VEP-FRD-47

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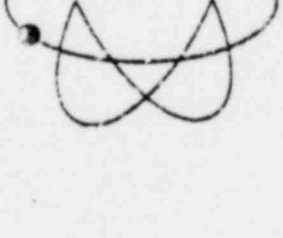
SURRY UNIT 2, CYCLE 6 STARTUP PHYSICS TEST REPORT



FUEL RESOURCES DEPARTMENT

Virginia Electric and Power Company

VEP-FRD-47

SURRY UNIT 2, CYCLE 6
STARTUP PHYSICS TEST REPORT

BY

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

PREFACE

The purpose of this report is to present the analysis and evaluation of the physics tests which were performed to verify that the Surry 2, Cycle 6 core could be operated safely, and to make an initial evaluation of the performance of the core. It is not the intent of this report to discuss the particular methods of testing or to present the detailed data taken. Standard test techniques and methods of data analysis were used. The test data, results and evaluations, together with the detailed startup procedures, are on file at the Surry Power Station. Therefore, only a cursory discussion of these items is included in this report. The analyses presented includes a brief summary of each test, a comparision of the test results with design predictions, and an evaluation of the results.

The Surry 2, Cycle 6 Startup Physics Tests Results and Evaluation Sheets have been included as an appendix to provide additional information on the startup test results. Each data sheet provides the following information: 1) test identification, 2) test conditions (design), 3) test conditions (actual), 4) test results, 5) acceptance criteria, and 6) comments concerning the test. These sheets provide a compact summary of the startup test results in a consistent format. The design test conditions and design values of the measured parameters were completed prior to startup physics testing. The entries for the design values were based on the calculations performed by Vepco's Nuclear Fuel Engineering Group.[1] During the tests, the data sheets were used as guidelines both to verify that the proper test conditions were met and to facilitate the preliminary comparison between measured and predicted test results, thus enabling a quick identification of possible problems occuring during the tests. The Appendix to this report contains the final completed and approved version of the Startup Physics Tests Results and Evaluation Sheets.

Section 1

INTRODUCTION AND SUMMARY

On November 7, 1981 Unit No. 2 of the Surry Power Station was shutdown for its fifth refueling. During this shutdown, 68 of the 157 fuel assemblies in the core were replaced with fresh fuel assemblies. The sixth cycle core consists of 6 batches of fuel: a once-burned batch from Cycle 2 (Batch 4A5), a once-burned batch from Cycle 4 (Batch 6A2), two once-burned batches from Cycle 5 (Batches 7A and 7B), one twice-burned batch from Cycles 4 and 5 (Batch 6B2), and one fresh batch (Batch 8). The core loading pattern and the design parameters for each batch are shown in Figure 1.1. Fuel assembly burnups are given in Figure 1.2. The incore instrumentation locations are identified in Figure 1.3. Figure 1.4 identifies the location and number of burnable poison rods and source assemblies for Cycle 6, and Figure 1.5 identifies the location and number of control rods in the Cycle 6 core.

On December 28, 1981 at 1745, the sixth cycle core achieved initial criticality. Following criticality, startup physics tests were performed as outlined in Table 1.1. A summary of the results of these tests follows:

1. The drop time of each control rod was confirmed to be within the 1.8 second limit of the Surry Technical Specifications[2].
2. The reactor coolant system flow rate was confirmed to be greater than the minimum limit specified in the Final Safety Analysis Report[3].

3. Individual control rod bank worths for all control rod banks were measured using the rod swap technique[4] and were found to be within 7.3% of the design predictions. The sum of the individual control rod bank worths was measured to be within 0.3% of the design prediction. These results are within the design tolerance of ±15% for individual bank worths (±10% for the rod swap reference bank worth) and the design tolerance of ±10% for the sum of the individual control rod bank worths.
4. Critical boron concentrations for two control bank configurations were measured to be within 16 ppm of the design predictions. These results were within the design tolerances and also meet the accident analysis acceptance criterion.
5. The boron worth coefficient was measured to be within 7.2% of the design prediction, which is within the design tolerance of ±10% and meets the accident analysis criterion.
6. Isothermal temperature coefficients for two control bank configurations were measured to be within 1.0 pcm/°F of design predictions. These results are within the design tolerance of ±3 pcm/°F and also meet the accident analysis acceptance criterion.
7. Core power distributions at HZP indicated that with the exception of several core locations in the flux map taken with Control Bank B nearly fully inserted (S2-06-02), the measured assemblywise power values were within the established design

tolerance. Measured assemblywise power distributions for zero-power flux maps were generally within 10% of predicted power distributions, while the difference for at-power maps was generally less than 5%. The deviations of power distribution at HZP had no adverse consequences since, for all maps, the hot channel factors were measured to be within the limits of the Technical Specifications.

In summary, all startup physics test results were acceptable. Detailed results, together with specific design tolerances and acceptance criteria for each measurement, are presented in the appropriate sections of this report.

Table 1.1

SURRY 2 - BOL CYCLE 6 PHYSICS TESTS

CHRONOLOGY OF TESTS

Test	Date	Time	Power	Reference Procedure
Hot Rod Drop-Hot Full Flow	12/27/81	2200	HSD	PT-7
Reactivity Computer Checkout	12/29/81	0600	HZP	PT28.11(B)
Boron Endpoint-ARO	12/29/81	1030	HZP	PT28.11(C)
Temperature Coefficient-ARO	12/29/81	1354	HZP	PT28.11(D)
Flux Map-ARO	12/30/81	0202	HZP	OP-57, PT28.2
Bank B Worth	12/30/81	0530	HZP	PT28.11(E)
Boron Endpoint-B In	12/30/81	1139	HZP	PT28.11(C)
Temperature Coefficient-B In	12/30/81	1205	HZP	PT28.11(D)
Flux Map-B In	12/30/81	1424	HZP	OP-57, PT28.2
Bank D Worth - Rod Swap	12/30/81	2200	HZP	PT28.11(F)
Bank C Worth - Rod Swap	12/30/81	2243	HZP	PT28.11(F)
Bank A Worth - Rod Swap	12/30/81	2343	HZP	PT28.11(F)
Bank SB Worth - Rod Swap	12/31/81	0015	HZP	PT28.11(F)
Bank SA Worth - Rod Swap	12/31/81	0048	HZP	PT28.11(F)
Flux Map - NI Calibration	1/1/82	0448	47%	OP-57, PT28.2
Flux Map - NI Calibration	1/1/82	1108	59%	OP-57, PT28.2
Flux Map - NI Calibration	1/1/82	1809	68%	OP-57, PT28.2
RCS Flow Measurement	1/27/82	1301	100%	ST-52
Flux Map - HFP, Eq. Xenon	2/10/82	1340	100%	OP-57, PT28.2

FIGURE 1.1

SURRY UNIT 2 - CYCLE 6

CORE LOADING MAP

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
						6B W41	8 2P8	6B W11							1
				7A 1L2	8 5P7	8 6P1	7B 4N1	8 5P2	8 6P3	7A 0L6					2
			7B 2N3	8 0P8	8 3P1	7B 0N7	7B 1N5	7B 0N3	8 2P1	8 4P3	7B 0N4				3
		7B 1N7	7B 1N2	8 3P9	7B 1N3	8 5P9	7A 0L9	8 1P5	7B 1N9	8 1P3	7B 2N8	7B 0N1			4
	7A 0L5	8 3P4	8 2P5	6B W22	8 0P6	7B 0N2	8 1P6	7B 1N0	8 3P7	6B W24	8 0P3	8 4P6	7A 1L0		5
	8 5P0	8 5P8	7B 3N4	8 5P1	6A V27	7B 4N8	6B W40	7B 4N6	6A V01	8 1P0	7B 4N2	8 0P5	8 1P1		6
6B W29	8 5P5	7B 3N5	8 3P6	7B 3N1	7B 1N6	6A V13	8 4P4	6A V14	7B 2N5	7B 4N7	8 4P9	7B 3N6	8 3P3	6B W20	7
8 6P6	7B 4N9	7B 3N8	7A 0L3	8 3P5	6B W50	8 5P4	4A S19	8 6P5	6B W07	8 4P8	7A 0L1	7B 2N6	7B 2N7	8 1P4	8
6B W32	8 5P6	7B 2N1	8 0P7	7B 2N9	7B 5N2	6A V15	8 0P1	6A V11	7B 2N2	7B 0N5	8 3P8	7B 4N4	8 3P0	6B W04	9
	8 4P5	8 2P4	7B 0N9	8 6P8	6A V25	7B 3N9	6B W26	7B 5N1	6A V09	8 6P2	7B 1N1	8 4P2	8 1P7		10
	7A 1L1	8 1P8	8 0P4	6B W42	8 4P1	7B 3N7	8 0P2	7B 1N4	8 6P4	6B W36	8 6P0	8 2P2	7A 0L7		11
		7B 0N6	7B 4N0	8 2P9	7B 1N8	8 2P3	7A 0L8	8 0P9	7B 3N3	8 6P7	7B 5N0	7B 3N2			12
			7B 0N8	8 2P6	8 2P0	7B 2N4	7B 4N5	7B 4N3	8 5P3	8 1P2	7B 3N0				13
				7A 0L4	8 4P0	8 3P2	7B 2N0	8 4P7	8 2P7	7A 0L2					14
						6B W05	8 1P9	6B W48							15

|--> BATCH
|--> ASSEMBLY ID

FUEL ASSEMBLY DESIGN PARAMETERS

BATCH

	4A5	6A2	6B2	7A	7B	8
Initial Enrichment (w/o U235)	2.606	2.906	3.203	3.126	3.406	3.607
Burnup at BOC-6 (MWD/MTU)	11,129	12,651	20,856	16,851	15,252	0
Assembly Type	15X15	15X15	15X15	15X15	15X15	15X15
Number Of Assemblies	1	8	16	12	52	68
Fuel Rods Per Assembly	204	204	204	204	204	204

FIGURE 1.2

SURRY UNIT 2 - CYCLE 6

BEGINNING OF CYCLE FUEL ASSEMBLY BURNUPS

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
						W41 17708	2P8 0	W11 17592							1
				1L2 16591	5P7 0	6P1 0	4N1 14820	5P2 0	6P3 0	0L6 16175					2
			2N3 16730	0P8 0	3P1 0	0N7 16869	1N5 14832	0N3 16720	2P1 0	4P3 0	0N4 16679				3
		1N7 16691	1N2 10089	3P9 0	1N3 14505	5P9 0	0L9 17649	1P5 0	1N9 14482	1P3 0	2N8 10435	0N1 16973			4
	0L5 16608	3P4 0	2P5 0	W22 24991	0P6 0	0N2 17695	1P6 0	1N0 17614	3P7 0	W24 24697	0P3 0	4P6 0	1L0 16448		5
	5P0 0	5P8 0	3N4 14580	5P1 0	V27 12773	4N8 12990	W40 23227	4N6 13633	V01 12571	1P0 0	4N2 14752	0P5 0	1P1 0		6
W29 17914	5P5 0	3N5 16999	3P6 0	3N1 17594	1N6 12986	V13 12482	4P4 0	V14 12623	2N5 12995	4N7 17617	4P9 0	3N6 17032	3P3 0	W20 17709	7
6P6 0	4N9 14750	3N8 14962	0L3 17755	3P5 0	W50 23304	5P4 0	S19 11129	6P5 0	W07 23386	4P8 0	0L1 17650	2N6 14966	2N7 15190	1P4 0	8
W32 17483	5P6 0	2N1 17003	0P7 0	2N9 17443	5N2 13347	V15 12576	0P1 0	V11 12871	2N2 12909	0N5 17435	3P8 0	4N4 16967	3P0 0	W04 17697	9
	4P5 0	2P4 0	0N9 14609	6P8 0	V25 12457	3N9 12920	W26 23300	5N1 12964	V09 12852	6P2 0	1N1 14864	4P2 0	1P7 0		10
	1L1 16499	1P8 0	0P4 0	W42 24715	4P1 0	3N7 17269	0P2 0	1N4 17614	6P4 0	W36 24579	6P0 0	2P2 0	0L7 16355		11
		0N6 16802	4N0 10124	2P9 0	1N8 14703	2P3 0	0L8 17635	0P9 0	3N3 14606	6P7 0	5N0 10406	3N2 16657			12
			0N8 17003	2P6 0	2P0 0	2N4 16920	4N5 14954	4N3 16995	5P3 0	1P2 0	3N0 16836				13
				0L4 16475	4P0 0	3P2 0	2N0 15584	4P7 0	2P7 0	0L2 16377					14
						W05 17635	1P9 0	W48 17753							15

--> ASSEMBLY ID
--> ASSEMBLY BURNUP

FIGURE 1.3

SURRY UNIT 2 - CYCLE 6

INCORE INSTRUMENTATION LOCATIONS

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
							MD	TC							1
						TC		TC	MD						2
			MD TC		TC	MD	MD TC		TC		MD TC				3
		TC		MD			MD		MD	TC					4
		MD		MD	TC	MD	TC		TC	MD	MD TC		MD TC		5
		TC		MD TC			MD	TC	MD						6
TC	TC	MD				MD		MD		TC	MD		MD		7
MD	TC	MD TC		MD TC	TC		TC	TC	MD	TC		MD TC	MD	TC	8
			TC	MD			TC	MD	MD TC					MD	9
		MD TC				MD TC				TC	MD		MD TC		10
			TC	MD	TC		MD TC		MD TC	MD					11
		MD		TC		MD TC				TC	MD	MD TC			12
							MD TC		MD TC						13
				MD TC				MD		TC					14
						MD	TC	TC							15

MD - MOVABLE DETECTOR
TC - THERMOCOUPLE

FIGURE 1.4

SURRY UNIT 2 - CYCLE 6

BURNABLE POISON AND SOURCE ASSEMBLY LOCATIONS

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
															1
						16		16							2
				12	20		SS		20	12					3
				16		20		20		16					4
		12	16		20		20		20		16	12			5
		20		20		4		4		20		20			6
	16		20		4		20		4		20		16		7
SS				20		20		20		20					8
	16		20		4		20		4		20		16		9
		20		20		4		4		20		20			10
		12	16		20		20		20		16	12			11
				16		20		20		16					12
				12	20		SS		20	12					13
						16		16							14
															15

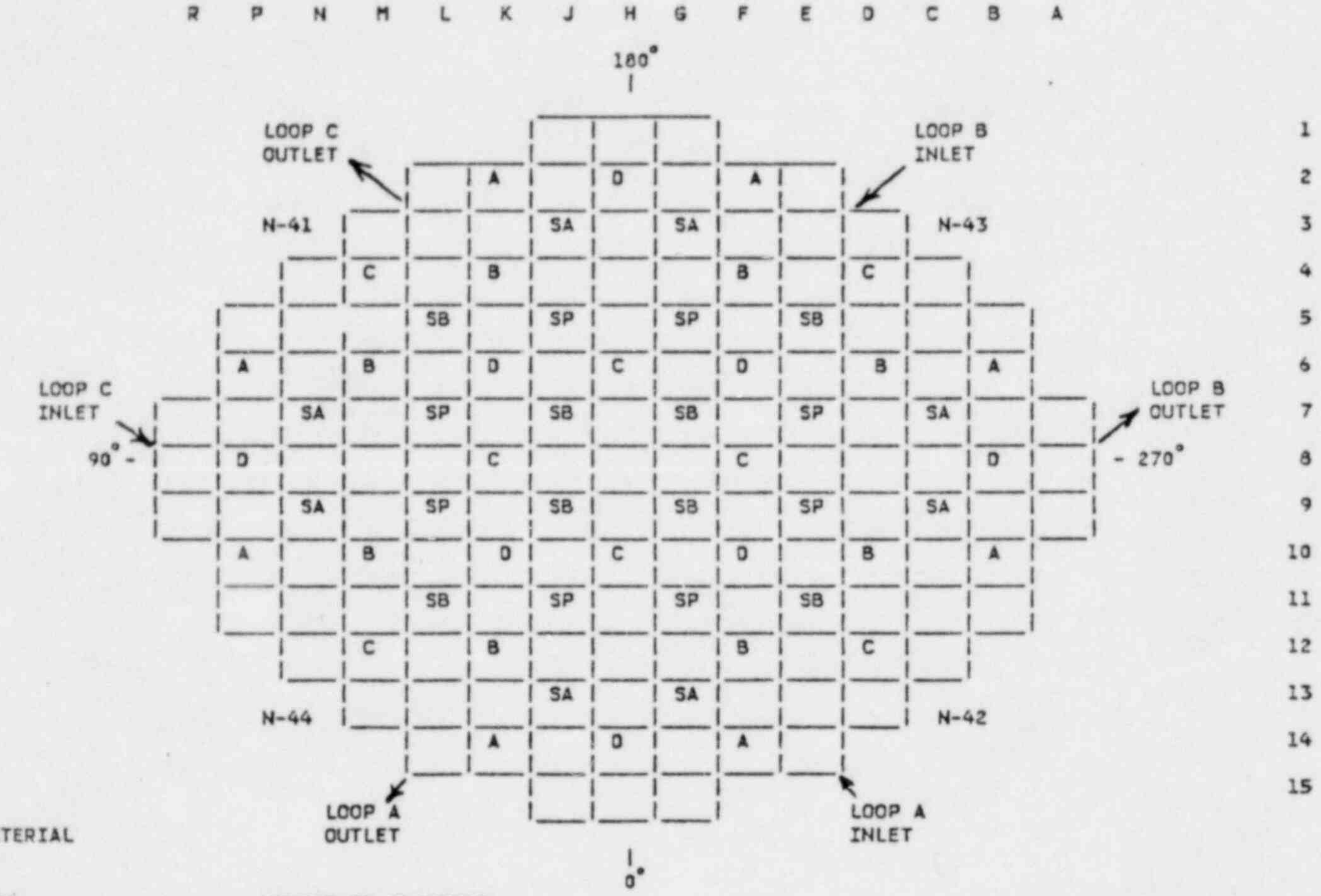
FRESH BURNABLE POISON RODS

- SECONDARY SOURCE

FIGURE 1.5

SURRY UNIT 2 - CYCLE 6

CONTROL ROD LOCATIONS



BSORBER MATERIAL
G-IN-CD

FUNCTION	NUMBER OF CLUSTERS
ONTROL BANK D	8
ONTROL BANK C	8
ONTROL BANK B	8
ONTROL BANK A	8
HUTDOWN BANK SB	8
HUTDOWN BANK SA	8
P (SPARE ROD LOCATIONS)	8

Section 2

CONTROL ROD DROP TIME MEASUREMENTS

The drop time of each control rod was measured at cold and at hot RCS conditions in order to confirm satisfactory operation and to verify that the rod drop times were less than the maximum allowed by the Technical Specifications. The hot control rod drop time measurements were run with the RCS at hot, full flow conditions (547 °F, 2235 psig) and are described below.

