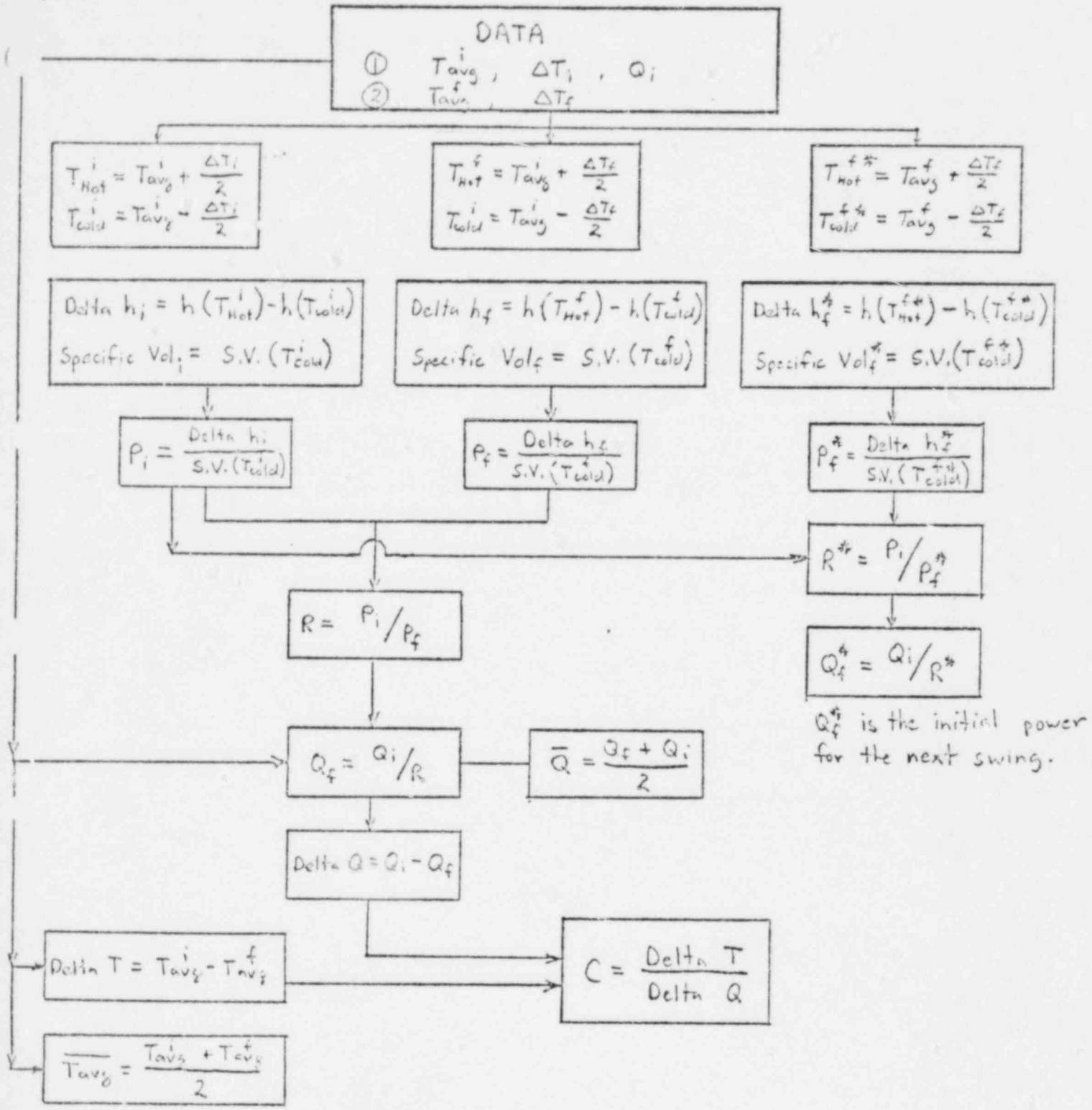
Therefore the measured doppler-only power coefficient is:

$$-(8.98 \text{ pcm/}^{o}F \times 1.036 \text{ }^{o}F/\%) = -9.30 \text{ pcm/}\%$$

This compares very favorably with the design value of -8.67 pcm/% found in Figure 5.5 of WCAP-9244.

Figure 1
Data Analysis Flow Diagram

SAO-NO-208



APPENDIX B

CORE LOADING SEQUENCE

EFFECTIVE DATE JUN 2 1978

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WESTINGHOUSE FORM 6588

FUEL HANDLING DATA SHEET

COMMENCEMENT OF FUEL SHUFFLE

STEP No.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
1		A14	164				E7											X						
1a		A14	164							X							E6							
1b		245	157				A5									E7								
2		A25	168				L9											X						
2a		A25	168							X							E5							
2b		253	146				R11									L9								
3		B35			20P 17		K9											X						
3a		B35			20P 17					X							D23							
3b		C20	156				R9									K9								
4		B62			20P 3		K7											X						
4a		B62			20P 3					X							D22							
4b		241	147				R7									K7								

FP-INT-01

WSD

FUEL HANDLING DATA SHEET

EFFECTIVE DATE JUN 2 1978

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REVISED DATE

NSD

STEP No.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
5		B63			20P 29		F7											X						
5a		B63			20P 29					X							D21							
5b		C40	148				A7									F7								
6		B26			20P 11		F9											X						
6a		B26			20P 11					X							D20							
6b		C11	143				A9									F9								
7		B02			16P 42		E10											X						
7a		B02			16P 42					X							D19							
7b		C46	166				B12									E10								
8		B13			16P 49		E6											X						
8a		B13			16P 49					X							D18							
8b		C05	161				B4									E6								

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NSD

FP-INT-R1

STEP No.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
9		B15			16P 59		L6			X								X						
9a		B15			16P 59					X							D17							
9b		347	160				P4									L6								
10		B33			16P 61		L10											X						
10a		B33			16P 61					X							D16							
10b		C19	155				P12									L10								
11		B23			16P 63		K11											X						
11a		B23			16P 63					X							D15							
11b		C16	165				M14									K11								
12		B01			16P 41		F11											X						
12a		B01			16P 41					X							D14							
12b		C57	162				D14									F11								

FUEL HANDLING DATA SHEET

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WESTINGHOUSE FORM 15348

STEP No.	DATE & TIME	PULL					FROM									TO								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
13	7/3/78 1655	B31			16P 50		F5											X						
13a	7/3/78 1709	B31			16P 50					X							D13							
13b	7/3/78 1707	C63	140				D2									F5								
14	7/3/78 1717	B10			16P 47		K5											X						
14a	7/3/78 1735	B10			16P 47					X							D12							
14b	7/3/78 1750	C36	158				M2									K5								
15	7/3/78 1521	A12	163				J5											X						
15a	7/3/78 1497	A12	163							X							E4							
15b	7/3/78 1514	J54	150				L1									J5								
16	7/3/78 1526	A22	132				G11											X						
16a	7/3/78 1503	A22	132							X							E3							
16b	7/3/78 1535	J58	133				E15									G11								

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NSD

FUEL HANDLING DATA SHEET

EFFECTIVE DATE JUN 2 1978

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REVISED DATE

STEP No.	DATE & TIME	PULL					FROM									INSERT IN							INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
17	7/3/78 1049	A55	137				E11											X						RHC 1951
17a	7/3/78 1104	A55	137							X							G18							SFP 1913
17b	7/3/78 1100	A35	134				E5											X						SFP 1913
17c	7/3/78 1124	A25	134							X							G16							SFP 1920
17d	7/3/78 1112	A60	138				L5											X						RHC 1927
17e	7/3/78 1132	A60	138							X							F18							RHC 1935
17f	7/3/78 1138	A31	153				L11											X						SFP 1940
17g	7/3/78 1146	A31	153							X							G14							SFP 1951
17h	7/3/78 1144	B20			20P 1		J6											X						RHC 1957
17i	7/3/78 1154	B20			20P 1					X							D11							RHC 2003
17j	7/3/78 1155	A60	139				J1									J6								SFP 2013
18	7/3/78 2015	B42			20P 33		J10											X						RHC 2022

NSD

FP-INT-R1

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM										INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
18a	7/3/05 2119	B42			SOP 23					X							D10								7/3/05 2122
18b	7/3/05 2116	C52	154				J15									J10									7/3/05 2123
19	7/3/05 2120	B09			SOP 12		G6											X							7/3/05 2132
19a	7/3/05 2127	B09			SOP 12					X							R19								7/3/05 2135
19b	7/3/05 2127	C12	144				G1									G6									7/3/05 2143
20	7/3/05 2124	B52			SOP 10		G10											X							7/3/05 2231
20a	7/3/05 2235	B52			SOP 10					X							R18								7/3/05 2241
20b	7/3/05 2240	C30	136				G15									G10									7/3/05 2301
21	7/3/05 2257	P07	251						P15									X			.				7/3/05 2301
21a	7/3/05 2302	P07	251							X						G1									7/3/05 2313
22	7/3/05 2305	P33	155						J14									X							7/3/05 2313
22a	7/3/05 2315	P33	155							X						J1									7/3/05 2324

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM											INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
23	7/3/78 2313	P50	226						K17									X							
23a	7/3/78 2331	P50	226							X						L1									
24	7/3/78 2333	P11	222						K13									X							
24a	7/3/78 2342	P11	222							X						J15									
25	7/3/78 2351	P63	216						J21									X							
25a	7/3/78 2352	P63	216							X						G15									
26	7/3/78 2359	P20	200						H17									X							
26a	7/4/78 0005	P20	200							X						E15									
27	7/4/78 0013	P47	245						L23									X							
27a	7/4/78 0017	P47	245							X						D14									
28	7/4/78 0019	P51	221						K12									X							
28a	7/4/78 0023	P51	221							X						M14									

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STEP No.	DATE & TIME	PULL					FROM										INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
29	7/4/78 0027	P36	244						L22									X							KHC 0030
29a	7/4/78 0034	P36	244							X						D2									JHC 0042
30	7/4/78 0037	P43	237						L15									X							MC 0045
30a	7/4/78 0046	P43	237							X						M2									RK 0046
31	7/4/78 0047	P04	242						L20									X							KHC 0051
31a	7/4/78 0105	P04	242							X						B4									KHC 0107
32	7/4/78 0059	P29	243						L21									X							KHC 0106
32a	7/4/78 0127	P29	243							X						P4									KHC 0134
33	7/4/78 0112	P08	231						K22									X							KHC 0135
33a	7/4/78 0140	P08	231							X						B12									KHC 0147
34		P39	233						L10									X							
34a		P39	233							X						P12									

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REVISED DATE

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STEP No.	DATE & TIME	PULL					FROM										INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
35		P40	218						J23									X						
35a		P40	218							X						A5								
36		P22	198						H15									X						
36a		P22	198							X						A7								
37		P58	205						H22									X						
37a		P58	205							X						A9								
38		P05	238						L16									X						
38a		P05	238							X						R11								
39		P30	195						H12									X						
39a		P30	195							X						R9								
40		P48	241						L19									X						
40a		P48	241							X						R7								

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	RCC CHANGE FIXTURE 2	RCC CHANGE FIXTURE 3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	RCC CHANGE FIXTURE 2	RCC CHANGE FIXTURE 3	
41		A09		R108			K6														X			
41a		P14							H11									X						
41b		P14								X													X	
41c				R108									X										X	
41d		A09											X					X						
41e		A09								X							C5							
41f		C27		R84			N3									K6								
42		A05		R82			K10														X			
42a		P14		R108											X	N3								
43		C13		R61			N13									K10								
44		P24							L11									X						
44a		P24								X													X	

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM → INSERT IN																		INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
44b				R82									X										X		
44c		A05											X					X							
44d		A05								X							B5								
44e		P24		R82											X	N13									
45		419		R72			F10														X				
45a		P34							J15									X							
45b		P34								X													X		
45c				R72									X										X		
45d		A19											X					X							
45e		A19								X							C4								
45f		C28		R78			C13									F10									
46		A10		K99			F6														X				

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL: ASSY. NO.	TP	RCC	BPRA	SOURCE	FROM: REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	INSERT IN: REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	INIT. & TIME
46a		P34		R72											X	C13								
47		C29		R90			C3									F6								
48		P16							J10									X						
48a	7/4/78 1600	P16								X													X	
48b	7/4/78 1630			R99									X										X	
48c	7/4/78 1645	A10											X					X						
48d	7/4/78 1657	A10								X							B4							
48e	7/4/78 1713	P16		R99											X	C3								
49	7/4/78 1803	B14			12P 18X		C6											X						
49a	7/4/78 1821	B14			12P 18X					X							D9							
49b	7/4/78 1841	B05			12P 6X		C10											X						
49c		B05			12P 6X					X							D8							

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STEP No.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
49a	7/4/78 1210	B37			12P 7X		N6											X						
49b	7/4/78 1214	B37			12P 7X					X							D7							
49c	7/4/78 1220	B56			12P 11X		H10											X						
49d	7/4/78 1224	B56			12P 11X					X							D6							
49e	7/4/78 1228	B41			12P 16X		K13											X						
49f	7/4/78 1231	B41			12P 16X					X							D5							
49g	7/4/78 1235	B25			12P 4X		F13											X						
49h	7/4/78 1239	B25			12P 4X					X							D4							
49i	7/4/78 1243	B03			12P 12X		K3											X						
49j	7/4/78 1247	B03			12P 12X					X							R17							
49k	7/4/78 1251	B19			12P 17X		F3											X						
49l	7/4/78 1256	B19			12P 17X					X							R16							

FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	PULL					FROM									INSERT IN							INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
49 10	7/4/75 1224	358			16P 56		H11											X						
49 9	7/4/75 1537	658			16P 56					X							R15							
49 12	7/4/75 1536	332			16P 64		E8											X						
49 8	7/4/75 1542	832			16P 64					X							R14							
49 11	7/4/75 1549	338			16P 60		L8											X						
49 7	7/4/75 1550	838			16P 60					X							R13							
49 14	7/4/75 1603	851			16P 52		H5											X						
49 13	7/4/75 1617	651			16P 52					X							R12							
49 6	7/4/75 1615	322			20P 16		D5											X						
49 5	7/4/75 1624	822			20P 16					X							R11							
49 2	7/4/75 1627	216			20P 14		H5											X						
49 33	7/4/75 1641	816			20P 14					X							N19							

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
2bb	7/4/78 1939	D01			20P 6		M11											X						
4202	7/4/78 2054	201			20P 6					X							N18							
41bb	7/4/78 1951	B15			20P 21		D11											X						
4122	7/4/78 2050	345			20P 21					X							N17							
4111	7/4/78 2059	517			16P 44		H9											X						
4133	7/4/78 2108	B17			16P 44					X							N14							
11bb	7/4/78 2016	353			16P 46		G8											X						
4166	7/4/78 2028	253			16P 46					X							N13							
2bb	7/4/78 2034	134			49P 1		A6											X						
4222	7/4/78 2041	134			49P 1					X							N12							
4211	7/4/78 2039	149			49P 4		A10											X						
4bb	7/4/78 2057	149			49P 4					X							N11							

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL: ASSY. NO.	PULL: TP	PULL: RCC	PULL: BPRA	PULL: SOURCE	FROM: REACTOR CORE POS.	FROM: NFS POS.	FROM: SFP POS.	FROM: UPENDER	FROM: TP TOOL	FROM: N.F.E.	FROM: RCC CHANGE FIXTURE 1	FROM: RCC CHANGE FIXTURE 2	FROM: RCC CHANGE FIXTURE 3	INSERT IN: REACTOR CORE POS.	INSERT IN: SFP POS.	INSERT IN: UPENDER	INSERT IN: N.F.E.	INSERT IN: TP TOOL	INSERT IN: RCC CHANGE FIXTURE 1	INSERT IN: RCC CHANGE FIXTURE 2	INSERT IN: RCC CHANGE FIXTURE 3	INIT. & TIME
49	7/4/78 2227	130			ASP 2		R6											X						RJC 2233
49	7/4/78 2238	138			ASP 2					X							N20								SAC 2243
49	7/4/78 2247	109			ASP 5		R10											X							RJC 2246
49	7/4/78 2254	109			ASP 5					X							G21								RJC 2255
49	7/4/78 2245	26			ASP 3		18											X							RJC 2257
49	7/4/78 2301	126			ASP 3					X							N15								SAC 2304
49	7/4/78 2310	122			ASP 6		R8											X							SAC 2312
49	7/4/78 2313	122			ASP 6					X							N16								RJC 2314
49	7/4/78 2317	117			ASP 3		33											X							RJC 2318
49	7/4/78 2324	117			ASP 3					X							F9								SAC 2329
49	7/4/78 2331	151			ASP 4		D3											X							RJC 2330
49	7/4/78 2345	156			ASP 4					X							F8								RJC 2334