The rod drop time measurements were performed by first withdrawing a rod bank to its fully withdrawn position, and then removing the movable gripper coil fuse and stationary gripper coil fuse for the test rod. This allows the rod to drop into the core as it would in a normal plant trip. The data recorded during this test are the stationary gripper coil voltage, the LVDT (Linear Variable Differential Transformer) primary coil voltage and a 60Hz timing trace which are recorded via a visicorder. The rod drop time to the dashpot entry and to the bottom of the dashpot are determined from this data. Figure 2.1 provides an example of the data that is recorded during a rod drop time measurement.

As shown in Figure 2.1, the initiation of the rod drop is indicated by the decay of the stationary gripper coil voltage when the stationary coil fuse is removed. A voltage is then induced in the LVDT primary coil as the rod drops. The magnitude of this voltage is a function of the rod velocity. When the rod enters the dashpot section of its guide tube, the velocity slows causing a voltage decrease in the LVDT coil. The LVDT voltage then reaches a minimum as the rod reaches the bottom of the dashpot. Subsequent variations in the trace are caused by the rod bouncing. This procedure was repeated for each control rod.

The measured drop times for each control rod are recorded on Figure 2.2. The slowest, fastest, and average drop times are summarized in Table 2.1. Technical Specification 3.12.C.1 specifies a maximum rod drop time from loss of stationary gripper coil voltage to dashpot entry of 1.8 seconds with the RCS at hot, full flow conditions. All test results met this limit.

Table 2.1

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST

HOT ROD DROP TIME SUMMARY

ROD DROP TIME TO DASHPOT ENTRY

SLOWEST ROD	FASTEST ROD	AVERAGE TIME
K-14, 1.27 sec.	C-9, 1.18 sec.	1.22 sec.

ROD DROP TIME TO BOTTOM OF DASHPOT

SLOWEST ROD	FASTEST ROD	AVERAGE TIME
G-7, 1.93 sec.	J-9, 1.76 sec.	1.86 sec.

Figure 2.1

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST

TYPICAL ROD DROP TRACE

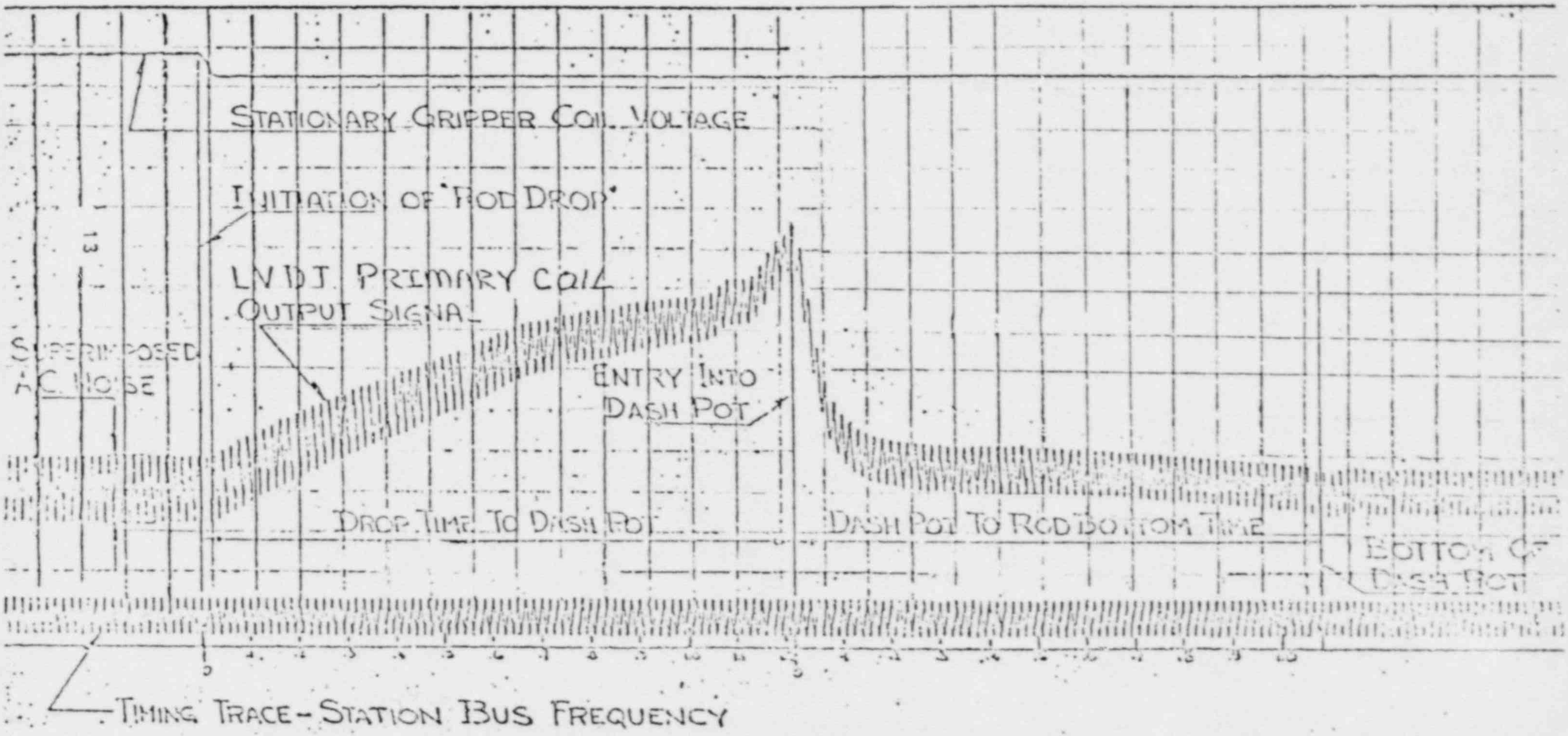


FIGURE 2.2

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST

ROD DROP TIME - HOT FULL FLOW CONDITIONS

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
															1
					1.22 1.82		1.22 1.89		1.21 1.82						2
						1.20 1.84		1.20 1.89							3
			1.20 1.81		1.23 1.88				1.23 1.87		1.21 1.86				4
				1.21 1.83						1.21 1.88					5
	1.22 1.80		1.19 1.78		1.24 1.88		1.23 1.81		1.21 1.85		1.22 1.92		1.24 1.91		6
		1.24 1.89				1.24 1.84		1.26 1.93				1.20 1.90			7
	1.22 1.91				1.19 1.80				1.24 1.83				1.25 1.91		8
		1.20 1.86				1.21 1.76		1.21 1.83				1.18 1.86			9
	1.19 1.85		1.23 1.88		1.23 1.87		1.22 1.85		1.24 1.88		1.21 1.87		1.23 1.89		10
				1.22 1.90						1.23 1.82					11
			1.20 1.88		1.20 1.84				1.24 1.86		1.20 1.85				12
						1.21 1.89		1.20 1.80							13
					1.27 1.87		1.19 1.89		1.21 1.83						14
															15

|--ROD DROP TIME TO DASHPOT ENTRY(SEC.)

|--ROD DROP TIME TO BOTTOM OF DASHPOT(SEC.)

Section 3

REACTOR COOLANT SYSTEM FLOW MEASUREMENT

The reactor coolant flow rate is measured in order to verify that the minimum flow rate requirement is satisfied. The RCS flow rate is determined using the calorimetric measurement technique. Precision calorimetric data (i.e., feedwater temperature, feedwater flow, and steam pressure) are obtained in order to accurately determine the secondary-side heat rate. The primary-side anthalpy rise is determined from the RCS pressure and the temperature increase associated with each RCS loop. The flow for each RCS loop is determined by establishing a primary-side to secondary-side heat balance. Steam generator blowdown heat loss, system heat losses, and the power produced by the reactor coolant pumps are taken into account in the heat balance. A reactor coolant flow measurement was performed at 100% power. This data was analyzed using the RXFLOW[5] computer code. A summary of the results for this test is given in Table 3.1. As shown by this table, the results demonstrated that tha RCS flow limit was met.

Table 3.1

SURRY 2 - CYCLE 6 BOL PHYSICS TEST

REACTOR COOLANT SYSTEM FLOW MEASUREMENT SUMMARY

Percent Power	Loop A Flow (gpm)	Loop B Flow (gpm)	Loop C Flow (gpm)	Total Flow (gpm)	Minimum Flow Limit* (gpm)
100 %	102,341	99,599	103,628	305,568	265,500

* FSAR Section 4.1.3; Letter from J. H. Ferguson (Vepco) to H. R. Denton (NRC) dated April 28, 1981 (Serial No. 232); Letter from C. M. Stallings (Vepco) to E. G. Case (NRC) dated November 16, 1977 (Serial No. 516).

Section 4

CONTROL ROD BANK WORTH MEASUREMENTS

Control rod bank worth measurements were obtained for all control and shutdown banks using the rod swap technique. The first step in the rod swap procedure was to dilute the most reactive control rod bank (hereafter referred to as the reference bank) into the core and measure its reactivity worth using conventional test techniques. The reactivity changes resulting from the reference bank movements were recorded continuously by the reactivity computer[6] and were used to determine the differential and integral worth of the reference bank (Control Bank B). At the completion of the reference bank reactivity worth measurement, the reactor coolant system temperature and boron concentration were stabilized such that the reactor was critical with the reference bank near full insertion. Initial statepoint data for the rod swap maneuver were obtained by moving the reference bank to its fully inserted position and recording the core reactivity and moderator temperature. At this point, a rod swap maneuver was performed by withdrawing the reference bank while one of the other control rod banks (i.e., a test bank) was inserted. The core was kept nominally critical throughout this rod swap and the maneuver was continued until the test bank was fully inserted and the reference bank was at the position at which the core was just critical. This measured critical position (MCP) of the reference bank with the test bank fully inserted is the major parameter of interest and was used to determine the integral reactivity worth of the test bank. Statepoint data (core reactivity, moderator temperature, and the differential worth of the reference bank) were recorded with the reference bank at the MCP. The rod swap maneuver was then performed in reverse order such that the reference bank once again was near full insertion and the test bank was once again fully withdrawn from the core. The rod swap process was then repeated for all of the other control rod banks (control and shutdown).

A summary of the results for these tests is given in Table 4.1. As shown by this table and the Startup Physics Tests Results and Evaluation Sheets given in the Appendix, the individual measured bank worths for all of the control and shutdown banks were within the design tolerance (±10% for the reference bank and ±15% for the test banks). The sum of the individual rod bank worths was measured to be within 0.3% of the design prediction. This is well within the design tolerance of ±10% for the sum of the individual control rod bank worths.

The integral and differential reactivity worths of the reference bank (Control Bank B) are shown in Figures 4.1 and 4.2, respectively. The design predictions and the measured data are plotted together in order to illustrate their agreement. In summary, all measured rod worth values were satisfactory.

Table 4.1

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST

CONTROL ROD BANK WORTH SUMMARY

BANK	MEASURED WORTH (PCM)	PREDICTED WORTH (PCM)	PERCENT DIFFERENCE (M-P)/P X 100
B-Reference Bank	1371	1355	+ 1.2
D	1115	1156	- 3.5
C	793	836	- 5.1
A	595	562	+ 5.9
SB	848	906	- 6.4
SA	1134	1057	+ 7.3
Total Worth	5856	5872	- 0.3

FIGURE 4.1

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST
BANK B INTEGRAL ROD WORTH - HZP

B BANK WITH ALL OTHER RODS OUT

-- PREDICTED

✱ MEASURED

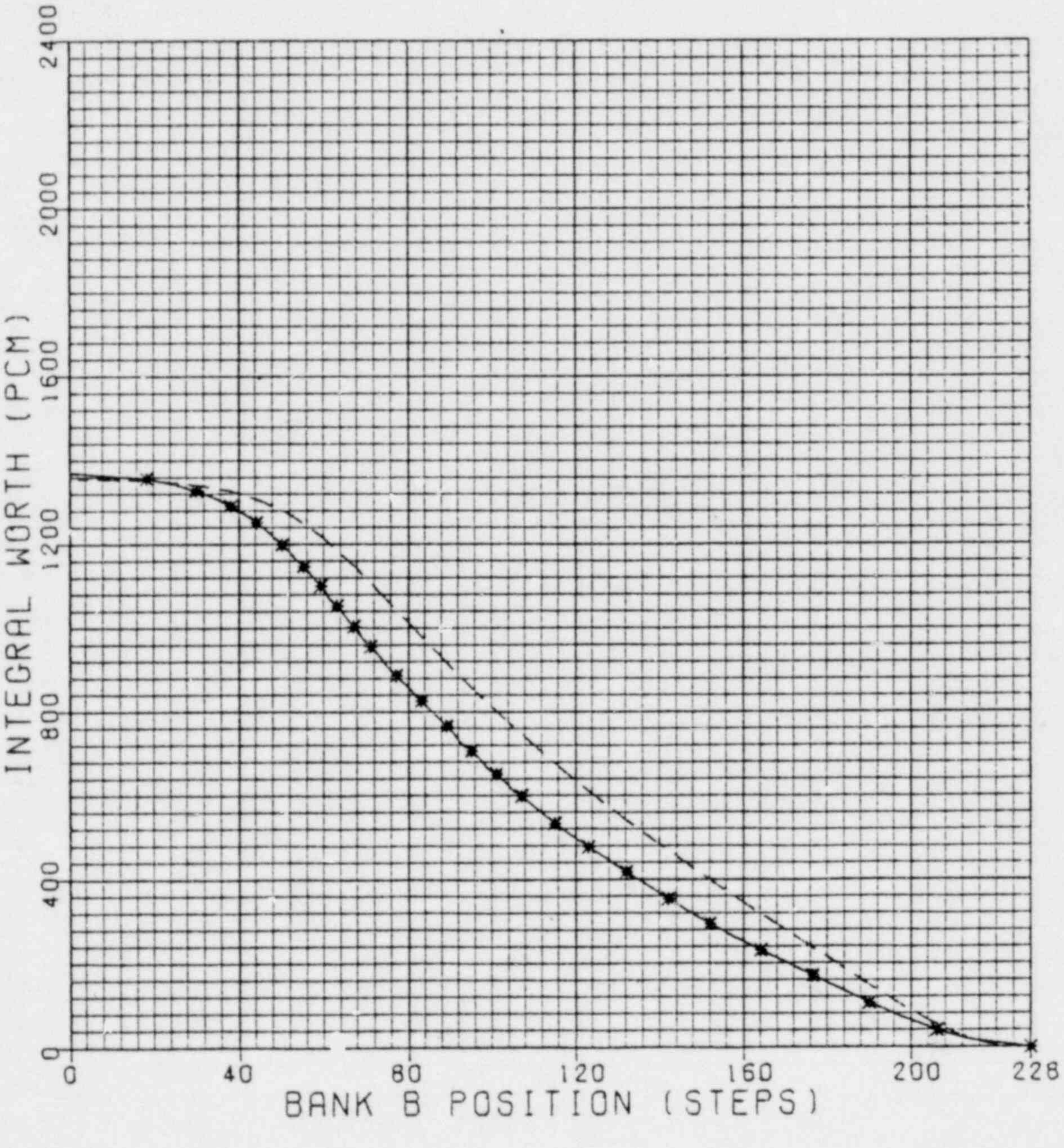


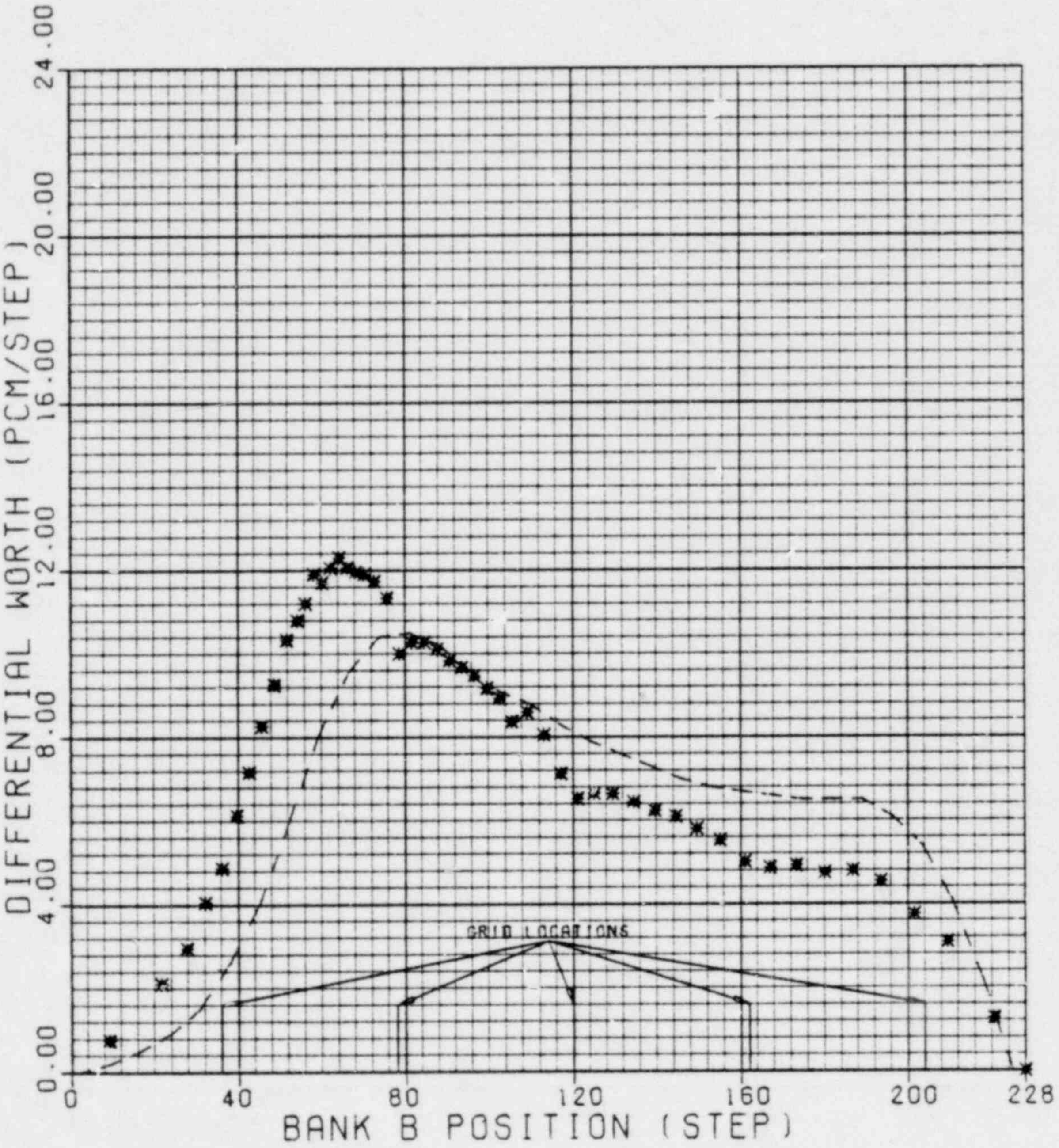
FIGURE 4.2

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST
BANK B DIFFERENTIAL ROD WORTH - HZP

B BANK WITH ALL OTHER RODS OUT

-- PREDICTED

✱ MEASURED



Section 5

BORON ENDPOINT AND WORTH MEASUREMENTS

Boron Endpoint

With the reactor critical at hot zero power, reactor coolant system boron concentrations were measured at selected rod bank configurations to enable a direct comparison of measured boron endpoints with design predictions. For each measurement, the RCS conditions were stabilized with the control banks at or very near a selected endpoint position. The critical boron concentration was then measured. If necessary, an adjustment to the measured critical boron concentration was made to account for off-nominal core conditions, i.e., for rod position and moderator temperature.