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STEP No.	DATE & TIME	PULL					FROM										INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
1/9 22	7/4/78 2236	233			BSP 1		B13											X							
4/9 2200	7/4/78 2307	C33			GSP 1					X							F7								
4/9 bb	7/4/78 2346	C35			ASP 1		P13											X							
4/9 cc	7/4/78 2355	C35			ASP 1					X							F6								
4/9 dd	7/4/78 2356	204			GSP 4		F1											X							
4/9 ee	7/5/78 0009	204			BSP 4					X							F5								
4/9 ff	7/5/78 0007	201			2SP 7		J2											X							
4/9 gg	7/5/78 0021	201			2SP 7					X							F4								
4/9 hh	7/5/78 0030	237			BSP 5		F15											X							
4/9 ii	7/5/78 0035	237			BSP 5					X							F3								
4/9 jj	7/5/78 0031	231			2SP 22		J14											X							
4/9 kk	7/5/78 0046	C31			2SP 22					X							G19								

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STEP No.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
49LL	7/15/78 0753	P49	196						H13									X						
49aa	7/15/78 0801	P49	196							X						J2								
50	7/15/78 0806	P10	223						K14									X						
50a	7/15/78 0813	P10	223							X						F1								
51	7/15/78 0811	P28	208						J12									X						
51a	7/15/78 0820	P28	208							X						J14								
52	7/15/78 0823	P19	206						H23									X						
52a	7/15/78 0832	P19	206							X						F15								
53		A03	135				G7											X						
53a		A03	135							X							E9							
53b		A04	167				G9											X						
53c		A04	167							X							E8							

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL: ASSY. NO.	PULL: TP	PULL: RCC	PULL: BPRA	PULL: SOURCE	FROM: REACTOR CORE POS.	FROM: NFS POS.	FROM: SFP POS.	FROM: UPENDER	FROM: TP TOOL	FROM: N.F.E.	FROM: RCC CHANGE FIXTURE 1	FROM: RCC CHANGE FIXTURE 2	FROM: RCC CHANGE FIXTURE 3	INSERT IN: REACTOR CORE POS.	INSERT IN: SFP POS.	INSERT IN: UPENDER	INSERT IN: N.F.E.	INSERT IN: TP TOOL	INSERT IN: RCC CHANGE FIXTURE 1	INSERT IN: RCC CHANGE FIXTURE 2	INSERT IN: RCC CHANGE FIXTURE 3	INIT. & TIME
53l		A28	145				J9											X						
53m		A28	145							X							E7							
53n		L42			12P 5X		P5											X						
53o		L42			12P 5X					X							G17							
53p		C02			12P 14X		E2											X						
53q		C02			12P 14X					X							G15							
53r		L21			12P 15X		L14											X						
53s		L21			12P 15X					X							F19							
			Commence				BPRA's				Thimble					Plug								
			Changeouts				in the				S.F.P.													

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STEP No.	DATE & TIME	PULL					FROM										INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
1					BP 17				D23																
2					BP 12				R19								Q19								
3					BP				D22								C22								
4					BP 10				R16							N7	Q16								
5					BP 09				D21								C21								
6					BP 12X				R17							C18	Q17								
7					BP 11				D20								C20								
8					BP 17X				R16								Q16								
9					BP 42				D19								C19								
10					BP 56				R15								Q15								
11					BP 41				D18								C18								
12					BP 61				R14								Q14								

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STEP No.	DATE & TIME	PULL: ASSY. NO.	TP	RCC	BPRA	SOURCE	FROM: REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	INSERT IN: REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	INIT. & TIME
13	7/31/75 0240				16P 57				D14	DN	P						Q23							RAC 0245
14	7/31/75 1145				16P 60				R13								Q13							RAC 1150
15	7/31/75 1153				16P 61				D16								Q16							RAC 1158
16	7/31/75 1206				16P 52				R12								Q12							RAC 1210
17	7/31/75 1212				16P 63				D15								Q15							RAC 1217
18	7/31/75 1216				16P 46				R11								Q11							RAC 1220
19	7/31/75 2136				16P 41				D14								Q14							RAC 2145
20	7/31/75 2354				30P 14				N19								P19							RAC 2359
21	7/31/75 2216				16P 50				D13								Q13							RAC 2220
22	7/31/75 2226				30P 6				N13								P13							RAC 2230
23	7/31/75 2232				16P 47				D12								Q12							RAC 2240
24	7/31/75 2243				30P 21				N17								P17							RAC 2247

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STEP No.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
25	7/6/75 2356				20P 1				D11								C11							KHC 2357
26	7/6/75 [illegible]				14P 6				N16								P16							KHC [illegible]
27	7/6/75 0002				20P 23				D10								C10							KHC 0005
28	7/6/75 0002				14P 3				N15								P15							KHC 0006
29	7/6/75 0053				12P 19X				D7								C7							KHC 0104
30	7/6/75 0102				16P 4X				N14								P14							KHC 0113
31	7/6/75 0116				12P 6X				D8								C8							KHC 0125
32	7/6/75 0129				16P 16				N13								P13							KHC 0134
33	7/6/75 0137				12P 7X				D7								C7							KHC 0142
34	[illegible]	[illegible]			14P 1				N12								P12							[illegible]
35	[illegible]				12P 11X				D6								C6							[illegible]
36	[illegible]				14P 4				N11								P11							[illegible]

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STEP No.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
37					12F 16X				D5								C5							
38					16F 5				N20								B5							
39					12F 4X				D4								C4							
40					16F 5				G21								B4							
41			135						E9								N14							
42			167						E8								N13							
43			145						E7								N12							
44			134						E6								N11							
45			168						E5								N20							
46			165						E4								G21							
47			132						E3								D10							
48			153						G14								D11							

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL						FROM										INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE		REACTOR CORE POS.	NFS PUS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3		REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3		
49			134							G16									D12									
50			137							G18									D13									
51			138							F18									D14									
52					ASP 3					F9									E9									
53					BSP 4					F8									E8									
54					BSP 1					F7									E7									
55					ASP 1					F6									E6									
56					BSP 4					F5									E5									
57					20P 7					F4									E4									
58					BSP 5					F3									E3									
59					10P 15X					F19									F18									
60					20P 22					G19									G18									

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STEP No.	DATE & TIME	PULL						FROM										INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE		REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3		REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
61					12P SX					G17									G16								
62					12P 1/4					G15									G14								
63			06										X						D15								
64			07										X						D20								
65			08										X						D21								
66			09										X						D22								
67			10										X						D23								
68			11										X						R18								
69			12										X						R19								
70			13										X						G19								
71			14										X						F19								
72			15										X						G17								
73			16										X						G15								

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL: ASSY. NO.	PULL: TP	PULL: RCC	PULL: BPRA	PULL: SOURCE	FROM: REACTOR CORE POS.	FROM: NFS POS.	FROM: SFP POS.	FROM: UPENDER	FROM: TP TOOL	FROM: N.F.E.	FROM: RCC CHANGE FIXTURE 1	FROM: RCC CHANGE FIXTURE 2	FROM: RCC CHANGE FIXTURE 3	INSERT IN: REACTOR CORE POS.	INSERT IN: SFP POS.	INSERT IN: UPENDER	INSERT IN: N.F.E.	INSERT IN: TP TOOL	INSERT IN: RCC CHANGE FIXTURE 1	INSERT IN: RCC CHANGE FIXTURE 2	INSERT IN: RCC CHANGE FIXTURE 3	INIT. & TIME
74	7/6/78 1954		17									X					F9							KHC 1954
75	7/6/78 1958		18									X					F8							KHC 2001
76	7/6/78 2009		19									X					F7							KHC- 2011
77	7/6/78 2014		20									X					F6							KHC 2017
78	7/6/78 2023		169									X					F5							KHC 2027
79	7/6/78 2030		170									X					F4							KHC- 2032
80	7/6/78 2037		171									X					F3							KHC 2032
			Critical			Fuel	Shuffle					at	STEP	53										

FUEL HANDLING DATA SHEET

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STEP No.	DATE & TIME	PULL					FROM									INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
53	7/26/85 0103	B10	134						D12									X							
53a	7/26/85 0112	B10	134							X						A3									
54	7/26/85 0115	B21	137						D13									X							
54a	7/26/85 0124	B21	137							X						F3									
55	7/26/85 0134	B01	138						D14									X							
55a	7/26/85 0159	B01	138							X						F13									
56	7/26/85 2001	B23	06						D15									X							
56a	7/26/85 2014	B23	06							X						K13									
57	7/26/85 2022	B52	11						R18									X							
57a	7/26/85 2031	B52	11							X						H5									
58	7/26/85 2044	B20	153						D11									X							
58a	7/26/85 2051	B20	153							X						H11									

FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	PULL: ASSY. NO.	TP	RCC	BPRA	SOURCE	FROM: REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	M.F.E.	RCC CHANGE FIXTURE 1	2	3	INSERT IN: REACTOR CORE POS.	SFP POS.	UPENDER	M.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	INIT. & TIME
59	7/6/78 2325	C21	14						FP									X						
59a	7/6/78 2326	C21	14							X						37								
60	7/6/78 2328	253	167						N13									X						
60a	7/6/78 2331	253	167							X						68								
61	7/6/78 2336	242	15						317									X						
61a	7/6/78 2339	242	15							X						39								
62	7/6/78 2344	202	16						315									X						
62a	7/6/78 2347	202	16							X						37								
63	7/6/78 2350	217	135						N14									X						
63a	7/6/78 2353	217	135							X						49								
64	7/6/78 2358	231	247						N11									X						
64a	7/6/78 2401	231	247							X						52								

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FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM															INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
65	7/3/75 2303	P42	225						K16									X							2351
65a	7/3/75 2315	P42	225							X						L14									
66	2352	B63	08						D21									X							2301
66a	7/3/75 2356	B63	08							X						E5									
67	7/3/75 2305	B62	09						D22									X							0012
67a	7/3/75 2316	B62	09							X						L5									
68	7/3/75 2321	B26	07						D20									X							2326
68a	7/3/75 2330	B26	07													E11									0037
69	7/3/75 2339	B35	10						D2									X			.				2339
69a	7/3/75 2343	B35	10							X						L11									2351
70	7/3/75 2352	B12	132						D10									X							2401
70a	7/3/75 2358	B12	132							X						E8									2414

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM										INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
71	7/27/78 0113	209	12						R19								X							
71a	7/27/78 0126	209	12							X						LB								
72		217	17						F9								X							
72a		217	17							X						D5								
73		233	19						F7								X							
73a		233	19							X						D11								
74		235	20						F6								X							
74a		235	20							X						M11								
75		256	18						F8								X							
75a		256	18							X						M5								
76		R02	250						M4								X							
76a		R02	250							X						B3								

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM										INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
77		P09	227						K18									X							
77a		P09	227							X						B13									
78		P12	220						K11									X							
78a		P12	220							X						P13									
79		P01	253						M17									X							
79a		P01	253							X						P3									
80		P26	203						H20									X							
80a		P26	203							X						P5									
81		P03	246						M10									X							
81a		P03	246							X						R6									
82		P21	201						H18									X							
82a		P21	201							X						A6									

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM											INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	EPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
83		P61	224						K15									X						
83a		P61	224							X						A10								
84		P27	224						L14									X						
84a		P27	224							X						R10								
85		P60	220						K23									X						
85a		P60	220							X						A8								
86		P46	201						J11									X						
86a		P46	201							X						R8								
87		206	151				R5																X	
87a		B02							D19									X						
87b		A13		R67			L7													X				
87c			151												X			X						

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STEP NO.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
77a				R67									X										X	
87a		B02	151							X						C10								
88		A13											X					X						
88a		A13								X							N14							
88b		306		R67											X	L7								
89		120		R98			G5														X			
89a		P59	209						J13									X						
89b		P59	209							X						R5								
90		B13							D18									X						
90a		C50	159				E1																X	
90b			159												X			X						
90c				R98									X										X	

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STEP No.	DATE & TIME	FULL					FROM									INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
90a		B13	159							X						P6									
91		420											X					X							
91a	"	420								X							N13								
91b		150		R78											X	G5									
92		416		R81			E9														X				
92a		P15	204						H21									X							
92b		P15	204							X						E1									
93		B15							D17									X							
93a		144	152				A11														.		X		
93b			152												X			X							
93c				R01									X										X		
93d		B15	152							X						N6									

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
94		A16											X					X							
94a		A16								X							G9								
94b		C4		R81											X	E9									
95		A15		R87			J11														X				
95a		P23	239						L17									X							
95b		P23	239							X						A11									
96		B33							D16									X							
96a		C44	141				L15																X		
96b			141												X			X							
96c				R87									X										X		
96d		B33	141							X						N10									
97		A15											X					X							

FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	FULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
97a	7/9/78 1153	A15								X							G8							1153
97b	7/9/78 1159	C44		R87											X	J11								1159
98	7/9/78 1237	A43		RS 28			K12											X						1247
98a	7/9/78 1253	A43		RS 28						X							G15							1255
98b	7/9/78 1251	A59		RS 26			D10											X						1250
98c	7/9/78 1249	A59		RS 26						X							G20							1249
98d	7/9/78 1248	A63		RS 25			D6											X						1248
98e	7/9/78 1234	A63		RS 25						X							F14							1241
98f	7/9/78 1231	A38		RS 22			K4											X						1243
98g	7/9/78 1243	A38		RS 22						X							F16							1252
98h	7/9/78 1244	A51		RS 23			F16											X						1255
98i	7/9/78	A51		RS 23						X							F17							1254

FUEL HANDLING DATA SHEET

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STEP	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
98	7/6/78 1359	64		K5 27			M10											X						KMC 1516
98A	7/6/78 1512	64		K5 27						X							F2							KMC 1516
98B	7/6/78 1520	237	171						F3									X						KMC 1523
98M	7/6/78 1527	237	171							X						K4								KMC 1543
99	7/6/78 1538	204	169						F5									X						KMC 1557
99A	7/6/78 1543	204	167							X						K12								KMC 1562
100	7/6/78 1549	249	164						N11									X						KMC 1592
100A	7/6/78 1553	249	164							X						M6								KMC 1606
101	7/6/78 1562	234	145						N12									X						KMC 1907
101A	7/6/78 1604	234	145							X						M10								KMC 1923
102	7/6/78 1608	238	168						N13									X						KMC 1915
102A	7/6/78 1614	238	168							X						D10								KMC 1927

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STEP No.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
103	7/6/78 1736	109	163						G21									X						
103a	7/6/78 1937	C09	163							X						D6								
104	7/6/78 1938	P64	212						J17									X						
104a	7/6/78 1945	P64	212							X						L15								
105	7/6/78 1955	A17		R89			K14														X			
105a	7/6/78 1959	B41							D5									X						
105b	7/6/78 2007	B41								X													X	
105c	7/6/78 2013			R89									X										X	
105d	7/6/78 2017	A17											X					X						
105e	7/6/78 2023	A17								X							G7							
105f	7/6/78 2033	B41		R89										X		K14								
106	7/6/78 2037	123		R86			F14													X				

FUEL HANDLING DATA SHEET

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STEP No.	DATE & TIME	PULL: ASSY. NO.	PULL: TP	PULL: RCC	PULL: BPRA	PULL: SOURCE	FROM: REACTOR CORE POS.	FROM: NFS POS.	FROM: SFP POS.	FROM: UPENDER	FROM: TP TOOL	FROM: N.F.E.	FROM: RCC CHANGE FIXTURE 1	FROM: RCC CHANGE FIXTURE 2	FROM: RCC CHANGE FIXTURE 3	INSERT IN: REACTOR CORE POS.	INSERT IN: SFP POS.	INSERT IN: UPENDER	INSERT IN: N.F.E.	INSERT IN: TP TOOL	INSERT IN: RCC CHANGE FIXTURE 1	INSERT IN: RCC CHANGE FIXTURE 2	INSERT IN: RCC CHANGE FIXTURE 3	INIT. & TIME
106a	2147	B25							D4									X						
106b	2147	B25								X													X	
106c	2153			R86									X										X	
106d	2157	A23											X					X						
106e	2206	A23								X							G6							
106f	2209	B25		R86											X	F14								
107a	2213	A01		R68			F2														X			
107b	2232	B19							R16									X						
107c	2237	B19								X													X	
107d	2243			R68									X										X	
107e	2243	A01											X					X						
107f	2243	A01								X							G5							

(12) NSD

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FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL: ASSY. NO.	PULL: TP	PULL: RCC	PULL: BPRA	PULL: SOURCE	FROM: REACTOR CORE POS.	FROM: NFS POS.	FROM: SFP POS.	FROM: UPENDER	FROM: TP TOOL	FROM: N.F.E.	FROM: RCC CHANGE FIXTURE 1	FROM: RCC CHANGE FIXTURE 2	FROM: RCC CHANGE FIXTURE 3	INSERT IN: REACTOR CORE POS.	INSERT IN: SFP POS.	INSERT IN: UPENDER	INSERT IN: N.F.E.	INSERT IN: TP TOOL	INSERT IN: RCC CHANGE FIXTURE 1	INSERT IN: RCC CHANGE FIXTURE 2	INSERT IN: RCC CHANGE FIXTURE 3	INIT. & TIME
107	7/16/79 2315	319		R68											X	F2								
108	7/16/79 2315	918		R96			K2														X			
108a	7/16/79 2319	203							R17									X						
108b	7/16/79 2324	303								X													X	
108c	7/16/79 2332			R96									X										X	
108d	7/16/79 2336	918											X					X						
108e	7/16/79 2340	A18								X							G4							
108f	7/16/79 2344	203		R96											X	K2								
109	7/16/79 2352	410		R92			H2														X			
109a	7/16/79 2357	B41							R12									X						
109b	7/17/79 0001	B41								X													X	
109c	7/17/79 0005			R12									X										X	

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STEP NO.	DATE & TIME	PULL: ASSY. ID.	PULL: TP	PULL: RCC	PULL: BPRA	PULL: SOURCE	FROM: REACTOR CORE POS.	FROM: NFS POS.	FROM: SFP POS.	FROM: UPENDER	FROM: TP TOOL	FROM: N.F.E.	FROM: RCC CHANGE FIXTURE 1	FROM: RCC CHANGE FIXTURE 2	FROM: RCC CHANGE FIXTURE 3	INSERT IN: REACTOR CORE POS.	INSERT IN: SFP POS.	INSERT IN: UPENDER	INSERT IN: N.F.E.	INSERT IN: TP TOOL	INSERT IN: RCC CHANGE FIXTURE 1	INSERT IN: RCC CHANGE FIXTURE 2	INSERT IN: RCC CHANGE FIXTURE 3	INIT. & TIME
109d	7/6/79 0811	A46											X					X						
109e	7/6/79 0819	A40								X							G3							
109f	7/6/79 0817	B61		R92											X	112								
110	7/6/79 0824	A32		R100			114														X			
110a	7/6/79 0829	B58							R15									X						
110b	7/6/79 0834	B58								X													X	
110c	7/6/79 0837			R100									X										X	
110d	7/6/79 0849	A32											X					X						
110e	7/6/79 0852	A32								X							N12							
110f	7/6/79 0857	B58		R100											X	114								
111	7/6/79 0902	A21		R76			B10														X			
111a	7/6/79 0905	B05							D8									X						

USB

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FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	FULL: ASSY. NO.	FULL: TP	FULL: RCC	FULL: BPRA	FULL: SOURCE	FROM: REACTOR CORE POS.	FROM: NFS POS.	FROM: SFP POS.	FROM: UPENDER	FROM: TP TOOL	FROM: N.F.E.	FROM: RCC CHANGE FIXTURE 1	FROM: RCC CHANGE FIXTURE 2	FROM: RCC CHANGE FIXTURE 3	INSERT IN: REACTOR CORE POS.	INSERT IN: SFP POS.	INSERT IN: UPENDER	INSERT IN: N.F.E.	INSERT IN: TP TOOL	INSERT IN: RCC CHANGE FIXTURE 1	INSERT IN: RCC CHANGE FIXTURE 2	INSERT IN: RCC CHANGE FIXTURE 3	INIT. & TIME
111.b	11/13/73 0114	B05								X													X	
111c	11/13/73 0116			R76									X										X	
111.d	11/13/73 0120	A21											X					X						
111.e	11/13/73 0135	A21								X							N11							
111.f	11/13/73 0138	B05		R76											X	B10								
112		A37		R88			B8														X			
112.a		B32							RM									X						
112.b		B32								X													X	
112.c				R88									X										X	
112.d		A39											X					X						
112.e		A39								X							N21							
112.f		B32		R88											X	B8								

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
113		A20		R103			18														X			
113a		B14							D9									X						
113b		B14								X													X	
113c				R103									X										X	
113d		A30											X					X						
113e		A30								X							G21							
113f		A24		R94			B6									118								
114		B14		R103											X	B6								
115		A06		R66			P6														X			
115a		B37							D7									X						
115b		B37								X													X	
115c				R66									X										X	
115d		A06											X					X						

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STEP NO.	DATE & TIME	PULL: ASSY. NO.	TP	RCC	BPRA	SOURCE	FROM: REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	INSERT IN: REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	INIT. & TIME
1152		206								X							F21							
1151		337		R66											X	P6								
1150		137		R91			P8														X			
1149		338							R13									X						
1148		038								X													X	
1147				R91									X										X	
1146		A37											X					X						
1145		137								X							G11							
1141		338		R91											X	P8								
1140		102		R64			P10														X			
1139		356							D6									X						
1138		356								X													X	

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FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
117c				R64									X										X	
117d		A02											X					X						
117e		A02								X							F15							
117f		356		R61											X	P10								
118		158		R80			N11														X			
118a		B04							[illegible]									X						
118b		B01								X													X	
118c				R80									X										X	
118d		156											X					X						
118e		158								X							C3							
119		B04		R80											X	N11								
119a		133		R11			C11														X			

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
112		A46							R17									X						
114		A40								X													X	
116				R113									X										X	
118		A33											X					X						
119		A23								X							E10							
121		A6		R113											X	C11								
125		A16		R83			C5														X			
126		B32							R11									X						
128		B22								X											.		X	
130				R83									X										X	
132		A5											X					X						
134		A4								X							G10							

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FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM → INSERT IN																				INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
120		B22		R83											X	L5									
121		A50		R65			N5														X				
121a		B16							N19									X							
121b		B16								X													X		
121c				R65									X										X		
121d		A50											X					X							
121e		150								X							E11								
121f		B16		R65											X	N5									
122		A53		R73			N18														X				
122a		126							N15									X							
122b		B16								X													X		
122c				R73									X										X		

FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
1224		A53											X					X							
1222		A52								X							N15								
1221		026		R72											X	H8									
1223		A26		R76			D8														X				
1220		122							N12									X							
1221		122								X													X		
1222	7/16/75 1601			R76									X										X		1601
1220	7/16/75 1603	A26											X					X							1603
1222	7/16/75 1614	122								X							N11								1612
1221	7/16/75 1615	122		R70											X	D8									1615
123	7/16/75 1616	A11			208 19		E4											X							1616
	7/16/75 1621	A11			208 11					X							F11								1635

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FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
124b	6/16/78 1624	B18			20P 4		L4											X						1637
124c	6/16/78 1642	B18			20P 4					X							F10							1645
124d	6/16/78 1646	B21			20P 20		E12											X						1655
124e	6/16/78 1657	B21			20P 20					X							F9							1655
124f	6/16/78 1651	B51			20P 5		L12											X						1700
124g	6/16/78 1701	B51			20P 5					X							F8							1712
124h	6/16/78 1713	B06			16P 62		D7											X						1713
124i	6/16/78 1717	B06			16P 62					X							F7							1722
124j	6/16/78 1725	B64			16P 43		D9											X						1733
124k	6/16/78 1732	B64			16P 43					X							F6							1743
124l	6/16/78 1742	B12			16P 54		J17											X						1755
124m	6/16/78 1758	B12			16P 54					X							F5							1744

FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	FULL: ASSY. NO.	FULL: TP	FULL: RCC	FULL: BPRA	FULL: SOURCE	FROM: REACTOR CORE POS.	FROM: NFS POS.	FROM: SFP POS.	FROM: UPENDER	FROM: TP TOOL	FROM: N.F.E.	FROM: RCC CHANGE FIXTURE 1	FROM: RCC CHANGE FIXTURE 2	FROM: RCC CHANGE FIXTURE 3	INSERT IN: REACTOR CORE POS.	INSERT IN: SFP POS.	INSERT IN: UPENDER	INSERT IN: N.F.E.	INSERT IN: TP TOOL	INSERT IN: RCC CHANGE FIXTURE 1	INSERT IN: RCC CHANGE FIXTURE 2	INSERT IN: RCC CHANGE FIXTURE 3	INIT. & TIME
124m	1745	B50			16P 51		K19											X						KRC 1741
124o	1752	B50			16P 51					X							D11							KRC 1755
124p	1753	215			11P 4		12											X						KRC 1759
124q	1800	215			11P 4					X							D10							KRC 1811
124r	1807	251			8P 3		N2											X						KRC 1813
124s	1810	251			8P 3					X							D9							KRC 1823
124t	1814	259			18P 2		N14											X						KRC 1825
124u	1822	259			18P 2					X							D8							KRC 1834
124v	1827	248			13P 2		C14											X						KRC 1836
124w	1832	248			13P 2					X							D7							KRC 1845
124x	1840	343			16P 48		G4											X						KRC 1849
124y	1847	343			16P 48					X							D6							KRC 1857
U																								