The results of these measurements are given in Table 5.1. As shown in this table and in the Startup Physics Test Results and Evaluation Sheets given in the Appendix, all measured critical boron endpoint values were within their respective design tolerances. All measured values met the accident analysis acceptance criterion. In summary, all results were satisfactory.

Boron Worth Coefficient

The measured boron endpoint values provide stable statepoint data from which the boron worth coefficient was determined. A plot of the boron concentration as a function of integrated reactivity can be constructed by relating each endpoint concentration to the integrated rod worth present in the core at the time of the endpoint measurement. The value of the boron coefficient, over the range of boron endpoint concentrations, is obtained directly from this plot.

The boron worth plot is shown in Figure 5.1. As indicated in this figure and in the Appendix, the boron worth coefficient of reactivity was measured to be -7.83 pcm/ppm. The measured boron worth coefficient is within 7.2% of the predicted value of -8.44 pcm/ppm and is well within the design tolerance of ±10%. The measurement result also met the accident analysis acceptance criterion. In summary, this result was satisfactory.

Table 5.1

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST

BORON ENDPOINTS SUMMARY

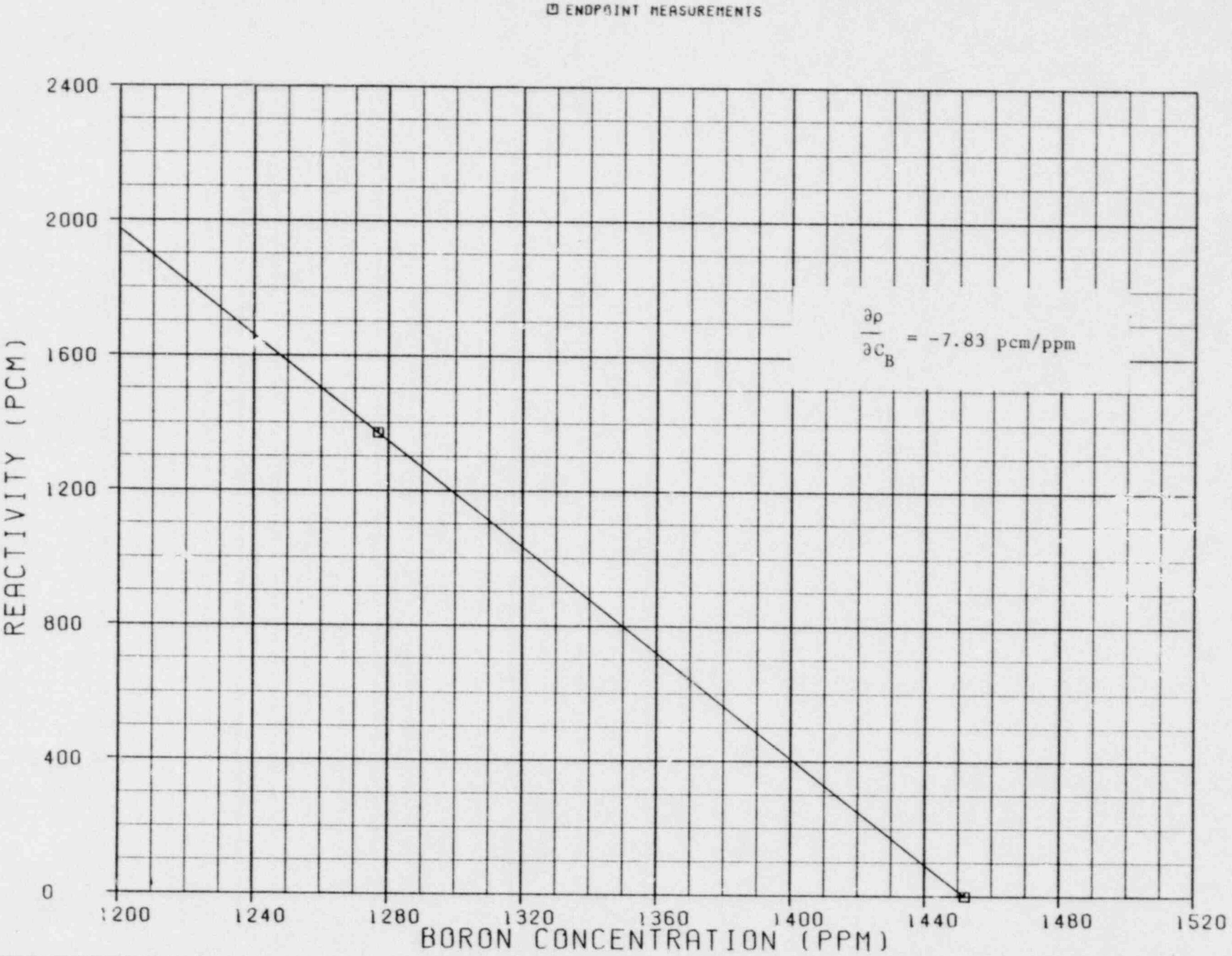
Control Rod Configuration	Measured Endpoint (ppm)	Predicted Endpoint (ppm)	Difference M-P (ppm)
ARO	1452	1445	7
B Bank In	1277	1293 *	-16

*The predicted endpoint for the B Bank in configuration has been adjusted for the difference between the measured and predicted values of the endpoint taken at the ARO configuration as shown in the boron endpoint Startup Physics Test Results and Evaluation Sheets in the Appendix.

FIGURE 5.1

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST

BORON WORTH COEFFICIENT



Section 6

TEMPERATURE COEFFICIENT MEASUREMENTS

The isothermal temperature coefficient measurements were accomplished by controlling the RCS heat gains/losses with the steam dump valves to the condenser, and/or steam generator blowdown, establishing a constant and uniform heatup/cooldown rate, and then monitoring the resulting reactivity changes on the reactivity computer. These measurements were performed at very low power levels in order to minimize the effects of non-uniform nuclear heating, thus, the moderator and fuel were approximately at the same temperature (between 542-547 °F) during these measurements. To eliminate the boron reactivity effect of outflow from the pressurizer, the pressurizer level was maintained constant or slightly increasing during these measurements.

Isothermal temperature coefficient measurements were performed at various control rod configurations. For each rod configuration, reactivity measurements were taken during both RCS heatup and cooldown ramps during which the RCS temperature varied approximately 3°F. Reactivity was determined using the reactivity computer and was plotted against the RCS temperature on an x-y recorder. The temperature coefficient was then determined from the slope of the plotted lines. The x-y recorder plots of reactivity changes versus RCS temperature for each measurement are shown in Figures 6.1 and 6.2.

The predicted and measured isothermal temperature coefficient values are compared in Table 6.1. As can be seen from this summary and from the Startup Physics Test Results and Evaluation Sheets given in the

Appendix, all measured isothermal temperature coefficient values were within the design tolerance of ±3 pcm/°F and met the accident analysis acceptance criterion. In summary, all measured results were satisfactory.

Table 6.1

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TESTS

ISOTHERMAL TEMPERATURE COEFFICIENT SUMMARY

BANK POSITION (steps)		TEMPERATURE RANGE (°F)	BORON CONCENTRATION (PPM)	ISOTHERMAL TEMPERATURE COEFFICIENT (PCM/°F)				
B	D			HEATUP	COOL DOWN	AVER.	PRED.	DIFFER. (M-P)
228	228	542 - 546	1445	-3.77	-3.03	-3.40	-4.42	+1.02
21	228	542 - 547	1286	-6.24	-6.36	-6.30	-6.78	+0.48

Figure 6.1

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TESTS

ISOTHERMAL TEMPERATURE COEFFICIENT

HZP, ARO

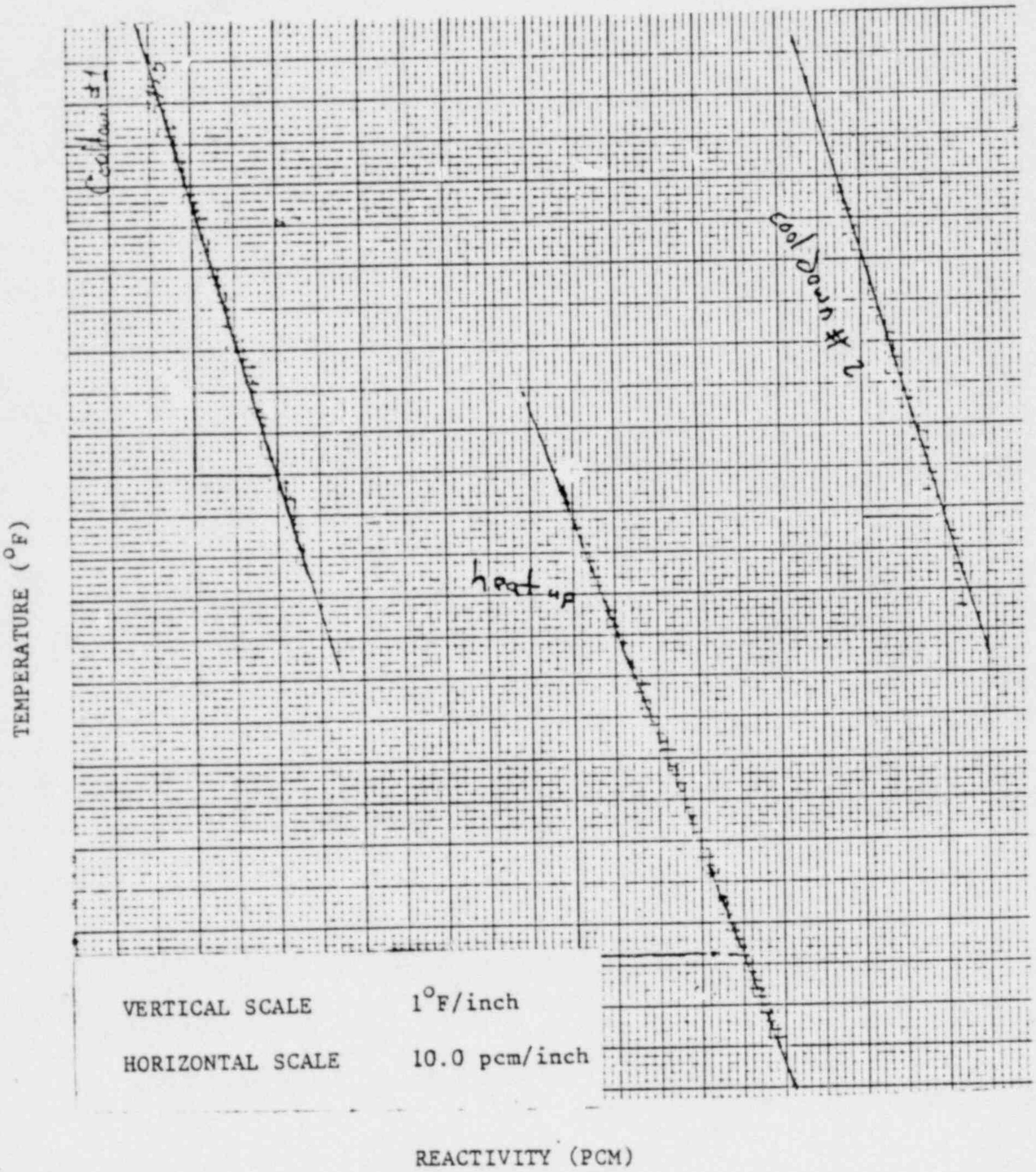
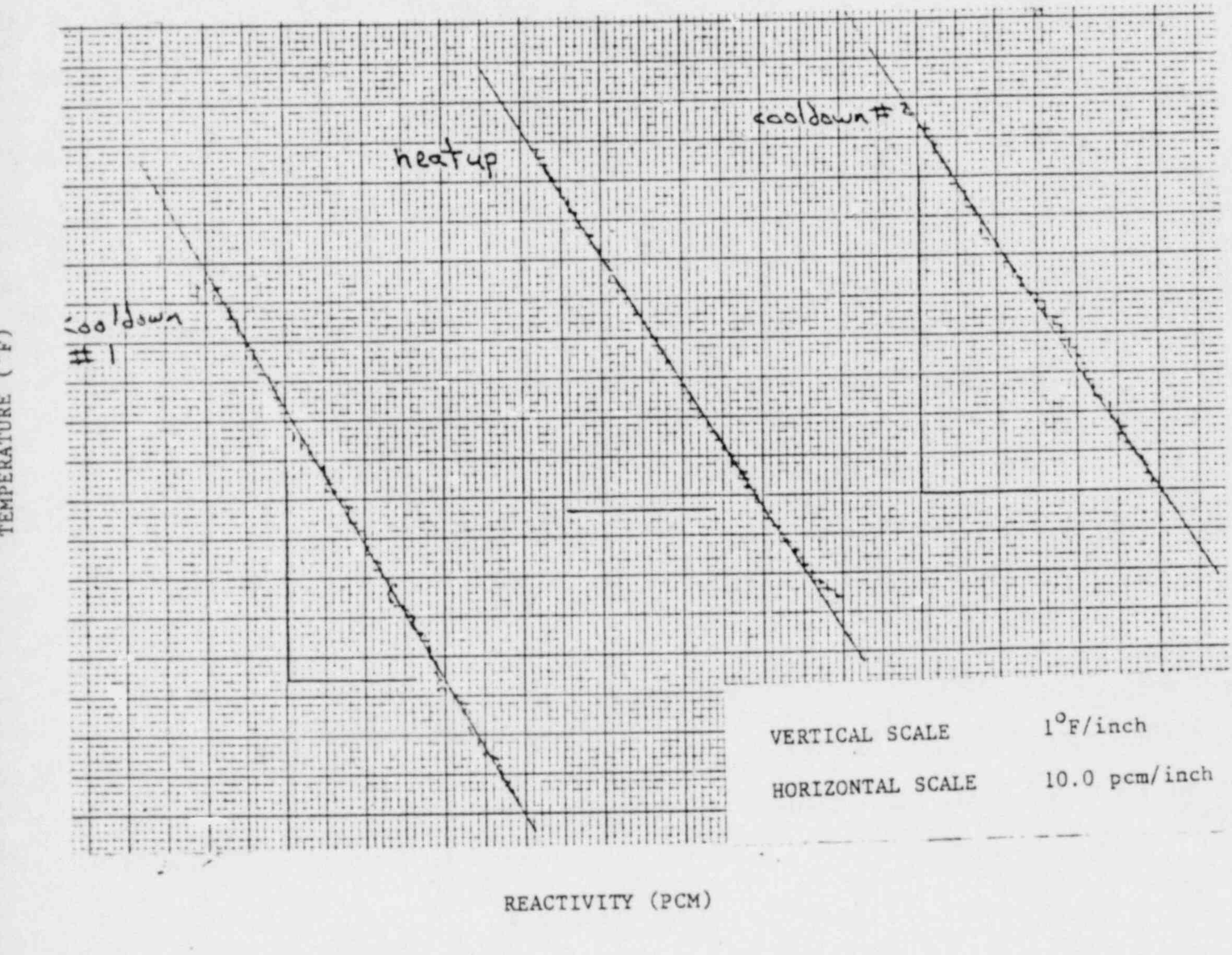


Figure 6.2

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TESTS

ISOTHERMAL TEMPERATURE COEFFICIENT

HZP, B-BANK IN



VERTICAL SCALE 1^{o}F/inch

HORIZONTAL SCALE 10.0 pcm/inch

Section 7

POWER DISTRIBUTION MEASUREMENTS

The core power distributions were measured using the incore movable detector flux mapping system. This system consists of five fission detectors which traverse fuel assembly instrumentation thimbles in 50 core locations (see Figure 1.3). For each traverse, the detector output is continuously monitored on a strip chart recorder. The output is also scanned for 61 discrete axial points by the PRODAC P-250 process computer. Full core, three-dimensional power distributions are then determined by analyzing this data using the Westinghouse computer program, INCORE[7]. INCORE couples the measured flux map data with predetermined analytic power-to-flux ratios in order to determine the power distribution for the whole core.

A list of all the flux maps taken during the test program together with a list of the measured values of the important power distribution parameters is given in Table 7.1. The measured power distribution parameter values are compared with their Technical Specifications limits in Table 7.2. Flux Maps 1 and 2 were taken at zero power. These flux maps serve as the base case design checks. Figures 7.1 and 7.2 show the resulting radial power distributions associated with these flux maps. These maps indicated the presence of some assemblywise relative power values in excess of the design tolerance, but all measured hot channel factor values were within the Technical Specifications limits. Flux Maps 3 through 5 and Map 7 were taken over a wide range of power levels and control rod configurations. These flux maps were taken to check the at-power design predictions and to measure core power distributions at various operating conditions. Maps 3 through 5 also provide incore/excore calibration data for the nuclear instrumentation system. The radial power distributions for these maps are given in Figures 7.3 through 7.6. These figures show that the measured relative assembly power values are generally within 5% of the predicted values.

In conclusion, all power distribution measurement results were considered to be acceptable with respect to the design tolerances, the accident analysis acceptance criteria, and the Technical Specification limits. It is therefore anticipated that the core will continue to operate safely throughout Cycle 6.

TABLE 7.1

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TESTS

INCORE FLUX MAP SUMMARY

MAP DESCRIPTION	MAP NO	DATE	BURN UP MWD/MTU	PWR (%)	BANK D STEPS	F-Q(T) HOT CHANNEL FACTOR [1]				F-DH(N) HOT CHNL.FACTOR [2]			CORE F(Z) MAX		F(XY) MAX [3]	QPTR [4]		AXIAL OFF SET (%)	NO. OF THIMBLES
						ASSY	PIN	AXIAL POINT	F-Q(T)	ASSY	PIN	F-DH N)	AXIAL POINT	F(Z)		MAX	LOC		
ARO	1	12-30-81	0	0	223	D07	GH	20	2.260	D07	GH	1.488	21	1.476	1.425	1.007	NE	24.83	47
B AT 23	2	12-30-81	0	1	228	K09	OM	14	2.641	K09	OM	1.799	20	1.392	1.710	1.015	NE	19.21	44
I/E CAL.	3	1- 1-82	10	47	184	B06	DE	32	1.982	K14	KL	1.446	32	1.305	1.404	1.005	NE	-0.54	48
I/E CAL.	4	1- 1-82	17	59	180	B10	DK	33	1.962	B06	DE	1.426	33	1.308	1.383	1.004	SW	-6.00	48
I/E CAL.	5	1- 1-82	22	68	204	K14	KL	22	1.853	D07	GH	1.422	23	1.255	1.373	1.005	SW	5.94	48
HFP, EQ. XENON [5]	7	2-10-82	1116	100	228	F04	FL	33	1.749	D07	GH	1.387	34	1.214	1.338	1.004	SW	-2.19	47

NOTES: HOT SPOT LOCATIONS ARE SPECIFIED BY GIVING ASSEMBLY LOCATIONS (E.G. H-8 IS THE CENTER-OF-CORE ASSEMBLY), FOLLOWED BY THE PIN LOCATION (DENOTED BY THE "Y" COORDINATE WITH THE FIFTEEN ROWS OF FUEL RODS LETTERED A THROUGH R AND THE "X" COORDINATE DESIGNATED IN A SIMILAR MANNER).
IN THE "Z" DIRECTION THE CORE IS DIVIDED INTO 61 AXIAL POINTS STARTING FROM THE TOP OF THE CORE.

1. F-Q(T) INCLUDES A TOTAL UNCERTAINTY OF 1.08

2. F-DH(N) INCLUDES A MEASUREMENT UNCERTAINTY OF 1.04

3. F(XY) IS EVALUATED AT THE MIDPLANE OF THE CORE

4. QPTR - QUADRANT POWER TILT RATIO.

5. FLUX MAP S2-6-6 WAS TAKEN ON JANUARY 24, 1982 AT 99% POWER. THIS FLUX MAP WAS NOT TAKEN AT EQUILIBRIUM CONDITIONS BUT WAS NEEDED FOR POWER SHAPE VERIFICATION. ALTHOUGH THIS MAP WAS NOT PART OF THE FORMAL PHYSICS TESTING PROGRAM, IT PROVIDED VERIFICATION OF ACCEPTABLE POWER SHAPE AND PEAKING FACTORS.

Table 7.2

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TESTS
COMPARISION OF MEASURED POWER DISTRIBUTION PARAMETERS
WITH THEIR TECHNICAL SPECIFICATION LIMITS

MAP NO.	F-Q(T) HOT CHANNEL FACTOR[1]			F-DH(N) HOT CHANNEL FACTOR[2]		
	MEAS	LIMIT	MARGIN (%)	MEAS	LIMIT	MARGIN (%)
3	1.98	4.36	54.6	1.45	1.71	15.2
4	1.96	3.70	47.0	1.43	1.68	14.9
5	1.85	3.13	40.9	1.42	1.65	13.9
7	1.75	2.18	19.7	1.39	1.55	10.3

[1] The technical specification limit for the heat flux hot channel factor, F-Q(T) is a function of core height. The value for F-Q(T) listed above is the maximum value of F-Q(T) in the core. The technical specification limit listed above is evaluated at the plane of maximum F-Q(T). The minimum margin values listed above are the minimum percent difference between the measured values of F-Q(T) and the technical specifications limit for each map. All measured F-Q(T) hot channel factors include 8% total uncertainty.

[2] The measured values for the enthalpy rise hot channel factor, F-dH(N) include 4% measurement uncertainty.

Figure 7.1

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST

ASSEBLYWISE POWER DISTRIBUTION

HZP, ARO

```
    R       P       N       M       L       K       J       H       G       F       E       D       C       B       A

        ................                        .........................                 ................
        .  PREDICTED   .                        .  0.39 .  0.70 .  0.39 .                 .  PREDICTED   .
        .   MEASURED   .                        .  0.39 .  0.70 .  0.39 .                 .   MEASURED   .                  1
        .PCT DIFFERENCE.                        .   0.9 .   0.9 .   1.4 .                 .PCT DIFFERENCE.
        ................        .........................................................  ................
                                .  0.42 .  0.95 .  0.97 .  1.01 .  0.97 .  0.95 .  0.42 .
                                .  0.43 .  0.97 .  0.99 .  1.03 .  0.99 .  0.97 .  0.43 .                                   2
                                .   1.7 .   2.6 .   1.6 .   1.2 .   1.4 .   2.3 .   3.6 .
                        .........................................................................
                        .  0.46 .  0.96 .  1.12 .  1.18 .  1.21 .  1.18 .  1.12 .  0.96 .  0.46 .
                        .  0.47 .  0.97 .  1.14 .  1.21 .  1.23 .  1.21 .  1.15 .  1.00 .  0.49 .                           3
                        .   1.5 .   0.9 .   1.6 .   2.6 .   1.5 .   2.8 .   3.2 .   4.2 .   5.6 .
                .........................................................................................
                .  0.46 .  0.91 .  1.14 .  1.24 .  1.24 .  1.16 .  1.24 .  1.24 .  1.14 .  0.91 .  0.46 .
                .  0.47 .  0.91 .  1.14 .  1.25 .  1.26 .  1.20 .  1.28 .  1.29 .  1.18 .  0.94 .  0.49 .                   4
                .   0.6 .   0.7 .   0.3 .   0.4 .   1.8 .   3.9 .   3.7 .   4.0 .   3.7 .   3.6 .   5.5 .
        .........................................................................................................
        .  0.42 .  0.96 .  1.14 .  0.97 .  1.20 .  1.22 .  1.21 .  1.22 .  1.20 .  0.97 .  1.14 .  0.96 .  0.42 .
        .  0.42 .  0.96 .  1.14    0.98 .  1.19 .  1.20 .  1.21 .  1.23 .  1.22 .  1.00 .  1.16 .  1.01 .  0.46 .           5
        .  -0.1 .  -0.1 .  -0.0 .   0.5 .  -0.5 .  -1.3 .  -0.0 .   0.8 .   1.7 .   2.8 .   2.1 .   5.4 .   9.0 .
        .........................................................................................................
        .  0.95 .  1.12 .  1.24 .  1.20 .  1.16 .  1.20 .  1.02 .  1.20 .  1.16 .  1.20 .  1.24 .  1.12 .  0.95 .
        .  0.95 .  1.13 .  1.24 .  1.18 .  1.13 .  1.14 .  0.98 .  1.14 .  1.13 .  1.21 .  1.28 .  1.18 .  1.02 .           6
        .   0.9 .   0.9 .   0.2 .  -0.9 .  -2.2 .  -4.2 .  -4.1 .  -4.5 .  -2.6 .   1.5 .   3.2 .   5.5 .   7.8 .
.........................................................................................................................
.  0.39 .  0.97 .  1.18 .  1.24 .  1.22 .  1.20 .  1.15 .  1.17 .  1.15 .  1.20 .  1.22 .  1.24 .  1.18 .  0.97 .  0.39 .
.  0.38 .  0.98 .  1.20 .  1.24 .  1.20 .  1.15 .  1.07 .  1.10 .  1.07 .  1.14 .  1.24 .  1.29 .  1.24 .  1.04 .  0.41 .   7
.  -2.2 .   0.3 .   1.9 .   0.1 .  -1.3 .  -3.9 .  -6.8 .  -6.1 .  -6.7 .  -5.0 .   1.7 .   4.5 .   5.7 .   6.6 .   6.6 .
.........................................................................................................................
.  0.70 .  1.01 .  1.21 .  1.16 .  1.21 .  1.02 .  1.17 .  1.07 .  1.17 .  1.02 .  1.21 .  1.16 .  1.21 .  1.01 .  0.70 .
.  0.68 .  1.01 .  1.23 .  1.15 .  1.19 .  0.99 .  1.08 .  0.99 .  1.09 .  0.95 .  1.21 .  1.22 .  1.28 .  1.08 .  0.75 .   8
.  -2.2 .  -0.6 .   1.9 .  -0.3 .  -1.4 .  -2.9 .  -7.2 .  -7.4 .  -6.8 .  -6.3 .  -0.2 .   5.2 .   6.0 .   6.7 .   7.3 .
.........................................................................................................................
.  0.39 .  0.97 .  1.18 .  1.24 .  1.22 .  1.20 .  1.15 .  1.17 .  1.15 .  1.20 .  1.22    1.24 .  1.18 .  0.97 .  0.39 .
.  0.38 .  0.98 .  1.21 .  1.24 .  1.21 .  1.17 .  1.09 .  1.09 .  1.07 .  1.13 .  1.19 .  1.27 .  1.23 .  1.03 .  0.42 .   9
.  -2.2 .   0.3 .   2.8 .   0.1 .  -0.8 .  -2.1 .  -4.9 .  -6.5 .  -7.1 .  -5.3 .  -2.6 .   3.0 .   4.1 .   6.1 .   7.5 .
.........................................................................................................................
        .  0.95 .  1.12 .  1.24 .  1.20 .  1.16 .  1.20 .  1.02 .  1.20 .  1.16 .  1.20 .  1.24 .  1.12 .  0.95 .
        .  0.97 .  1.15 .  1.25 .  1.19 .  1.13 .  1.14 .  0.96 .  1.14 .  1.11 .  1.18 .  1.25 .  1.15 .  0.99 .           10
        .   2.7 .   2.7 .   0.8 .  -0.7 .  -2.6 .  -4.8 .  -5.2 .  -5.0 .  -4.1 .  -1.7 .   0.6 .   2.6 .   4.7 .
        .........................................................................................................
        .  0.42 .  0.96    1.14 .  0.97 .  1.20 .  1.22 .  1.21 .  1.22 .  1.20 .  0.97 .  1.14 .  0.96 .  0.42 .
        .  0.43 .  0.98 .  1.15 .  0.97 .  1.18 .  1.19 .  1.17 .  1.18 .  1.17 .  0.96 .  1.15 .  0.99 .  0.44 .           11
        .   2.5 .   2.5 .   1.1 .  -0.8 .  -1.4 .  -2.5 .  -3.5 .  -3.1 .  -2.2 .  -1.4 .   1.0 .   3.0 .   4.3 .
        .........................................................................................................
                .  0.46 .  0.91 .  1.14 .  1.24 .  1.24 .  1.16 .  1.24 .  1.24 .  1.14 .  0.91 .  0.46 .
                .  0.48 .  0.92 .  1.13 .  1.25 .  1.24 .  1.14 .  1.22 .  1.23 .  1.13 .  0.92 .  0.48 .                   12
                .   2.4 .   1.1 .  -0.8 .   0.4 .   0.5 .  -1.2 .  -1.4 .  -0.8 .  -0.2 .   1.7 .   3.9 .
                .........................................................................................
                        .  0.46 .  0.96 .  1.12 .  1.18 .  1.21 .  1.18 .  1.12 .  0.96 .  0.46 .
                        .  0.48 .  0.99 .  1.14 .  1.18 .  1.21 .  1.19 .  1.13 .  0.97 .  0.48 .                           13
                        .   2.9 .   3.5 .   2.4 .   0.1 .  -0.4 .   1.1 .   1.4 .   1.4 .   2.7 .
                        .........................................................................
                                .  0.42 .  0.95 .  0.97 .  1.01 .  0.97 .  0.95 .  0.42 .
                                .  0.43 .  0.99 .  1.00 .  1.04 .  1.00 .  0.97 .  0.43 .                                   14
                                .   3.5 .   4.5 .   3.1 .   2.2 .   2.5 .   2.1 .   1.3 .
        ................        .........................................................  ................
        .   STANDARD   .                        .  0.39 .  0.70 .  0.39 .                 .   AVERAGE    .
        .  DEVIATION   .                        .  0.41 .  0.73 .  0.40 .                 .PCT DIFFERENCE.                  15
        .   =2.106     .                        .   5.7 .   4.6 .   3.0 .                 .    = 2.8     .
        ................                        .........................                 ................
```

```
                                   SUMMARY
                                   -------

   MAP NO: S2-6- 1               DATE: 12/30/81              POWER:    0%

   CONTROL ROD POSITIONS:        F-Q(T)  = 2.260             QPTR:

   D BANK AT 223 STEPS           F-DH(N) = 1.488             NW   0.992 | NE  1.017
                                                             -----------|----------
                                 F(Z)    = 1.476             SW   0.992 | SE  0.999

                                 F(XY)   = 1.425

                                 BURNUP  =     0 MWD/MTU   A.O =  24.83(%)
```