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
124z	7/16/79 1552	B34			16P 53		J4											X						RFC 1605
124aa	7/16/79 1456	B34			16P 53					X							D5							RFC 1516
124bb	7/16/79 1704	B60			16P 55		G12											X						RFC 1912
124cc	7/16/79 1536	B60			16P 55					X							D4							RFC 1912
124dd	7/16/79 1604	B30			16P 58		J12											X						RFC 1934
124ee	7/16/79 1731	B30			16P 58					X							F3							RFC 1935
124ff	7/16/79 1737	B47			20P 9		D3											X						RFC 1935
124gg	7/16/79 1949	B47			20P 9					X							J10							RFC 1945
124hh	7/16/79 1942	B46			20P 21		M3											X						RFC 1949
124ii	7/16/79 1555	B46			20P 21					X							B3							RFC 2001
124jj	7/16/79 1957	B08			20P 13		D13											X						RFC 2003
124kk	7/16/79 2002	B08			20P 13					X							D3							RFC 2012

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STEP No.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
124ll	7/16/80 2206	B29			20P 8		M13											X						AC- 2214
124ma	7/16/80 2213	B29			20P 8					X							FP							AHC- 2223
124na	7/16/80 2217	J26	149				J7											X						AHC- 2229
124oa	7/16/80 2223	J26	149							X							G11							AHC- 2238
124pa	7/16/80 2233	C18			12P 8X		B11											X						AHC- 2246
124qa	7/16/80 2241	C18			12P 8X					X							H11							AHC- 2251
124ra	7/16/80 2245	C31	13						G19									X						AHC- 2255
124sa	7/16/80 2254	C31	13							X						M13								AHC- 2300
125	7/16/80 2311	C01	170						F4									X			.			AHC- 2310
125a	7/16/80 2319	C01	170							X						M13								AHC- 2321
126	7/16/80 2330	P25	230						K21									X						AHC- 2336
126a	7/16/80 2335	P25	230							X						C2								AHC- 2342

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FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
127	7/16/79 2249	P53	249						M13									X						
127a	7/16/79 2316	P53	249							X						N2								
128	7/16/79 2324	P56	199						H16									X						
128a	7/16/79 2329	P56	199							X						C14								
129	7/16/79 2336	P45	235						L13									X						
129a	7/16/79 2338	P45	235							X						N14								
130	7/16/79 2347	C23			BPR 3		H15											X						
130a	7/16/79 2349	223			BPR 3					X							F4							
130b	7/16/79 0016	224			BPR 6		H1											X						
130c	7/16/79 0022	224			BPR 6					X							G19							
130d	7/16/79 0026	P54	219						K10									^						
130e	7/16/79 0030	P54	219							X						H1								

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
131	Hold 2350	P52	211						J16									X						
131a	Hold 0641	P52	211							X						H15								
					Connect				BPRA															
				Change							tool			SF		P.								
1					20P 8				F17								F15							
2					16P 6				J19								J17							
3					16P 58				F3								G3							
4					BPR 3				F4								G4							
5					16P 54				F5								G5							
6					16P 43				F6								G6							
7					6P 62				F7								G7							
8					20P 5				F8								G8							

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STEP No.	DATE & TIME	PULL					FROM								INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
9					24				F9								B9							
10					24				F10								E10							
11					24 19				F11								E11							
12					16A 51				D11								N15							
13					24 11				D10								N16							
14					24				D9								N14							
15					16A 51				D8								N13							
16					24 2				D7								N12							
17					16A 48				D6								E11							
18					24				D5								N21							
19					24 22				D4								G21							
20					24 12				D3								13							

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM										INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
21					20P 21				B3								F21								
22					20I 9				J10								G10								
23			141						G11							31	J10								
24					12P 8X				H11								G11								
25			172									X					F19								
26			173									X					D3								
27			174									X					B3								
28			175									X					D10								
29			176									X					D9								
30			177									X					D8								
31			178									X					D7								
32			179									X					H11								
		Com	me	l.	Sec																				

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
132	7/16/85 1552	B19	149					J11	J10									X						RHC 1553
132a	7/16/85 1600	B47	149							X						G4									SFP 1600
133	7/16/85 1603	B46	174						B3									X							SFP 1603
133a	7/16/85 1605	B46	174							X						J4									SFP 1605
134	7/16/85 1610	B08	173						D3									X							RHC 1610
134a	7/16/85 1616	B08	173							X						G12									RHC 1616
135	7/16/85 1621	B29	172						F19									X							RHC 1623
135a	7/16/85 1625	B29	172							X						J12									RHC 1626
136	7/16/85 1627	C18	179						H11									X							RHC 1629
136a	7/16/85 1629	C18	179							X						J7									RHC 1635
137	7/16/85 1648	215	175						D10									X							RHC 1655
137a	7/16/85 1655	115	175							X						E4									RHC 1655

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STEP NO.	DATE & TIME	PULL / FROM	INSERT IN
		ASSY. NO.	
		TP	
		RCC	
		BPRA	
		SOURCE	
		REACTOR CORE POS.	
		NFS POS.	
		SFP POS.	
		UPENDER	
		TP TOOL	
		N.F.E.	
		RCC CHANGE FIXTURE 1	
		RCC CHANGE FIXTURE 2	
		RCC CHANGE FIXTURE 3	
		REACTOR CORE POS.	
		SFP POS.	
		UPENDER	
		N.F.E.	
		TP TOOL	
		RCC CHANGE FIXTURE 1	
		RCC CHANGE FIXTURE 2	
		RCC CHANGE FIXTURE 3	
		INIT. & TIME	

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FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
139	7/4/75 1657	C51	176						D9									X						RHC 1705
139a	7/4/75 1716	C51	176							X						L4									RHC 1705
139	7/4/75 1705	C48	178						D7									X						RHC 1716
139a	7/4/75 1717	C48	178							X						E12									RHC 1725
140	7/4/75 1719	C59	177						D8									X						RHC 1732
140a	7/4/75 1731	C59	177							X						L12							4A	RHC 1736
141	7/4/75 1743	P17	213						J18									X						RHC 1739
141a	7/4/75 1746	P17	213							X						B11									RHC 1747
142	7/4/75 1756	A46		R112			C9														X			RHC 1757
142a	7/4/75 1738	B64							F6									X						RHC 1745
142b	7/4/75 1805	B64								X													X	RHC 1807
142c	7/4/75 1809			R112									X										X	RHC 1807

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FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM → INSERT IN																			INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
1		A16											X					X						
2		A16								X							D10							
3		B14		R12											X	C9								
4		A15		R10			C7														X			
5		B06							F7									X						
6		B06								X													X	
7				R10									X										X	
8		A15								X			X					X						
9		A15								X							D9							
10		B06		R10											X	C7								
11		A16		R15			N7														X			
12		B12							F5									X						

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Fuel HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
1446	4/16/78 1053	B12								X													X	
1446	4/16/78 1114			R75									X										X	
1442	4/16/78 1114	A36											X					X						
1446	4/16/78 1133	A36								X							D8							
1441	4/16/78 1133	B12		R75											X	N7								
1443	4/16/78 1151	A49		R77			N9														X			
1450	4/16/78 1205	B50							D11									X						
1451	4/16/78 1206	B50								X													X	
1450	4/16/78 1206			R77									X										X	
1452	4/16/78 1206	A49											X					X						
1452	4/16/78 1207	A49								X							D11							
1451	4/16/78 1207	B50		R77											X	N9								

FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
146	7/16/73 2018	A62		R79			L13														X			
146a	7/16/73 2019	B51						D8	F8									X						
146b	7/16/73 2019	B51								X													X	
146c	7/16/73 2024			R79									X										X	
146d	7/16/73 2024	A62											X					X						
146e	7/16/73 2025	A62								X							D7							
146f	7/16/73 2034	B51		R79											X	L13								
147	7/16/73 2035	A42		R62			E13														X			
147a	7/16/73 2035	B21							F9									X						
147b	7/16/73 2034	B21								X													X	
147c	7/16/73 2037			R62									X										X	
147d	7/16/73 2043	A42											X					X						