Figure 7.2

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST

ASSEMBLYWISE POWER DISTRIBUTION

HZP, B-BANK IN

```
   R      P      N      M      L      K      J      H      G      F      E      D      C      B      A

       .................                  ......................               .................
       .   PREDICTED   .                  . 0.45 . 0.82 . 0.45 .               .   PREDICTED   .
       .   MEASURED    .                  . 0.47 . 0.80 . 0.47 .               .   MEASURED    .      1
       .PCT DIFFERENCE.                   .  4.3 . -2.4 .  4.5 .               .PCT DIFFERENCE.
       .................                                                       .................
                            ..................................................
                            . 0.39 . 0.94 . 1.05 . 1.15 . 1.05 . 0.94 . 0.39 .
                            . 0.41 . 0.98 . 1.07 . 1.15 . 1.07 . 0.98 . 0.41 .                        2
                            .  5.0 .  4.3 .  1.7 .  0.3 .  1.8 .  4.3 .  5.8 .
                     ................................................................
                     . 0.40 . 0.80 . 0.95 . 1.17 . 1.30 . 1.17 . 0.95 . 0.80 . 0.40 .
                     . 0.42 . 0.82 . 0.97 . 1.21 . 1.29 . 1.20 . 0.99 . 0.85 . 0.43 .                 3
                     .  4.4 .  2.4 .  2.6 .  3.3 . -0.9 .  2.1 .  5.1 .  6.3 .  8.0 .
              ..............................................................................
              . 0.40 . 0.76 . 0.87 . 0.65 . 1.16 . 1.23 . 1.16 . 0.65 . 0.87 . 0.76 . 0.40 .
              . 0.41 . 0.77 . 0.87 . 0.65 . 1.17 . 1.25 . 1.19 . 0.68 . 0.91 . 0.80 . 0.43 .          4
              .  2.9 .  2.2 .  0.1 .  0.3 .  1.0 .  1.7 .  2.8 .  4.3 .  4.8 .  5.3 .  9.1 .
       ............................................................................................
       . 0.39 . 0.80 . 0.87 . 0.81 . 1.10 . 1.32 . 1.40 . 1.32 . 1.10 . 0.81 . 0.87 . 0.80 . 0.39 .
       . 0.40 . 0.81 . 0.87 . 0.81 . 1.08 . 1.30 . 1.40 . 1.34 . 1.11 . 0.83 . 0.90 . 0.88 . 0.45 .   5
       .  1.7 .  1.6 .  0.2 . -0.6 . -1.1 . -1.5 .  0.3 .  1.9 .  1.7 .  2.3 .  4.2 .  9.6 . 14.7 .
       ............................................................................................
       . 0.94 . 0.95 . 0.65 . 1.10 . 1.32 . 1.51 . 1.33 . 1.51 . 1.32 . 1.10 . 0.65 . 0.95 . 0.94 .
       . 0.94 . 0.94 . 0.64 . 1.09 . 1.28 . 1.43 . 1.24 . 1.41 . 1.28 . 1.11 . 0.67 . 1.03 . 1.06 .   6
       . -0.7 . -0.8 . -1.3 . -0.9 . -3.4 . -5.5 . -7.0 . -6.8 . -3.5 .  1.6 .  3.5 .  8.7 . 12.7 .
...........................................................................................................
. 0.45 . 1.05 . 1.17 . 1.16 . 1.32 . 1.51 . 1.59 . 1.65 . 1.59 . 1.51 . 1.32 . 1.16 . 1.17 . 1.05 . 0.45 .
. 0.45 . 1.03 . 1.13 . 1.13 . 1.30 . 1.44 . 1.44 . 1.49 . 1.44 . 1.41 . 1.34 . 1.21 . 1.25 . 1.16 . 0.49 .   7
.  0.2 . -1.9 . -3.3 . -1.9 . -0.9 . -4.4 . -9.1 . -9.6 . -9.4 . -6.8 .  1.7 .  4.7 .  6.9 .  9.9 . 10.4 .
...........................................................................................................
. 0.82 . 1.15 . 1.30 . 1.23 . 1.40 . 1.33 . 1.65 . 1.57 . 1.65 . 1.33 . 1.40 . 1.23 . 1.30 . 1.15 . 0.82 .
. 0.82 . 1.14 . 1.26 . 1.21 . 1.38 . 1.28 . 1.50 . 1.42 . 1.52 . 1.23 . 1.40 . 1.28 . 1.36 . 1.26 . 0.92 .   8
.  0.2 . -1.1 . -3.3 . -2.1 . -1.2 . -3.9 . -9.2 . -9.1 . -8.0 . -7.1 .  0.2 .  3.9 .  4.5 .  9.6 . 11.8 .
...........................................................................................................
. 0.45 . 1.05 . 1.17 . 1.16 . 1.32 . 1.51 . 1.59 . 1.65 . 1.59 . 1.51 . 1.32 . 1.16 . 1.17 . 1.05 . 0.45 .
. 0.45 . 1.08 . 1.24 . 1.16 . 1.28 . 1.46 . 1.47 . 1.53 . 1.47 . 1.43 . 1.31 . 1.21 . 1.25 . 1.15 . 0.51 .   9
.  0.2 .  2.9 .  5.5 .  0.1 . -2.6 . -3.6 . -7.0 . -7.5 . -7.4 . -5.2 . -0.5 .  4.5 .  6.3 .  9.5 . 13.4 .
...........................................................................................................
       . 0.94 . 0.95 . 0.65 . 1.10 . 1.32 . 1.51 . 1.33 . 1.51 . 1.32 . 1.10 . 0.65 . 0.95 . 0.94 .
       . 0.99 . 1.00 . 0.66 . 1.08 . 1.27 . 1.41 . 1.25 . 1.44 . 1.26 . 1.08 . 0.67 . 1.01 . 1.03 .   10
       .  5.5 .  5.3 .  1.4 . -1.2 . -3.7 . -6.5 . -5.6 . -4.8 . -4.6 . -1.2 .  3.1 .  6.8 .  9.1 .
       ............................................................................................
       . 0.39 . 0.80 . 0.87 . 0.81 . 1.10 . 1.32 . 1.40 . 1.32 . 1.10 . 0.81 . 0.87 . 0.80 . 0.39 .
       . 0.42 . 0.85 . 0.90 . 0.82 . 1.07 . 1.25 . 1.35 . 1.28 . 1.06 . 0.79 . 0.90 . 0.86 . 0.43 .   11
       .  6.1 .  6.0 .  3.5 .  0.3 . -2.4 . -4.8 . -3.2 . -2.7 . -3.0 . -2.9 .  3.3 .  7.4 .  8.8 .
       ............................................................................................
              . 0.40 . 0.76 . 0.87 . 0.65 . 1.16 . 1.23 . 1.16 . 0.65 . 0.87 . 0.76 . 0.40 .
              . 0.43 . 0.79 . 0.87 . 0.65 . 1.14 . 1.22 . 1.15 . 0.64 . 0.87 . 0.80 . 0.43 .          12
              .  6.7 .  4.2 .  0.3 . -0.1 . -1.2 . -1.3 . -0.4 . -1.3 .  0.4 .  5.4 .  8.8 .
              ..............................................................................
                     . 0.40 . 0.80 . 0.95 . 1.17 . 1.30 . 1.17 . 0.95 . 0.80 . 0.40 .
                     . 0.43 . 0.86 . 1.01 . 1.18 . 1.31 . 1.21 . 0.98 . 0.84 . 0.43 .                 13
                     .  6.9 .  7.1 .  7.1 .  0.2 .  0.7 .  3.0 .  3.8 .  4.5 .  7.2 .
                     ................................................................
                            . 0.39 . 0.94 . 1.05 . 1.15 . 1.05 . 0.94 . 0.39 .
                            . 0.42 . 1.02 . 1.11 . 1.20 . 1.10 . 0.98 . 0.41 .                        14
                            .  7.1 .  7.8 .  5.5 .  4.2 .  4.5 .  4.4 .  3.7 .
       .................    ..................................................     .................
       .   STANDARD    .                  . 0.45 . 0.82 . 0.45 .               .    AVERAGE    .
       .   DEVIATION   .                  . 0.49 . 0.88 . 0.47 .               .PCT DIFFERENCE.       15
       .    =3.144     .                  .  9.0 .  7.4 .  5.0 .               .     = 4.3     .
       .................                  ......................               .................
```

```
                              SUMMARY
                              -------

MAP NO: S2-6- 2             DATE: 12/30/81              POWER:    1%

CONTROL ROD POSITIONS:      F-Q(T)  = 2.641             QPTR:

D BANK AT 228 STEPS         F-DH(N) = 1.799             NW   0.982 | NE  1.015
B BANK AT  23 STEPS                                     -----------|----------
                            F(Z)    = 1.392             SW   0.994 | SE  1.009

                            F(XY)   = 1.710

                            BURNUP  =     0 MWD/MTU   A.O =  19.21(%)
```

Figure 7.3

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST

ASSEMBLYWISE POWER DISTRIBUTION

I/E CALIBRATION - FLUX MAP

```
    R      P      N      M      L      K      J      H      G      F      E      D      C      B      A

       ................                   ......................                ................
       .   PREDICTED  .                   . 0.40 . 0.69 . 0.40 .                .   PREDICTED  .
       .   MEASURED   .                   . 0.40 . 0.70 . 0.40 .                .   MEASURED   .               1
       .PCT DIFFERENCE.                   .  0.8 .  0.6 .  1.3 .                .PCT DIFFERENCE.
       ................     ..................................................  ................
                            . 0.44 . 0.96 . 0.97 . 0.97 . 0.97 . 0.96 . 0.44 .
                            . 0.46 . 0.97 . 0.97 . 0.97 . 0.97 . 0.98 . 0.45 .                                 2
                            .  3.9 .  1.2 .  0.4 . -0.1 .  0.9 .  2.1 .  1.9 .
                     ................................................................
                     . 0.49 . 0.98 . 1.12 . 1.17 . 1.20 . 1.17 . 1.12 . 0.98 . 0.49 .
                     . 0.50 . 0.99 . 1.13 . 1.18 . 1.19 . 1.18 . 1.14 . 0.99 . 0.50 .                          3
                     .  3.4 .  1.8 .  0.6 .  0.8 . -0.7 .  0.5 .  1.8 .  1.8 .  1.7 .
              ..............................................................................
              . 0.49 . 0.93 . 1.15 . 1.24 . 1.23 . 1.16 . 1.23 . 1.24 . 1.15 . 0.93 . 0.49 .
              . 0.49 . 0.94 . 1.15 . 1.23 . 1.23 . 1.16 . 1.23 . 1.26 . 1.16 . 0.95 . 0.51 .                   4
              .  1.4 .  0.9 .  0.0 . -0.4 . -0.3 .  0.1 .  0.5 .  1.4 .  1.2 .  1.4 .  3.9 .
       ............................................................................................
       . 0.44 . 0.98 . 1.15 . 0.98 . 1.18 . 1.21 . 1.20 . 1.21 . 1.18 . 0.98 . 1.15 . 0.98 . 0.44 .
       . 0.44 . 0.97 . 1.14 . 0.97 . 1.17 . 1.19 . 1.18 . 1.19 . 1.17 . 0.98 . 1.17 . 1.02 . 0.47 .            5
       . -0.2 . -0.2 . -0.3 . -0.6 . -0.8 . -1.8 . -2.0 . -1.2 . -0.2 .  0.3 .  1.7 .  5.0 .  8.0 .
       ............................................................................................
       . 0.96 . 1.12 . 1.24 . 1.18 . 1.10 . 1.18 . 1.03 . 1.18 . 1.10 . 1.18 . 1.24 . 1.12 . 0.96 .
       . 0.96 . 1.13 . 1.24 . 1.18 . 1.07 . 1.13 . 0.98 . 1.13 . 1.06 . 1.18 . 1.26 . 1.17 . 1.02 .            6
       .  0.6 .  0.6 .  0.1 . -0.1 . -2.3 . -4.6 . -4.7 . -4.4 . -3.5 .  0.2 .  1.7 .  4.4 .  6.6 .
..........................................................................................................
. 0.40 . 0.97 . 1.17 . 1.23 . 1.21 . 1.18 . 1.15 . 1.17 . 1.15 . 1.18 . 1.21 . 1.23 . 1.17 . 0.97 . 0.40 .
. 0.39 . 0.97 . 1.19 . 1.23 . 1.20 . 1.14 . 1.07 . 1.11 . 1.09 . 1.13 . 1.22 . 1.26 . 1.21 . 1.01 . 0.41 .     7
. -2.4 . -0.1 .  1.3 .  0.2 . -0.6 . -3.5 . -7.0 . -5.8 . -5.3 . -4.2 .  0.5 .  2.3 .  3.0 .  4.6 .  4.4 .
..........................................................................................................
. 0.69 . 0.97 . 1.20 . 1.16 . 1.20 . 1.03   1.17 . 1.08 . 1.17 . 1.03 . 1.20 . 1.16 . 1.20 . 0.97 . 0.69 .
. 0.68 . 0.96 . 1.22 . 1.15 . 1.19 . 0.99 . 1.09 . 1.01 . 1.10 . 0.96 . 1.19 . 1.18 . 1.22 . 1.00 . 0.73 .     8
. -2.6 . -1.2 .  1.3 . -0.6 . -1.3 . -3.0 . -7.2 . -6.8 . -6.3 . -6.0 . -1.3 .  1.8 .  1.9 .  3.2 .  5.0 .
..........................................................................................................
. 0.40 . 0.97 . 1.17 . 1.23 . 1.21 . 1.18 . 1.15 . 1.17 . 1.15 . 1.18 . 1.21 . 1.23 . 1.17 . 0.97 . 0.40 .
. 0.39 . 0.98 . 1.23 . 1.23 . 1.19 . 1.15 . 1.08 . 1.09 . 1.07 . 1.12 . 1.17 . 1.24 . 1.20 . 1.01 . 0.42 .     9
. -2.4 .  1.2 .  4.5 .  0.4 . -1.3 . -2.7 . -5.9 . -6.9 . -7.3 . -5.6 . -2.8 .  0.8 .  2.3 .  4.3 .  6.3 .
..........................................................................................................
       . 0.96 . 1.12 . 1.24 . 1.18 . 1.10 . 1.18 . 1.03 . 1.18 . 1.10 . 1.18 . 1.24 . 1.12 . 0.96 .
       . 1.00 . 1.17 . 1.26 . 1.17 . 1.06 . 1.12 . 0.97 . 1.13 . 1.05 . 1.17 . 1.25 . 1.15 . 1.01 .            10
       .  4.5 .  4.5 .  1.8 . -0.4 . -3.1 . -5.6 . -4.9 . -4.7 . -3.9 . -0.9 .  0.5 .  2.6 .  5.0 .
       ............................................................................................
       . 0.44 . 0.98 . 1.15 . 0.98 . 1.18 . 1.21 . 1.20 . 1.21 . 1.18 . 0.98 . 1.15 . 0.98 . 0.44 .
       . 0.46 . 1.02 . 1.18 . 0.98 . 1.17 . 1.18 . 1.18 . 1.18 . 1.16 . 0.99 . 1.16 . 1.00 . 0.46 .            11
       .  4.2 .  4.2 .  2.6 .  0.6 . -1.0 . -2.2 . -2.2 . -2.1 . -1.5 .  0.8 .  1.4 .  2.4 .  3.9 .
       ............................................................................................
              . 0.49 . 0.93 . 1.15 . 1.24 . 1.23 . 1.16 . 1.23 . 1.24 . 1.15 . 0.93 . 0.49 .
              . 0.51 . 0.96 . 1.15 . 1.25 . 1.24 . 1.15 . 1.22 . 1.25 . 1.16 . 0.95 . 0.50 .                   12
              .  3.9 .  2.6 .  0.6 .  1.0 .  0.7 . -1.0 . -0.6 .  1.0 .  1.2 .  1.7 .  2.5 .
              ..............................................................................
                     . 0.49 . 0.98 . 1.12 . 1.17 . 1.20 . 1.17 . 1.12 . 0.98 . 0.49 .
                     . 0.51 . 1.04 . 1.17 . 1.17 . 1.18 . 1.19 . 1.16 . 1.00 . 0.50 .                          13
                     .  5.3 .  6.7 .  4.0 . -0.4 . -1.4 .  1.2 .  3.5 .  2.8 .  2.0 .
                     ................................................................
                            . 0.44 . 0.96 . 0.97 . 0.97 . 0.97 . 0.96 . 0.44 .
                            . 0.47 . 1.02 . 0.99 . 0.98 . 0.98 . 0.99 . 0.45 .                                 14
                            .  6.7 .  6.5 .  2.7 .  1.2 .  1.7 .  2.8 .  3.6 .
       ................     ..................................................  ................
       .   STANDARD   .                   . 0.40 . 0.69 . 0.40 .                .    AVERAGE   .
       .   DEVIATION  .                   . 0.42 . 0.72 . 0.40 .                .PCT DIFFERENCE.               15
       .    =2.018    .                   .  5.7 .  4.1 .  1.9 .                .    = 2.5     .
       ................                   ......................                ................
```

```
                          SUMMARY
                          -------

MAP NO: S2-6- 3           DATE:  1/ 1/82            POWER:   47%

CONTROL ROD POSITIONS:    F-Q(T)  = 1.982           QPTR:

D BANK AT 184 STEPS       F-DH(N) = 1.446           NW   0.992 | NE  1.005
                                                    -----------|----------
                          F(Z)    = 1.305           SW   1.004 | SE  0.999

                          F(XY)   = 1.404

                          BURNUP  =    10 MWD/MTU   A.O =  -0.54(%)
```

Figure 7.4

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST

ASSEMBLYWISE POWER DISTRIBUTION

I/E CALIBRATION - FLUX MAP

```
    R      P      N      M      L      K      J      H      G      F      E      D      C      B      A

       ...............                    ......................                     ...............
       .  PREDICTED  .                    . 0.41 . 0.71 . 0.41 .                     .  PREDICTED  .
       .  MEASURED   .                    . 0.41 . 0.71 . 0.41 .                     .  MEASURED   .             1
       .PCT DIFFERENCE.                   . -0.0 . -0.2 .  0.6 .                     .PCT DIFFERENCE.
       ...............                                                               ...............
                            ..................................................
                            . 0.45 . 0.96 . 0.97 . 0.98 . 0.97 . 0.96 . 0.45 .
                            . 0.45 . 0.97 . 0.97 . 0.97 . 0.97 . 0.97 . 0.45 .                                  2
                            .  1.3 .  0.8 . -0.0 . -0.6 .  0.3 .  1.6 .  1.5 .
                     ................................................................
                     . 0.50 . 0.97 . 1.11 . 1.17 . 1.20 . 1.17 . 1.11 . 0.97 . 0.50 .
                     . 0.51 . 0.98 . 1.12 . 1.18 . 1.19 . 1.18 . 1.13 . 0.99 . 0.51 .                           3
                     .  1.2 .  1.1 .  0.9 .  0.5 . -0.9 .  0.6 .  2.3 .  1.9 .  1.5 .
              ..............................................................................
              . 0.50 . 0.94 . 1.14 . 1.23 . 1.21 . 1.15 . 1.21 . 1.23 . 1.14 . 0.94 . 0.50 .
              . 0.50 . 0.95 . 1.15 . 1.23 . 1.21 . 1.15 . 1.22 . 1.26 . 1.16 . 0.96 . 0.52 .                    4
              .  0.4 .  0.8 .  0.9 .  0.4 . -0.3 . -0.1 .  0.8 .  2.8 .  1.9 .  1.6 .  3.5 .
       ............................................................................................
       . 0.45 . 0.97 . 1.14 . 0.98 . 1.16 . 1.20 . 1.20 . 1.20 . 1.16 . 0.98 . 1.14 . 0.97 . 0.45 .
       . 0.45 . 0.97 . 1.14 . 0.98 . 1.17 . 1.19 . 1.17 . 1.19 . 1.17 . 0.99 . 1.16 . 1.02 . 0.48 .             5
       . -0.2 . -0.2 .  0.5 .  0.8 .  0.2 . -1.4 . -1.8 . -1.2 .  0.2 .  1.0 .  1.9 .  4.6 .  7.2 .
       ............................................................................................
       . 0.96 . 1.11 . 1.23 . 1.16 . 1.10 . 1.19 . 1.04 . 1.19 . 1.10 . 1.16 . 1.23 . 1.11 . 0.96 .
       . 0.97 . 1.12 . 1.24 . 1.17 . 1.08 . 1.14 . 0.99 . 1.13 . 1.05 . 1.17 . 1.25 . 1.16 . 1.02 .             6
       .  1.3 .  1.3 .  0.9 .  0.6 . -1.7 . -4.4 . -4.6 . -5.2 . -4.4 .  0.3 .  2.3 .  4.3 .  6.0 .
..........................................................................................................
. 0.41 . 0.97 . 1.17 . 1.21 . 1.20 . 1.19 . 1.17 . 1.18 . 1.17 . 1.19 . 1.20 . 1.21 . 1.17 . 0.97 . 0.41 .
. 0.39 . 0.97 . 1.20 . 1.23 . 1.20 . 1.15 . 1.08 . 1.11 . 1.09 . 1.13 . 1.21 . 1.25 . 1.20 . 1.01 . 0.43 .      7
. -4.7 . -0.1 .  2.7 .  1.1 . -0.1 . -3.3 . -7.0 . -6.2 . -6.4 . -5.4 .  0.5 .  3.0 .  3.0 .  4.2 .  3.9 .
..........................................................................................................
. 0.71 . 0.98 . 1.20 . 1.15 . 1.20 . 1.04 . 1.18 . 1.10 . 1.18 . 1.04 . 1.20 . 1.15 . 1.20 . 0.98 . 0.71 .
. 0.68 . 0.96 . 1.23 . 1.16 . 1.19 . 1.01 . 1.10 . 1.03 . 1.11 . 0.98 . 1.19 . 1.18 . 1.22 . 1.00 . 0.74 .      8
. -4.9 . -2.0 .  2.7 .  0.4 . -0.7 . -2.4 . -7.2 . -6.9 . -6.3 . -6.0 . -0.8 .  2.2 .  1.8 .  2.4 .  3.0 .
..........................................................................................................
. 0.41 . 0.97 . 1.17 . 1.21 . 1.20 . 1.19 . 1.17 . 1.18 . 1.17 . 1.19 . 1.20 . 1.21 . 1.17 . 0.97 . 0.41 .
. 0.39 . 0.97 . 1.22 . 1.22 . 1.20 . 1.17 . 1.10 . 1.11 . 1.04 . 1.13 . 1.17 . 1.23 . 1.20 . 1.00 . 0.43 .      9
. -4.7 .  0.1 .  4.6 .  1.0 . -0.2 . -1.9 . -5.8 . -6.3 . -6.5 . -5.4 . -2.5 .  1.1 .  2.4 .  3.6 .  4.4 .
..........................................................................................................
       . 0.96 . 1.11 . 1.23 . 1.16 . 1.10 . 1.19 . 1.04 . 1.19 . 1.10 . 1.16 . 1.23 . 1.11 . 0.96 .
       . 1.00 . 1.16 . 1.25 . 1.17 . 1.07 . 1.13 . 0.99 . 1.15 . 1.07 . 1.16 . 1.24 . 1.14 . 1.01 .             10
       .  4.5 .  4.5 .  2.0 .  0.1 . -2.6 . -5.4 . -4.2 . -3.7 . -2.9 . -0.3 .  1.1 .  3.0 .  5.0 .
       ............................................................................................
       . 0.45 . 0.97 . 1.14 . 0.98 . 1.16 . 1.20 . 1.20 . 1.20 . 1.16 . 0.98 . 1.14 . 0.97 . 0.45 .
       . 0.47 . 1.01 . 1.16 . 0.98 . 1.16 . 1.19 . 1.18 . 1.20 . 1.17 . 0.99 . 1.15 . 0.99 . 0.46 .             11
       .  4.2 .  4.2 .  2.5 .  0.3 . -0.6 . -1.2 . -1.1 . -0.5 .  0.2 .  0.9 .  1.2 .  2.3 .  3.9 .
       ............................................................................................
              . 0.50 . 0.94 . 1.14 . 1.23 . 1.21 . 1.15 . 1.21 . 1.23 . 1.14 . 0.94 . 0.50 .
              . 0.52 . 0.96 . 1.14 . 1.25 . 1.24 . 1.16 . 1.22 . 1.25 . 1.15 . 0.95 . 0.51 .                    12
              .  3.8 .  2.4 .  0.3 .  2.1 .  2.4 .  0.2 .  0.3 .  1.7 .  1.3 .  1.2 .  1.9 .
              ..............................................................................
                     . 0.50 . 0.97 . 1.11 . 1.17 . 1.20 . 1.17 . 1.11 . 0.97 . 0.50 .
                     . 0.52 . 1.02 . 1.15 . 1.18 . 1.19 . 1.19 . 1.15 . 1.00 . 0.51 .                           13
                     .  4.1 .  4.4 .  3.8 .  0.8 . -0.7 .  2.0 .  3.7 .  2.6 .  1.4 .
                     ................................................................
                            . 0.45 . 0.96 . 0.97 . 0.98 . 0.97 . 0.96 . 0.45 .
                            . 0.47 . 1.00 . 0.98 . 0.99 . 1.00 . 1.00 . 0.46 .                                  14
                            .  4.4 .  4.1 .  1.4 .  1.3 .  3.4 .  3.8 .  3.6 .
       ...............      ..................................................       ...............
       .  STANDARD   .                    . 0.41 . 0.71 . 0.41 .                     .   AVERAGE   .
       .  DEVIATION  .                    . 0.42 . 0.74 . 0.42 .                     .PCT DIFFERENCE.            15
       .   =1.914    .                    .  3.3 .  3.4 .  3.8 .                     .   =  2.4    .
       ...............                    ......................                     ...............
```

```
                              SUMMARY
                              -------

MAP NO: S2-6- 4            DATE:  1/ 1/82            POWER:   59%

CONTROL ROD POSITIONS:     F-Q(T)  = 1.962           QPTR:

D BANK AT 180 STEPS        F-DH(N) = 1.426           NW  0.993 | NE  1.003
                                                     ----------|----------
                           F(Z)    = 1.308           SW  1.004 | SE  [illegible]00

                           F(XY)   = 1.383

                           BURNUP  =    17 MWD/MTU   A.O =  -6.00(%)
```

Figure 7.5

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST

ASSEMBLYWISE POWER DISTRIBUTION

I/E CALIBRATION - FLUX MAP

PREDICTED
MEASURED
PCT DIFFERENCE

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
						0.42 0.41 -1.7	0.74 0.72 -1.8	0.42 0.42 -0.3							1
				0.44 0.44 0.9	0.95 0.96 0.3	0.98 0.97 -0.9	1.03 1.01 -1.4	0.98 0.98 -0.2	0.95 0.97 1.7	0.44 0.45 2.0					2
			0.49 0.49 0.9	0.96 0.96 0.9	1.10 1.10 0.5	1.17 1.17 0.1	1.21 1.19 -1.3	1.17 1.17 0.4	1.10 1.12 2.0	0.96 0.98 2.3	0.49 0.50 2.5				3
		0.49 0.49 0.8	0.92 0.93 0.5	1.12 1.13 0.6	1.21 1.21 -0.1	1.21 1.20 -0.4	1.15 1.15 0.2	1.21 1.21 0.7	1.21 1.24 2.2	1.12 1.14 2.0	0.92 0.94 2.0	0.49 0.51 3.3			4
	0.44 0.44 0.9	0.96 0.96 0.9	1.12 1.12 0.3	0.97 0.97 -0.4	1.17 1.17 -0.4	1.20 1.19 -1.4	1.19 1.17 -1.7	1.20 1.19 -1.2	1.17 1.17 0.0	0.97 0.98 0.9	1.12 1.14 2.0	0.96 0.99 3.7	0.44 0.46 5.2		5
	0.95 0.96 0.8	1.10 1.11 0.8	1.21 1.22 0.3	1.17 1.17 0.3	1.15 1.13 -1.8	1.20 1.15 -4.2	1.04 0.99 -4.6	1.20 1.14 -4.9	1.15 1.10 -3.6	1.17 1.18 0.5	1.21 1.25 2.5	1.10 1.14 3.9	0.95 1.00 4.9		6
0.42 0.40 -4.0	0.98 0.97 -1.1	1.17 1.18 0.7	1.21 1.21 0.4	1.20 1.21 0.1	1.20 1.17 -2.8	1.17 1.10 -6.3	1.18 1.11 -5.8	1.17 1.10 -6.0	1.20 1.14 -5.0	1.20 1.22 1.0	1.21 1.25 3.5	1.17 1.20 2.5	0.98 1.01 3.6	0.42 0.43 3.0	7
0.74 0.71 -4.1	1.03 1.00 -2.3	1.21 1.22 0.7	1.15 1.15 -0.1	1.19 1.19 -0.3	1.04 1.02 -2.2	1.18 1.11 -6.5	1.10 1.03 -6.6	1.18 1.11 -6.0	1.04 0.98 -5.5	1.19 1.19 -0.1	1.15 1.17 2.1	1.21 1.22 1.0	1.03 1.04 1.4	0.74 0.76 3.0	8
0.42 0.40 -4.0	0.98 0.98 0.4	1.17 1.22 4.7	1.21 1.22 0.9	1.20 1.20 -0.7	1.20 1.18 -1.7	1.17 1.12 -4.6	1.18 1.11 -6.0	1.17 1.09 -6.5	1.20 1.15 -4.5	1.20 1.18 -2.1	1.21 1.21 0.6	1.17 1.18 1.2	0.98 1.00 2.5	0.42 0.43 4.0	9
	0.95 1.00 4.7	1.10 1.15 4.7	1.21 1.24 1.8	1.17 1.16 -0.5	1.15 1.12 -2.4	1.20 1.15 -4.3	1.04 1.00 -3.8	1.20 1.16 -3.3	1.15 1.12 -2.3	1.17 1.17 -0.2	1.21 1.22 0.8	1.10 1.12 2.1	0.95 0.99 3.6		10
	0.44 0.46 3.5	0.96 0.99 3.5	1.12 1.14 1.9	0.97 0.97 -0.1	1.17 1.16 -0.7	1.20 1.19 -1.1	1.19 1.18 -1.0	1.20 1.20 -0.0	1.17 1.18 0.9	0.97 0.98 0.7	1.12 1.13 1.2	0.96 0.98 2.1	0.44 0.45 3.2		11
		0.49 0.50 2.3	0.92 0.94 1.3	1.12 1.12 -0.1	1.21 1.23 1.3	1.21 1.22 1.6	1.15 1.15 -0.3	1.21 1.21 0.6	1.21 1.24 2.2	1.12 1.14 1.5	0.92 0.94 1.2	0.49 0.50 2.6			12
			0.49 0.51 4.2	0.96 1.02 6.1	1.10 1.14 4.2	1.17 1.17 0.1	1.21 1.19 -1.3	1.17 1.19 1.8	1.10 1.14 4.4	0.96 0.99 3.1	0.49 0.50 1.7				13
				0.44 0.47 6.1	0.95 1.00 4.9	0.98 0.99 1.0	1.03 1.03 1.0	0.98 1.00 2.6	0.95 0.99 3.7	0.44 0.46 4.5					14
						0.42 0.43 3.0	0.74 0.76 3.0	0.42 0.43 2.9							15

PREDICTED
MEASURED
PCT DIFFERENCE

STANDARD
DEVIATION
=1.776

AVERAGE
PCT DIFFERENCE
= 2.2

SUMMARY

MAP NO: S2-6- 5

DATE: 1/ 1/82

POWER: 68%

CONTROL ROD POSITIONS:

D BANK AT 204 STEPS

F-Q(T) = 1.853

F-DH(N) = 1.422

F(Z) = 1.255

F(XY) = 1.373

BURNUP = 22 MWD/MTU A.O = 5.94(%)

QPTR:

NW 0.991	NE 1.003
SW 1.005	SE 1.001

Figure 7.6

SURRY UNIT 2 - CYCLE 6 BOL PHYSICS TEST

ASSEMBLYWISE POWER DISTRIBUTION

HFP, EQ. XENON

```
    R      P      N      M      L      K      J      H      G      F      E      D      C      B      A

       ...............                     ......................                  ...............
       .  PREDICTED  .                     . 0.43 . 0.74 . 0.43 .                  .  PREDICTED  .
       .  MEASURED   .                     . 0.42 . 0.72 . 0.42 .                  .  MEASURED   .      1
       .PCT DIFFERENCE.                    . -2.4 . -2.4 . -1.8 .                  .PCT DIFFERENCE.
       ...............                                                             ...............
                              . 0.45 . 0.94 . 0.98 . 1.03 . 0.98 . 0.94 . 0.45 .
                              . 0.46 . 0.94 . 0.96 . 1.01 . 0.96 . 0.93 . 0.45 .                          2
                              .  1.4 .  0.3 . -1.3 . -1.8 . -1.8 . -0.9 .  0.4 .
                       . 0.50 . 0.96 . 1.09 . 1.15 . 1.19 . 1.15 . 1.09 . 0.96 . 0.50 .
                       . 0.51 . 0.96 . 1.09 . 1.15 . 1.17 . 1.14 . 1.10 . 0.97 . 0.52 .                   3
                       .  1.2 .  0.5 .  0.0 . -0.1 . -1.8 . -0.4 .  0.9 .  1.5 .  2.4 .
                . 0.50 . 0.93 . 1.13 . 1.20 . 1.20 . 1.14 . 1.20 . 1.20 . 1.13 . 0.93 . 0.50 .
                . 0.50 . 0.94 . 1.12 . 1.20 . 1.20 . 1.13 . 1.21 . 1.23 . 1.15 . 0.95 . 0.52 .            4
                .  0.1 .  0.3 . -0.1 . -0.1 . -0.6 . -0.2 .  0.5 .  2.7 .  2.1 .  1.7 .  2.8 .
         . 0.45 . 0.96 . 1.13 . 0.98 . 1.18 . 1.20 . 1.20 . 1.20 . 1.18 . 0.98 . 1.13 . 0.96 . 0.45 .
         . 0.45 . 0.95 . 1.12 . 0.99 . 1.18 . 1.18 . 1.18 . 1.19 . 1.20 . 1.00 . 1.14 . 0.99 . 0.47 .     5
         . -0.8 . -0.8 . -0.2 .  0.4 . -0.2 . -1.0 . -1.0 . -0.2 .  1.2 .  1.9 .  0.9 .  3.1 .  5.5 .
         . 0.94 . 1.09 . 1.20 . 1.18 . 1.16 . 1.20 . 1.04 . 1.20 . 1.16 . 1.18 . 1.20 . 1.09 . 0.94 .
         . 0.94 . 1.09 . 1.20 . 1.18 . 1.15 . 1.17 . 1.02 . 1.17 . 1.15 . 1.19 . 1.22 . 1.12 . 0.98 .     6
         . -0.3 . -0.3 . -0.1 . -0.1 . -1.0 . -2.3 . -2.4 . -2.7 . -1.5 .  0.8 .  1.7 .  2.8 .  4.0 .
  . 0.43 . 0.98 . 1.15 . 1.20 . 1.20 . 1.20 . 1.17 . 1.19 . 1.17 . 1.20 . 1.20 . 1.20 . 1.15 . 0.98 . 0.43 .
  . 0.40 . 0.95 . 1.15 . 1.20 . 1.19 . 1.18 . 1.13 . 1.15 . 1.13 . 1.17 . 1.21 . 1.23 . 1.17 . 1.00 . 0.44 .    7
  . -6.1 . -2.3 .  0.2 . -0.1 . -0.3 . -1.8 . -3.5 . -3.4 . -3.8 . -2.9 .  0.8 .  2.2 .  1.7 .  2.3 .  2.5 .
  . 0.74 . 1.03 . 1.19 . 1.14 . 1.20 . 1.04 . 1.19 . 1.11 . 1.19 . 1.04 . 1.20 . 1.14 . 1.19 . 1.03 . 0.74 .
  . 0.69 . 0.99 . 1.19 . 1.14 . 1.19 . 1.03 . 1.15 . 1.07 . 1.15 . 1.01 . 1.19 . 1.15 . 1.19 . 1.05 . 0.77 .    8
  . -6.1 . -3.6 .  0.2 . -0.1 . -0.4 . -1.2 . -3.7 . -3.6 . -3.3 . -3.2 . -0.1 .  1.2 .  0.5 .  2.3 .  4.3 .
  . 0.43 . 0.98 . 1.15 . 1.20 . 1.20 . 1.20 . 1.17 . 1.19 . 1.17 . 1.20 . 1.20 . 1.20 . 1.15 . 0.98 . 0.43 .
  . 0.40 . 0.96 . 1.18 . 1.21 . 1.19 . 1.19 . 1.14 . 1.16 . 1.14 . 1.17 . 1.18 . 1.21 . 1.16 . 1.00 . 0.45 .    9
  . -6.1 . -1.5 .  3.0 .  0.7 . -0.2 . -0.9 . -2.8 . -2.8 . -2.8 . -2.7 . -1.2 .  0.6 .  0.7 .  2.6 .  5.0 .
         . 0.94 . 1.09 . 1.20 . 1.18 . 1.16 . 1.20 . 1.04 . 1.20 . 1.16 . 1.18 . 1.20 . 1.09 . 0.94 .
         . 0.97 . 1.12 . 1.22 . 1.18 . 1.15 . 1.17 . 1.02 . 1.18 . 1.15 . 1.18 . 1.21 . 1.10 . 0.96 .     10
         .  3.0 .  3.0 .  1.5 .  0.3 . -1.1 . -2.6 . -2.3 . -1.9 . -1.1 .  0.2 .  1.0 .  1.2 .  1.8 .
         . 0.45 . 0.96 . 1.13 . 0.98 . 1.18 . 1.20 . 1.20 . 1.20 . 1.18 . 0.98 . 1.13 . 0.96 . 0.45 .
         . 0.46 . 0.99 . 1.15 . 0.99 . 1.18 . 1.18 . 1.18 . 1.19 . 1.18 . 0.99 . 1.14 . 0.97 . 0.46 .     11
         .  3.1 .  3.1 .  2.0 .  0.6 . -0.3 . -1.1 . -1.3 . -0.7 .  0.2 .  1.2 .  1.3 .  1.6 .  1.8 .
                . 0.50 . 0.93 . 1.13 . 1.20 . 1.20 . 1.14 . 1.20 . 1.20 . 1.13 . 0.93 . 0.50 .
                . 0.52 . 0.95 . 1.13 . 1.21 . 1.21 . 1.12 . 1.20 . 1.22 . 1.14 . 0.94 . 0.51 .            12
                .  3.1 .  2.1 .  0.6 .  0.7 .  0.3 . -1.1 . -0.4 .  1.3 .  1.2 .  1.1 .  2.3 .
                       . 0.50 . 0.96 . 1.09 . 1.15 . 1.19 . 1.15 . 1.09 . 0.96 . 0.50 .
                       . 0.53 . 1.02 . 1.13 . 1.14 . 1.17 . 1.15 . 1.12 . 0.98 . 0.51 .                   13
                       .  4.9 .  6.7 .  3.7 . -0.9 . -2.0 .  0.3 .  2.3 .  1.8 .  1.5
                              . 0.45 . 0.94 . 0.98 . 1.03 . 0.98 . 0.94 . 0.45 .
                              . 0.48 . 0.99 . 0.98 . 1.03 . 0.99 . 0.96 . 0.46 .                          14
                              .  6.7 .  5.1 .  0.6 .  0.1 .  1.0 .  1.8 .  2.4 .
       ...............                                                             ...............
       .  STANDARD   .                     . 0.43 . 0.74 . 0.43 .                  .   AVERAGE   .
       .  DEVIATION  .                     . 0.44 . 0.75 . 0.43 .                  .PCT DIFFERENCE.      15
       .   =1.463    .                     .  2.6 .  2.1 .  1.3 .                  .   = 1.7     .
       ...............                     ......................                  ...............
```

SUMMARY

```
MAP NO: S2-6- 7              DATE:  2/10/82              POWER:  100%

CONTROL ROD POSITIONS:       F-Q(T)  = 1.749             QPTR:

D BANK AT 228 STEPS          F-DH(N) = 1.387             NW  0.992 | NE  1.002
                                                         ----------|----------
                             F(Z)    = 1.214             SW  1.004 | SE  1.002

                             F  Y)   = 1.338

                             BURNUP  =  1116 MWD/MTU    A.O =  -2.19(%)
```

Section 8

REFERENCES

1. M. E. Paul, S. A. Ahmed, "Surry Unit 2, Cycle 6, Design Report," NFE Technical Report No. 209, Vepco, November, 1981

2. Surry Power Station Technical Specifications.

3. Surry Power Station Final Safety Analysis Report.

4. T. K. Ross, W. C. Beck, "Control Rod Reactivity Worth Determination By The Rod Swap Technique," VEP-FRD-36A, December, 1980.