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FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
147	7/10/73 2250	A42								X							D3							
147A	7/10/73 2255	321		R62											X	E13								
148	7/10/73 2259	A51		R93			E3														X			
148A	7/10/73 2303	B49							F11									X						
148B	7/10/73 2307	B49								X													X	
148C	7/10/73 2312			R93									X										X	
148D	7/10/73 2316	A54											X					X						
148E	7/10/73 2320	A54								X							F19							
148F	7/10/73 2324	349		R93											X	E3								
149	7/10/73 2328	411		R106			L3														X			
149A	7/10/73 2332	B49							F10									X						
149B	7/10/73 2336	B48								X													X	

FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	PULL					FROM									INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
148c	shuffle core			R106									X										X	
148a	shuffle core	A41											X					X						
148L	shuffle core	A41								X							F6							
148d	shuffle core	B48		R106											X	L3								
150	shuffle core	A47		R110			J3														X			
150a	shuffle core	B34							D5									X						
150b	shuffle core	B31								X													X	
150c	shuffle core			R110									X										X	
150d	shuffle core	A47											X					X			.			
150e	shuffle core	A47								X							F5				.			
150f	shuffle core	B31		R110											X	J3								
151	shuffle core	A52		R63			G3														X			

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FUEL HANDLING DATA SHEET

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STEP NO.	DATE & TIME	FULL					FROM									INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
151a	shutdown cool	B12							D6									X						
151b	shutdown cool	B13								X													X	
151c	shutdown cool			R62									X										X	
151d	shutdown cool	A52											X					X						
151e	shutdown cool	152								X							F17							
151f	shutdown cool	B13		R63											X	R3								
151g		A31		R105			G13														X			
152a		B10							D4									X						
152b		B10								X													X	
152c				R105									X										X	
152d		A31											X					X						
152e		A31								X							F15							

IN-INT-N

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
152		B60		R105											X	G13									
153		A57		R111			J13														X				
153a		B30							F3									X							
153b		B30								X														X	
153c				R111									X											X	
153d		A57											X					X							
153e		A57								X							D4								
153f		B30		R111											X	J13									
154		A51		R107			H12														X				
154a		C24							SA									X							
154b		C24								X														X	
154c				R107									X											X	

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
154a		A27											X					X						
154c		A27								X							E12							
154		224		R109											X	H12								
155		A61		R71			H4														X			
155a		223							F4									X						
155b		223								X													X	
155c				R71									X										X	
155d		A61											X					X						
155e		A61								X							E13							
155f		223		R71											X	H4								
156		A62			12P 2X		E14											X						
154e		262			12P 2X					X							F12							

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FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	DPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
156b		232			12P 13X		L2											X						
156c		232			12P 13X					X							F13							
156d		225			12P 10X		B5											X						
156e		225			12P 10X					X							D13							
156f		208			12P 1X		P11											X						
156g		208			12P 1X					X							D12							
156h		255			20P 18		B7											X						
156i		255			20P 18					X							F11							
156j		239			20P 30		B9											X						
156k		239			20P 30					X							F10							
156l		203			20P 15		P7											X						
156m		203			20P 15					X							F9							

FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	H.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	H.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
15a		B55			20P 26		L12											X						
15b		B55			20P 31					X							F8							
15c		B39			20P 37		C4											X						
15d		B39			20P 37					X							F7							
15e		D22			20P 1		N4											X						
15f		F08			20P 3					X							D6							
15g		B54			20P 35		N12											X						
15h		C54			20P 35					X							D5							
15i		F43			6P 2		K1											X						
15j		G43			6P 2					X							F4							
15k		J54			6P		K15											X						
15l		J44			6P					X							F3							

FUEL HANDLING DATA SHEET

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STEP No.	DATE & TIME	PULL					FROM → INSERT IN																		INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
										X											X			
													X			B-1								
		695					B7											X							

PAD

MAIN

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DSN

FUEL HANDLING DATA SHEET

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STEP No.	DATE & TIME	PULL: ASSY. NO.	PULL: TP	PULL: RCC	PULL: BPRA	PULL: SOURCE	FROM: REACTOR CORE POS.	FROM: NFS POS.	FROM: SFP POS.	FROM: UPENDER	FROM: TP TOOL	FROM: N.F.E.	FROM: RCC CHANGE FIXTURE 1	FROM: RCC CHANGE FIXTURE 2	FROM: RCC CHANGE FIXTURE 3	INSERT IN: REACTOR CORE POS.	INSERT IN: SFP POS.	INSERT IN: UPENDER	INSERT IN: N.F.E.	INSERT IN: TP TOOL	INSERT IN: RCC CHANGE FIXTURE 1	INSERT IN: RCC CHANGE FIXTURE 2	INSERT IN: RCC CHANGE FIXTURE 3	INIT. & TIME
	[illegible]	[illegible]			[illegible]					X							[illegible]							[illegible]
	[illegible]	[illegible]		[illegible]			Z13														X			[illegible]
	[illegible]	[illegible]							F8									X						[illegible]
	[illegible]	[illegible]								X													X	[illegible]
	[illegible]			R7?									X										X	[illegible]
	[illegible]	[illegible]			[illegible]				D8								F8							[illegible]
	[illegible]	[illegible]											X					X						[illegible]
	[illegible]	[illegible]								X							D8							[illegible]
	[illegible]	[illegible]		R7?											X	Z13								[illegible]

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	LPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
156a		C07				NFS 2	G2											X						
156aa		C07				NFS 2				X							G19							
156b		P55	215						J20									X						
156cc		P55	215							X						K1								
157		P38	229						K20									X						
157a		P38	229							X						L2								
158		P13	217						J22									X						
158a		P12	217							X						K15								
159		P32	218						M12									X						
159a		P32	218							X						E14								
160		P62	202						H19									X						
160a		P62	202							X						G2								
				Remove Cover			Remove	Bring	Return	to		Install	SFP			Return								

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FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM										INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
1									F12								E6								
2									D13								H8								
3									F13								E12								
4									D12								N11								
5									F11								D11								
6									F10								D10								
7									F9								D9								
8									F8								D8								
9									F7								D7								
10									D6								F6								
11									D5								F5								
12									F4								D4								

FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
13					BPR 1				F3								D3							
14						APS 2			F19								F19							
15			180									X					F11							
16			181									X					F10							
17			182									X					F9							
18			183									X					F8							
19			184									X					F7							
20			254									X					D6							
21			186									X					D5							
22			187									X					F4							
23			188									X					F3							
24			189									X					F19							
			Commence fuel shuffle at step 161																					

FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
161	7/16/75 1650	207	189						G19									X						
161a	7/16/75 1654	207	189							X						D3								
162	7/16/75 1659	255	180						F11									X						
162a	7/16/75 1703	255	180							X						C4								
163	7/16/75 1705	203	182						F9									X						
163a	7/16/75 1708	203	182							X						N4								
164	7/16/75 1711	D18	197						H14									X						
164a	7/16/75 1713	D18	197							X						B5								
165	7/16/75 1715	339	184						F7									X						
165a	7/16/75 1719	B39	184							X						D7								
166	7/16/75 1722	B55	183						F8									X						
166a	7/16/75 1725	B55	183							X						D9								

FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	PULL					FROM										TO									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
167		B54	186						D5									X							
167a		B54	186							X						M9									
168		B28	254						D6									X							
168a		B28	254							X						M7									
169		A39	181						F10									X							
169a		A39	181							X						C12									
170		P57	252						M16									X							
170a		P57	252							X						B7									
171		P44	240						L18									X							
171a		P44	240							X						B9									
172		P37	194						H10									X							
172a		P37	194							X						P7									

FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
173	7/16/85 2245	P41	228						K19									X						
173a	7/16/85 2247	P41	228							X						P11								
174	7/16/85 2248	A15		RS 24			F12											X						
174a	7/16/85 2250	A15		RS 24						X							G19							
174b	7/16/85 2251	A11		RS 21			F4											X						
174c	7/16/85 2252	A11		RS 21						X							B3							
174d	7/16/85 2254	A29		R85			H6														X			
174e	7/16/85 2256	132							F13									X						
174f	7/16/85 2300	132								X													X	
174g	7/16/85 2351			R85									X										X	
174h	7/16/85 2355	A29											X					X						
174i	7/16/85 2357	A29								X							D6							