5. T. J. Kunsitis, "RXFLOW, A Computer Program to Calculate Reactor Flow and Thermal Output," NFO-CCR-8, Vepco, December, 1979.

6. "Technical Manual for Westinghouse Solid State Reactivity Computer," Westinghouse Electric Corporation.

7. W. Leggett and L. Eisenhart, "The INCORE Code," WCAP-7149, December, 1967.

APPENDIX

STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEETS

JUL 3 · 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: Reactivity Computer Checkout Proc No /Section: PT28.11/APP. B	Sequence Step No: 6
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: 228 CC: 228 CD: *	RCS Temperature (°F): 547 Power Level (% F.P.): 0 Other (specify): Below Nuclear Heating *At the just crit. position
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: 228 CC: 228 CD: 165	RCS Temperature (°F): 546.5 Power Level (% F.P.): 0 Other (Specify): Below nuclear heat
	Date/Time Test Performed: 12/29/81 0600	

IV	Measured Parameter (Description)	ρ_c = Measured Reactivty using ρ -comp ρ_t = Inferred React from react period
Test Results	Measured Value	ρ_c = 24.7 -21.0 45.0 -37.5 52.0 -48.5 ρ_t = 24.8 -21.2 43.3 -37.6 51.0 -50.0 %D = -0.40 -0.94 3.9 -0.27 2.0 -3.0
	Design Value (Actual Conditions)	$\%D = \lvert(\rho_c - \rho_t)/\rho_t\rvert \times 100\% \leq 4.0\%$
	Design Value (Design Conditions)	$\%D = \lvert(\rho_c - \rho_t)/\rho_t\rvert \times 100\% \leq 4.0\%$
	Reference	WCAP 7905, Rev. 1, Table 3.6
V Acceptance Criteria	FSAR/Tech Spec	Not Applicable
	Reference	Not Applicable

VI Comments	Design Tolerance is met : ✓ YES ___NO Acceptance Criteria is met : ✓ YES ___NO
	Allowable Range = ± 48.5 pcm

Completed By: L. J. Cushman
Test Engineer

Evaluated By:

Recommended for Approval By : C. T. Snow
NFO Engineer

JUL 3 1 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: Critical Boron Concentration - ARO Proc No /Section: PT28.11/APP. C	Sequence Step No: 7
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: 228 CC: 228 CD: 228	RCS Temperature (°F): 547 Power Level (% F.P.): 0 Other (specify): Below Nuclear Heating
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: 228 CC: 228 CD: 228	RCS Temperature (°F): 543.2 Power Level (% F.P.): 0% Other (Specify): Below Nuclear Heating
	Date/Time Test Performed: 12/29/81 1030-1100	
IV	Meas Parameter (Description)	$(C_B)^M_{ARO}$; Crit Boron Conc - ARO
Test Results	Measured Value	$(C_B)^M_{ARO}$ = 1452 ppm
	Design Value (Actual Cond)	C_B = 1445 ± 50 ppm
	Design Value (Design Cond)	C_B = 1445 ± 50 ppm
	Reference	VEP-FRD-NFE-209
V Acceptance Criteria	FSAR/Tech Spec	$\alpha_{C_B} \times C_B \le 15,115$ pcm
	Reference	FSAR Section 14.2.5
	Design Tolerance is met : ✓ YES __ NO Acceptance Criteria is met : ✓ YES __ NO	
VI Comments	$\alpha_{C_B} = -8.44$ pcm/ppm for preliminary analysis $\alpha_{C_B} = -7.83$ pcm/ppm for final analysis	

Completed By: L. J. Curfman
Test Engineer

Evaluated By: B D Mann

Recommended for Approval By : C J Snow
NFO Engineer

JUL 3 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: Isothermal Temperature Coefficient-ARO Proc No /Section: PT28.11/APP. D Sequence Step No: 8	
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: 228 CC: 228 CD: 228	RCS Temperature (°F): 547 Power Level (% F.P.): 0 Other (specify): Below Nuclear Heating
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: 228 CC: 228 CD: 228	RCS Temperature (°F): 544.1 Power Level (% F.P.): 0% Other (Specify): Below Nuclear Heating
	Date/Time Test Performed: 12/29/81 1354-1447	
IV	Meas Parameter (Description)	$(\alpha_T^{ISO})_{ARO}$ Iso Temp Coeff - ARO
Test Results	Measured Value	$(\alpha_T^{ISO})_{ARO}$ = -3.40 pcm/F (C_B = 1445)
	Design Value (Actual Cond)	$(\alpha_T^{ISO})_{ARO}$ = -4.42±3.0 pcm/°F (C_B = 1445)
	Design Value (Design Cond)	$(\alpha_T^{ISO})_{ARO}$ = - 4.42 ± 3.0 pcm/°F (C_B = 1445 ppm)
	Reference	VEP-FRD-NFE 209
V Acceptance Criteria	FSAR/Tech Spec	$\alpha_T^{ISO} \le 0.44$ pcm/°F* α_T^{DOP} = -2.06 pcm/°F
	Reference	TS 3.1, VEP-FRD-NFE 209
VI	Design Tolerance is met : ✓ YES ___ NO Acceptance Criteria is met : ✓ YES ___ NO	
Comments	*Uncertainty on $\alpha_{T_{MOD}}$ = 0.5 pcm/°F (Reference: memorandum from C. T. Snow to E. J. Lozito dated June 27, 1980).	

Completed By: ____________
Test Engineer

Evaluated By: ____________

Recommended for
Approval By : C. T. Snow
NFO Engineer

JUL 3 1 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description : M/D Flux Map - HZP, ARO Proc No / Section: PT28.2, OP-57	Sequence Step No: 9
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB : 228 CC : 228 CD: 228	RCS Temperature (°F): T_{REF} ±1 Power Level (% F.P.): ~0 Other (specify) Must have ≥ 40 thimbles
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB : 228 CC : 228 CD: 223	RCS Temperature (°F): 547 °F Power Level (% F.P.): ~1% Other (Specify): 47 thimbles
	Date/Time Test: Performed: 12/30/81 0202	

IV	Meas Parameter (Description)	MAX. REL ASSY PWR % DIFF (M-P)/P	NUC ENTHAL RISE HOT CHAN FACT F-dH(N)	TOTAL HEAT FLUX HOT CHAN FACT F-Q(T)	QUADRANT POWER TILT RATIO QPTR
Test Results	Measured Value	7.5% for P_{J-6} = 1.02 9.0% for P_{J-5} = 0.46	1.488	2.260	1.0168
	Design Value (Design Conds)	±10% for P_i ≥ .9 ±15% for P_i < .9 (P_i = Assy. Pwr.)	$F^N_{\Delta H} \leq 1.55(1+.2(1-P))$	$F^T_Q(Z) \leq 4.36 \times K(Z)$	≤ 1.02
	Reference	WCAP-7905 REV. 1	NONE	NONE	WCAP-7905 REV. 1
V Acceptance Criteria	FSAR/Tech Spec	NONE	NA	NA	NA
	Reference	NONE	T.S. 3.12	T.S. 3.12	T.S. 3.12

	Design Tolerance is met : ✓ YES ___NO Acceptance Criteria is met : ✓ YES ___NO
VI Comments	

Completed By: L. J. Curfman
Test Engineer

Evaluated By: E. J. Hob

Recommended for
Approval By : C. T. Snow
NFO Engineer

JUL 3 1 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: Cntl Bank B Worth Meas.-Rod Swap Ref Bank Proc No /Section: PT28.11/APP. E Sequence Step No: 10	
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB:Moving CC: 228 CD: 228	RCS Temperature (°F): 547 Power Level (% F.P.): 0 Other (specify): Below Nuclear Heating
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: Moving CC: 228 CD: 228	RCS Temperatura (°F): 546.0 Power Level (% F.P.): 0% Other (Specify): Below Nuclear Heating
	Date/Time Test Performed: 12/30/81 0530	
IV Test Results	Measured Parameter (Description)	I_B^{REF} ;Integral Worth of Cntl Bank B, All Other Rods Out
	Measured Value	I_B^{REF} = 1371 pcm
	Design Value (Actual Conditions)	I_B^{REF} = 1355 ± 136 pcm
	Design Value (Design Conditions)	I_B^{REF} = 1355 ± 136 pcm
	Reference	VEP-FRD-NFE-209
V Acceptance Criteria	FSAR/Tech Spec	If Design Tolerance is exceeded, SNSOC shall evaluate impact of test result on safety analysis. SNSOC may specify that additional testing be performed.
	Reference	VEP-FRD-36A
VI Comments	Design Tolerance is met : ✓YES __NO Acceptance Criteria is met : ✓YES __NO	

Completed By: L. J. Aufman
Test Engineer

Evaluated By: B. D. Mann

Recommended for
Approval By : C. T. Snow
NFO Engineer

JUL 31 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: Critical Boron Concentration - B In Proc No /Section: PT28.11/APP. C Sequence Step No: 11	
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: 0 CC: 228 CD: 228	RCS Temperature (°F). 547 Power Level (% F.P.): 0 Other (specify): Below Nuclear Heating
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: 0 CC: 228 CD: 228	RCS Temperature (°F): 545.8 Power Level (% F.P.): 0% Other (Specify): Below Nuclear Heating
	Date/Time Test Performed: 12/30/81 1139-1148	
IV	Meas Parameter (Description)	$(C_B)_B^M$; Crit Boron Conc - B Bank In
Test Results	Measured Value	$(C_B)_B^M = 1277$ ppm
	Design Value (Actual Cond)	$C_B = 1293 \pm 27$ ppm
	Design Value (Design Cond)	$C_B = 1236 + \Delta C_B^{PREV} \pm (10 + 135.5/\lvert \alpha C_B \rvert)$ ppm
	Reference	VEP-FRD-NFE-209
V Acceptance Criteria	FSAR/Tech Spec	$\alpha C_B \times C_B \leq 15{,}115$ pcm
	Reference	FSAR Section 14.2.5
	Design Tolerance is met : ✓ YES ___ NO Acceptance Criteria is met : ✓ YES ___ NO	
VI Comments	$\alpha C_B = -8.44$ pcm/ppm for preliminary analysis $\Delta C_B^{PREV} = (C_B)_{ARO}^M - 1445$ $\alpha C_B = -7.83$ pcm/ppm for final analysis	

Completed By: L. J. Cuffman
Test Engineer

Evaluated By: B D Mann

Recommended for Approval By : C J Snow
NFO Engineer

JUL 3 1 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: Isothermal Temperature Coefficient-B In Proc No /Section: PT28.11/APP. D	 Sequence Step No: 12
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: 0 CC: 228 CD: 228	RCS Temperature (°F): 547 Power Level (% F.P.): 0 Other (specify): Below Nuclear Heating
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: 21 CC: 228 CD: 228	RCS Temperature (°F): 545 Power Level (% F.P.): 0% Other (Specify): Below Nuclear Heating
	Date/Time Test Performed: 12/30/81 1205	

IV Test Results	Meas Parameter (Description)	$(\alpha_T^{ISO})_B$ Iso Temp Coeff - B Bank In
	Measured Value	$(\alpha_T^{ISO})_B$ = -6.30 pcm/°F (C_B = 1286)
	Design Value (Actual Cond)	$(\alpha_T^{ISO})_B$ = -6.78 ± 3.0 pcm/°F (C_B = 1286)
	Design Value (Design Cond)	$(\alpha_T^{ISO})_B$ = - 6.78 ± 3.0 pcm/°F (C_B = 1286 ppm)
	Reference	VEP-FRD-NFE 209
V Acceptance Criteria	FSAR/Tech Spec	$\alpha_T^{ISO} \le 0.44$ pcm/°F* α_T^{DOP} = -2.06 pcm/°F
	Reference	TS 3.1, VEP-FRD-NFE 209
VI	Design Tolerance is met : ✓ YES ___ NO Acceptance Criteria is met : ✓ YES ___ NO	
Comments	*Uncertainty on $\alpha_{T\,MOD}$ = 0.5 pcm/°F (Reference: memorandum from C. T. Snow to E. J. Lozito dated June 27, 1980).	

Completed By: ______________
Test Engineer

Evaluated By: ______________

Recommended for Approval By : C. T. Snow
NFO Engineer

JUL 3 1 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: HZP Boron Worth Coefficient Proc No /Section: PT28.11/APP. E	Sequence Step No: N/A
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: Moving CC: 228 CD: 228	RCS Temperature (°F): 547 Power Level (% F.P.): 0 Other (specify): Below Nuclear Heating
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: Moving CC: 228 CD: 228	RCS Temperature (°F): 543 Power Level (% F.P.): 0% Other (Specify): Below Nuclear Heating
	Date/Time Test Performed: 12/29/81 1030	
IV Test Results	Measured Parameter (Description)	α_{C_B}, Boron Worth Coefficient
	Measured Value	$\alpha_{C_B} = -7.83$ pcm/ppm
	Design Value (Actual Conditions)	$\alpha_{C_B} = -8.44 \pm 0.84$ pcm/ppm
	Design Value (Design Conditions)	$\alpha_{C_B} = -8.44 \pm 0.84$ pcm / ppm
	Reference	VEP-FRD-NFE 209
V Acceptance Criteria	FSAR/Tech Spec	$\alpha_{C_B} \times C_B \leq 15{,}115$ pcm
	Reference	FSAR Section 14.2.5
VI Comments	Design Tolerance is met : ✓ YES ___NO Acceptance Criteria is met : ✓ YES ___NO	

Completed By: L. J. Guzman
Test Engineer

Evaluated By: B. D. Mann

Recommended for Approval By: C. J. Snow
NFO Engineer

JUL 3 1 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference

Test Description : M/D Flux Map -HZP, B-Bank In
Proc No / Section: PT28.2, OP-57   Sequence Step No: 13

II Test Conditions (Design)

Bank Positions (Steps)
SDA: 228 SDB: 228 CA: 228
CB : 0 CC : 228 CD: 228

RCS Temperature (°F): T_{REF} ±1
Power Level (% F.P.): ~0
Other (specify)
Must have ≥ 40 thimbles

III Test Conditions (Actual)

Bank Positions (Steps)
SDA: 228 SDB: 228 CA: 228
CB : 23 CC : 228 CD: 228

RCS Temperature(°F): ~547°F
Power Level (% F.P.): ~1 %
Other (Specify):
44 thimbles

Date/Time Test Performed: 12/30/81 1424

IV Test Results

Meas Parameter (Description)	MAX. REL ASSY PWR % DIFF (M-P)/P	NUC ENTHAL RISE HOT CHAN FACT F-dH(N)	TOTAL HEAT FLUX HOT CHAN FACT F-Q(T)	QUADRANT POWER TILT RATIO QPTR
Measured Value	12.7%* for P_{G-6}=1.4 14.7% for P_{G-5}=[illegible]	1.799	2.641	1.0149
Design Value (Design Conds)	±10% for P_i ≥ .9 ±15% for P_i < .9 (P_i = Assy. Pwr.)	NA	NA	≤ 1.02
Reference	WCAP-7905 REV. 1	NONE	NONE	WCAP-7905 REV.1

V Acceptance Criteria

FSAR/Tech Spec	NONE	NA	NA	NA
Reference	NONE	T.S. 3.12	T.S. 3.12	T.S. 3.12

VI Comments

Design Tolerance is met : ___YES [✓ NO]*
Acceptance Criteria is met : [✓ YES] ___NO

*Design tolerances not met, but test results are acceptable per Reference:
1. Surry Power Station Deviation Report No: S2-82-20.