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NSD

FULL HANDLING DATA SHEET

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STEP No.	DATE & TIME	FULL: ASSY. NO.	FULL: TP	FULL: RCC	FULL: BPRA	FULL: SOURCE	FROM: REACTOR CORE POS.	FROM: NFS POS.	FROM: SFP POS.	FROM: UPENDER	FROM: TP TOOL	FROM: N.F.E.	FROM: RCC CHANGE FIXTURE 1	FROM: RCC CHANGE FIXTURE 2	FROM: RCC CHANGE FIXTURE 3	INSERT IN: REACTOR CORE POS.	INSERT IN: SFP POS.	INSERT IN: UPENDER	INSERT IN: N.F.E.	INSERT IN: TP TOOL	INSERT IN: RCC CHANGE FIXTURE 1	INSERT IN: RCC CHANGE FIXTURE 2	INSERT IN: RCC CHANGE FIXTURE 3	INIT. & TIME
174	[illegible]	232		R25											X	H6								
175	[illegible]	A11		R95			H10														X			
175a	[illegible]	162							F12									X						
175b	[illegible]	C62								X													X	
175c	[illegible]			R95									X										X	
175d	[illegible]	A11											X					X						
176	[illegible]	A11								X							D5							
175e	[illegible]	C62		R95											X	H10								
176	[illegible]	A08		R74			K8														X			
176a	[illegible]	109							D12									X						
176b	[illegible]	C08								X													X	
176c	[illegible]			R74									X										X	

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FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
176d	7/16/85 0145	A02											X					X						
176f	7/16/85 0146	A08								X							F7							
176h	7/16/85 0146	108		R74											X	K8								
177	7/16/85 0147	A07		R107			F8														X			
177a	7/16/85 0147	C25							D13									X						
177b	7/16/85 0148	C25								X													X	
177c	7/16/85 0153			R101									X										X	
177d	7/16/85 0157	A07											X					X						
177e	7/16/85 0160	A07								X							F8							
177f	7/16/85 0158	125		R161											X	F8								
177g		214	188						F3									X						
177h		214	188							X						F4								

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FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
179		C43	187						F4									X						
179a		C43	187							X						F12								
180		307			16P 57		H7											X						
180a		307			16P 57					X							F4							
180b		B11			16P 45		J8											X						
180c		B11			16P 45					X							F3							
180d		C61			20P 28		P9											X						
180e		C61			20P 28					X							F9							
180f		J10				BIS 2	G14											X						
180g		C10				BIS 2				X							F10							
180h		P06	234						L12									X						
180i		100	234							X						G14								

FUEL HANDLING DATA SHEET

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STEP No.	DATE & TIME	PULL					FROM									INSERT IN										INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
181		P35	214						J19										X					
181a			214	FROM	FA	P35	AND	STORE	FOR	FUTURE	USE													
181b						SPS 13	FROM STORAGE				BOX								X					
181c		P35				SPS 13						X						X						
181d		P35				SPS 13				X											X			
181e		B09	12				L8																X	
181f			12												X					X				X
181g						SPS 13							X										X	
181h	X		12								X										X			
181i		B09				SPS 13									X	L8								
181j		P35	12										X			D9								
		COMMENCE BPRA & THIMBLE PLUG CHANGEOUTS IN THE SFP																						
		AS PER PAGE 379																						

FUEL HANDLING DATA SHEET

STEP NO.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
181		P35	214						J19									X						
181a		P35	214							X						P9								
						Consumed EPRI + Trim test Plug																		
						SK	S	FP																
1	"					ORS 2			F10								F8							
2	"					BOP 2S			F9								F7							
3	"					BOP 5T			F4								D5							
4	"					BOP 4S			F3								D6							
5	"		190									X					F10							
6	"		191									X					F9							
7	"		192									X					F4							
8	"		193									X					F3							
					Unbraced		Grid	pin	Upper	Int	Plug					182								

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FUEL HANDLING DATA SHEET

STEP No.	DATE & TIME	PULL					FROM									INSERT IN									INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
182		B07	192						F4									X						
182a		B07	192							X						H7								
183		B11	193						F3									X						
183a		B11	193							X						J8								
184		[illegible]	190	[illegible]	[illegible]				E10	[illegible]								X						
184a		[illegible]	190	[illegible]	[illegible]					X						D13								
186		C61	191						F9									X						
185a		C61	191							X						N12								
					END		0.9		FUEL			SHUFFLE												
		ENSURE			DUMMY		F/A		IS		LOCATED					IN								
			IT	NFS			POSITION			DT			B	3	3									

FUEL HANDLING DATA SHEET

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STEP NO.	DATE & TIME	PULL					FROM									INSERT IN								INIT. & TIME
		ASSY. NO.	TP	RCC	BPRA	SOURCE	REACTOR CORE POS.	NFS POS.	SFP POS.	UPENDER	TP TOOL	N.F.E.	RCC CHANGE FIXTURE 1	2	3	REACTOR CORE POS.	SFP POS.	UPENDER	N.F.E.	TP TOOL	RCC CHANGE FIXTURE 1	2	3	
185b	11:45 8/15	A33			2C F4		D13											X						
186	11:45 8/15	A37			2C F4					X							E10							
187	11:45 8/15	C10	190						F10									X						
188	11:45 8/15	C10	190							X						D13								

FH-INIT-1

APPENDIX C

Generation of Withdrawal Limits to Insure a Negative Moderator Coefficient

1) Figure 1 presents the predicted moderator temperature coefficient versus bank position for Indian Point Unit 3, BOL cycle 2. As can be seen the predicted ARO coefficient is +2.0 pcm/^{o}F. The measured results were +1.1 for ARO, -0.54 for D at 0 and -2.47 for D and C at 0 allowing -1.6 pcm/^{o}F for doppler. Plotting these results on Figure 1 indicates a constant negative bias of about 1.0 pcm/^{o}F. That is, the measurements are consistently 1.0 pcm/^{o}F more negative than the predictions. This bias is indicated by the dashed line in Figure 1.

2) Fiture 2 presents the predicted moderator coefficient versus bank position for the overlap condition. The bias observed in step 1 was applied to this figure to arrive at the dashed line. From this plot the equivalent overlap rod position corresponding to a -0.54 moderator coefficient (D at 0) can be found. This corresponds to Band D 61% inserted and Bank C 5% inserted. The equivalent position for a -2.47 moderator coefficient (D & C at 0) would be below the HZP insertion limits.

3) Figure 3 presents the moderator coefficient versus boron concentration for three rod position (ARO), D at 0 and D & C at 0) at an average moderator temperature of 547^{o}F. Figures 4 and 5 are identical except these are for an average moderator temperature of 553.7 F (25% power) and 560.4^{o}F (50% power) respectively. Plotted on Figure 3 are the results of the moderator coefficient measurements and the corresponding boron endpoints. Boron endpoint results were as follows: ARO = 1446 ppm, D at 0 = 1362 ppm and D & C at 0 = 1255 ppm.

Through each of these points draw curves that are parallel to the proper rod configuration curve. This is indicated by the dashed lines in Figure 3, in this case always offset more negative than predicted.

4) To insure a negative moderator coefficient as required by technical specifications, a measurement uncertainty has to be accounted for. During the temperature coefficient measurements at Indian Point Unit 3, the ΔKO measurement was repeated six times and an average value plus an error band were calculated. The results indicated that all data points were included in a band of ±1.0 pcm/°F about the average value. Therefore a measurment uncertainty of 1.0 pcm/°F was used.

Therefore, we could have to measure at least -1.0 pcm/°F to insure a negative temperature coefficient. This is taken into account by the horizontal line in Figure 3 at -1.0 pcm/°F. Where this line intersects the measurement lines (dashed lines) defines a boron concentration and rod position that insures a negative moderator coefficient.

From Figure 3, three data points can be derived that guarantee and negative moderator coefficient at zero power:

1) In the all-rod-out configuration, the maximum boron concentration can be 1262 ppm.
2) In the D at 0 steps configuration (or the corresponding overlap condition of Band D at 80 steps and Bank C at 217 steps) the maximum boron concentration is 1317 ppm.

3) In the HZP insertion limit configuration (D at 0, C at 100) the maximum boron concentration is 1404 ppm.

4) These data points were then plotted on a separate graph to form a line below which would guarantee a negative moderator coefficient and above which the coefficient would be positive. This is presented in Figure 6.

5) Steps 3 and 4 were then repeated to generate other lines in Figure 6 for 25% and 50% power. Figure 4 and 5 were used here assuming the same positive bias as in Figure 3.

6) Finally after all data have been transposed to Figure 6, the rod insertion limits were drawn on Figure 6.