Completed By: L. J. Guffman
Test Engineer

Evaluated By: K. D. Main

Recommended for Approval By : C. T. Snow
NFO Engineer

JUL 3 1 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: Cntl Bank D Worth Measurement-Rod Swap Proc No /Section: PT28.11/APP. F Sequence Step No: 14	
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB:Moving CC: 228 CD:Moving	RCS Temperature (°F): 547 Power Level (% F.P.): 0 Other (specify): Below Nuclear Heating
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: Moving CC: 228 CD: Moving	RCS Temperature (°F): 546.1 Power Level (% F.P.): 0 Other (Specify): Below Nuclear Heating
	Date/Time Test Performed: 12/30/81 - 2200	
IV Test Results	Meas Parameter (Description)	I_D^{RS} ;Int Worth of Cntl Bank D-Rod Swap
	Measured Value	I_D^{RS} = 1115 pcm (Adj. Meas. Crit. Ref Bank Position = 159 steps)
	Design Value (Actual Cond)	I_D^{RS} = 1156 ± 173 pcm (Adj. Meas. Crit. Ref Bank Position = 159 steps)
	Design Value (Design Cond)	I_D^{RS} = 1155 ± 173 pcm (Critical Ref Bank Position = 132 steps)
	Reference	VEP-FRD-NFE-209, VEP-FRD-36A, NFO-TI-2.2A
V Acceptance Criteria	FSAR/Tech Spec	If Design Tolerance is exceeded, SNSOC shall evaluate impact of test result on safety analysis. SNSOC may specify that additional testing be performed.
	Reference	VEP-FRD-36A
VI Comments	Design Tolerance is met : X YES ___NO Acceptance Criteria is met : X YES ___NO	

Completed By: ________
Test Engineer

Evaluated By: ________

Recommended for
Approval By : C. T. Snow
NFO Engineer

JUL 3 1 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: Cntl Bank C Worth Measurement-Rod Swap Proc No /Section: PT28.11/APP. F Sequence Step No: 16	
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB:Moving CC:Moving CD: 228	RCS Temperature (°F): 547 Power Level (% F.P.): 0 Other (specify): Below Nuclear Heating
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: Moving CC: Moving CD: 228	RCS Temperature (°F): 545.8 Power Level (% F.P.): 0 Other (Specify): Below Nuclear Heating
	Date/Time Test Performed: 12/30/81 - 2243	
IV Test Results	Meas Parameter (Description)	I_C^{RS} ;Int Worth of Cntl Bank C-Rod Swap
	Measured Value	I_C^{RS} = 793 pcm (Adj. Meas. Crit. Ref Bank Position = 110 steps)
	Design Value (Actual Cond)	I_C^{RS} = 836 ± 125 pcm (Adj. Meas. Crit. Ref Bank Position = 110 steps)
	Design Value (Design Cond)	I_C^{RS} = 829 ± 124 pcm (Critical Ref Bank Position = 134 steps)
	Reference	VEP-FRD-NFE-209, VEP-FRD-36A, NFO-TI-2.2A
V Acceptance Criteria	FSAR/Tech Spec	If Design Tolerance is exceeded, SNSOC shall evaluate impact of test result on safety analysis. SNSOC may specify that additional testing be performed
	Reference	VEP-FRD-36A
VI Comments	Design Tolerance is met : X YES ___NO Acceptance Criteria is met : X YES ___NO	

Completed By: ______________
Test Engineer

Evaluated By: ______________

Recommended for
Approval By : C. T. Snow
NFO Engineer

JUL 31 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: Cntl. Bank A Worth Measurement-Rod Swap Proc No /Section: PT28.11/APP. F Sequence Step No: 16	
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA:Moving CB:Moving CC: 228 CD: 228	RCS Temperature (°F): 547 Power Level (% F.P.): 0 Other (specify): Below Nuclear Heating
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: Moving CB: Moving CC: 228 CD: 228	RCS Temperature (°F): 545.7 Power Level (% F.P.): 0 Other (Specify): Below Nuclear Heating
	Date/Time Test Performed: 12/30/81 2343	
IV Test Results	Meas Parameter (Description)	I_A^{RS} ;Int Worth of Cntl Bank A-Rod Swap
	Measured Value	I_A^{RS} = 595 pcm (Adj. Meas. Crit. Ref Bank Position = 88 steps)
	Design Value (Actual Cond)	I_A^{RS} = 562 ± 100 pcm (Adj. Meas. Crit. Ref Bank Position = 88 steps)
	Design Value (Design Cond)	I_A^{RS} = 582 ± 100 pcm (Critical Ref Bank Position = 104 steps)
	Reference	VEP-FRD-NFE-209, VEP-FRD-36A, NFO-TI-2.2A
V Acceptance Criteria	FSAR/Tech Spec	If Design Tolerance is exceeded, SNSOC shall evaluate impact of test result on safety analysis. SNSOC may specify that additional testing be performed.
	Reference	VEP-FRD-36A
VI Comments	Design Tolerance is met : X YES __NO Acceptance Criteria is met : X YES __NO	

Completed By: L. J. Gullman
Test Engineer

Evaluated By: E. J. Heub

Recommended for
Approval By : C. T. Snow
NFO Engineer

JUL 31 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: Shutdown Bank B Worth Measurement-Rod Swap Proc No /Section: PT28.11/APP. F Sequence Step No: 17	
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: Moving CA: 228 CB: Moving CC: 228 CD: 228	RCS Temperature (°F): 547 Power Level (% F.P.): 0 Other (specify): Below Nuclear Heating
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: Moving CA: 228 CB: Moving CC: 228 CD: 228	RCS Temperature (°F): 545.8 Power Level (% F.P.): 0 Other (Specify): Below Nuclear Heating
	Date/Time Test Performed: 12/31/81 0015	

IV Test Results	Meas Parameter (Description)	I_{SB}^{RS} ; Int Worth of Shutdown Bank B-Rod Swap
	Measured Value	I_{SB}^{RS} = 848 pcm (Adj. Meas. Crit. Ref Bank Position = 116 steps)
	Design Value (Actual Cond)	I_{SB}^{RS} = 906 ± 136 (Adj. Meas. Crit. Ref Bank Position = 116 steps)
	Design Value (Design Cond)	I_{SB}^{RS} = 915 ± 137 pcm (Critical Ref Bank Position = 146 steps)
	Reference	VEP-FRD-NFE-209, VEP-FRD-36A, NFO-TI-2.2A
V Acceptance Criteria	FSAR/Tech Spec	If Design Tolerance is exceeded, SNSOC shall evaluate impact of test result on safety analysis. SNSOC may specify that additional testing be performed.
	Reference	VEP-FRD-36A
VI Comments	Design Tolerance is met : X YES ___NO Acceptance Criteria is met : X YES ___NO	

Completed By: Test Engineer

Evaluated By:

Recommended for Approval By: NFO Engineer

JUL 3 1 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: Shutdown Bank A Worth Measurement-Rod Swap Proc No /Section: PT28.11/APP. F	Sequence Step No: 18
II Test Conditions (Design)	Bank Positions (Steps) SDA: Moving SDB: 228 CA: 228 CB: Moving CC: 228 CD: 228	RCS Temperature (°F): 547 Power Level (% F.P.): 0 Other (specify): Below Nuclear Heating
III Test Conditions (Actual)	Bank Positions (Steps) SDA: Moving SDB: 228 CA: 228 CB: Moving CC: 228 CD: 228	RCS Temperature (°F): 545.4 Power Level (% F.P.): 0 Other (Specify): Below Nuclear Heating
	Date/Time Test Performed: 12/31/81 0048	

IV Test Results	Meas Parameter (Description)	I_{SA}^{RS} ; Int Worth of Shutdown Bank A-Rod Swap
	Measured Value	I_{SA}^{RS} = 1134 pcm (Adj. Meas. Crit. Ref Bank Position = 163 steps)
	Design Value (Actual Cond)	I_{SA}^{RS} = 1057 ± 159 pcm (Adj. Meas. Crit. Ref Bank Position = 163 steps)
	Design Value (Design Cond)	I_{SA}^{RS} = 1057 ± 159 pcm (Critical Ref Bank Position = 167 steps)
	Reference	VEP-FRD-NFE-209, VEP-FRD-36A, NFO-TI-2.2A
V Acceptance Criteria	FSAR/Tech Spec	If Design Tolerance is exceeded, SNSOC shall evaluate impact of test result on safety analysis. SNSOC may specify that additional testing be performed.
	Reference	VEP-FRD-36A
VI Comments	Design Tolerance is met : X YES ___NO Acceptance Criteria is met : X YES ___NO	

Completed By: Test Engineer

Evaluated By:

Recommended for Approval By : C. T. Snow
NFO Engineer

JUL 3 1 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: Total Rod Worth-Rod Swap Proc No /Section: PT28.11/APP. F	Sequence Step No: N/A
II Test Conditions (Design)	Bank Positions (Steps) SDA:Moving SDB:Moving CA:Moving CB:Moving CC:Moving CD:Moving	RCS Temperature (°F): 547 Power Level (% F.P.): 0 Other (specify): Below Nuclear Heating
III Test Conditions (Actual)	Bank Positions (Steps) SDA: Moving SDB: Moving CA: Moving CB: Moving CC: Moving CD: Moving	RCS Temperature (°F): 545.8 Power Level (% F.P.): 0 Other (Specify): Below Nuclear Heating
	Date/Time Test Performed: 12/30/81-0530 - 12/31/81-0121	
IV Test Results	Measured Parameter (Description)	I_{TOTAL}; Integral Worth of All Rod Banks-Rod Swap
	Measured Value	I_{TOTAL}= 5856 pcm
	Design Value (Actual Conditions)	I_{TOTAL}= 5872 ± 587 pcm
	Design Value (Design Conditions)	I_{TOTAL}= 5893 ± 589 pcm
	Reference	VEP-FRD-NFE-209, VEP-FRD-36A, NFO-TI-2.2A
V Acceptance Criteria	FSAR/Tech Spec	If Design Tolerance is exceeded, SNSOC shall evaluate impact of test result on safety analysis. SNSOC may specify that additional testing be performed.
	Reference	VEP-FRD-36A
VI Comments	Design Tolerance is met : ☒ YES ☐ NO Acceptance Criteria is met : ☒ YES ☐ NO	

Completed By: ______________
Test Engineer

Evaluated By: ______________

Recommended for Approval By : C. T. Snow
NFO Engineer

JUL 3 1 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description : M/D Flux Map - At Power, NI Calib. Proc No / Section: PT28.2, OP-57	Sequence Step No: 46
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB : 228 CC : 228 CD: *	RCS Temperature (°F): T_{REF} ±1 Power Level (% F.P.): ~50 Other (specify) Must have ≥ 40 thimbles
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB : 228 CC : 228 CD: 184 Date/Time Test: Performed: 1/1/82 0448	RCS Temperature (°F): T_{REF} ±1 Power Level (% F.P.): 47.3 Other (Specify): 48 thimbles

IV	Meas Parameter (Description)	MAX. REL ASSY PWR % DIFF (M-P)/P	NUC ENTHAL RISE HOT CHAN FACT F-dH(N)	TOTAL HEAT FLUX HOT CHAN FACT F-Q(T)	QUADRANT POWER TILT RATIO QPTR
Test Results	Measured Value	7.31 for P_{G-9} = 1.07 8.0% for P_{D-5} = 0.47	1.446	1.982	1.0057
	Design Value (Design Conds)	±10% for $P_i \geq .9$ ±15% for $P_i < .9$ (P_i = Assy. Pwr.)	NA	NA	≤ 1.02
	Reference	WCAP-7905 REV.1	NONE	NONE	WCAP-7905 REV.1
V Acceptance Criteria	FSAR/Tech Spec	NONE	$F^N_{\Delta H} \leq 1.55(1+.2(1-P))$	$F^T_Q(Z) \leq \frac{2.18}{P} \times K(Z)$	NA
	Reference	NONE	T.S. 3.12	T.S. 3.12	T.S. 3.12

VI Comments

Design Tolerance is met : ✓ YES ___ NO

Acceptance Criteria is met : ✓ YES ___ NO

* Above Insertion Limits

Completed By: ____________ Test Engineer

Evaluated By: ____________

Recommended for Approval By : ____________ NFO Engineer

JUL 3 1 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description : M/D Flux Map - At Power, NI Calib. Proc No / Section: PT28.2, OP-57 Sequence Step No: 47				
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB : 228 CC : 228 CD: *		RCS Temperature (°F): T_{REF} ±1 Power Level (% F.P.): ~60 Other (specify) Must have ≥ 40 thimbles		
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB : 228 CC : 228 CD: 180/179 Date/Time Test Performed: 1/1/82 - 1108		RCS Temperature (°F): T_{REF} ±1 Power Level (% F.P.): 57.0% Other (Specify): 48 thimbles		
IV	Meas Parameter (Description)	MAX. REL ASSY PWR % DIFF (M-P)/P	NUC ENTHAL RISE HOT CHAN FACT F-dH(N)	TOTAL HEAT FLUX HOT CHAN FACT F-Q(T)	QUADRANT POWER TILT RATIO QPTR
Test Results	Measured Value	-7.21 for $P_{J-8} = 1.10$ 7.21 for $P_{B5} = 0.46$	1.426	1.962	1.0039
	Design Value (Design Conds)	±10% for $P_i \geq .9$ ±15% for $P_i < .9$ (P_i = Assy. Pwr.)	NA	NA	≤ 1.02
	Reference	WCAP-7905 REV.1	NONE	NONE	WCAP-7905 REV.1
V Acceptance Criteria	FSAR/Tech Spec	NONE	$F^N_{\Delta H} \leq 1.55(1+.2(1-P))$	$F^T_Q(Z) \leq \frac{2.18}{P} \times K(Z)$	NA
	Reference	NONE	T.S. 3.12	T.S. 3.12	T.S. 3.12
VI Comments	Design Tolerance is met : X YES ___NO Acceptance Criteria is met : X YES ___NO * Above Insertion Limits				

Completed By: L. J. Aufinaw
Test Engineer

Evaluated By: E. J. Hed

Recommended for Approval By : C. T. Snow
NFO Engineer

JUL 3 1 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description : M/D Flux Map - At Power, NI Calib. Proc No / Section: PT28.2, OP-57	Sequence Step No: 48
II Test Conditions (Design)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB : 228 CC : 228 CD: *	RCS Temperature (°F): T_{REF} ±1 Power Level (% F.P.): ~70 Other (specify) Must have ≥ 40 thimbles
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB : 228 CC : 228 CD: 204	RCS Temperature(°F): T_{Ref} ±1 Power Level (% F.P.): 68% Other (Specify): 48 Thimbles
	Date/Time Test: Performed: 1/1/82 1809	

IV	Meas Parameter (Description)	MAX. REL ASSY PWR % DIFF (M-P)/P	NUC ENTHAL RISE HOT CHAN FACT F-dH(N)	TOTAL HEAT FLUX HOT CHAN FACT F-Q(T)	QUADRANT POWER TILT RATIO QPTR
Test Results	Measured Value	-6.6% for P_{N-8}=1.03 6.1% for P_{L-14}=0.47	1.422	1.853	1.0045
	Design Value (Design Conds)	±10% for $P_i \geq .9$ ±15% for $P_i < .9$ (P_i = Assy. Pwr.)	NA	NA	≤ 1.02
	Reference	WCAP-7905 REV. 1	NONE	NONE	WCAP-7905 REV. 1
V Acceptance Criteria	FSAR/Tech Spec	NONE	$F^N_{\Delta H} \leq 1.55(1+.2(1-P))$	$F^T_Q(z) \leq \frac{2.18}{P} \times K(z)$	NA
	Reference	NONE	T.S. 3.12	T.S. 3.12	T.S. 3.12

VI
Comments

Design Tolerance is met : ✓ YES ___ NO
Acceptance Criteria is met : ✓ YES ___ NO

* Above Insertion Limits

Completed By: L. J. Gufman
Test Engineer

Evaluated By: B. D. Mann

Recommended for
Approval By : C. T. Snow
NFO Engineer

JUL 31 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference

Test Description : M/D Flux Map - HFP, ARO, Eq. Xe. Map
Proc No / Section: PT28.2, OP-57 Sequence Step No: 49

II Test Conditions (Design)

Bank Positions (Steps)	
SDA: 228 SDB: 228 CA: 228	RCS Temperature (°F): T_{REF} ±1
CB : 228 CC : 228 CD: *	Power Level (% F.P.): 100
	Other (specify): Eq. Xe.
	Must have ≥ 40 thimbles

III Test Conditions (Actual)

Bank Positions (Steps)	
SDA: 228 SDB: 228 CA: 228	RCS Temperature (°F): T_{REF} ± 1
CB : 228 CC : 228 CD: 228	Power Level (% F.P.): 100%
Date/Time Test: Performed: 2/10/82 1344	Other (Specify): 47 Thimbles

	Meas Parameter (Description)	MAX. REL ASSY PWR % DIFF (M-P)/P	NUC ENTHAL RISE HOT CHAN FACT F-dH(N)	TOTAL HEAT FLUX HOT CHAN FACT F-Q(T)	QUADRANT POWER TILT RATIO QPTR
IV Test Results	Measured Value	6.7% for P_{L-13} = 1.02 6.77 for P_{L-14} = 0.48	1.387	1.740	1.0053
	Design Value (Design Conds)	±10% for $P_i \geq .9$ ±15% for $P_i < .9$ (P_i = Assy Pwr.)	NA	NA	≤ 1.02
	Reference	WCAP-7905 REV. 1	NONE	NONE	WCAP-7905 REV. 1
V Acceptance Criteria	FSAR/Tech Spec	NONE	$F^N_{\Delta H} \leq 1.55(1+.2(1-P))$	$F^T_Q(Z) \leq \frac{2.18}{P} \times K(Z)$	NA
	Reference	NONE	T.S. 3.12	T.S. 3.12	T.S. 3.12

VI Comments

Design Tolerance is met : ✓ YES ___NO
Acceptance Criteria is met : ✓ YES ___NO

* Above Insertion Limits

Completed By: R. J. Cuffman
Test Engineer

Evaluated By:

Recommended for
Approval By : C. J. Snow
NFO Engineer

JUL 31 1980

SURRY POWER STATION UNIT 2 CYCLE 6
STARTUP PHYSICS TEST RESULTS AND EVALUATION SHEET

I Reference	Test Description: RCS Flow Measurement Proc No /Section: ST-52	Sequence Step No: 50
II Test Conditions (Design)	Bank Positions (Steps) SDA: 223 SDB: 228 CA: 228 CB: 228 CC: 228 CD: AR	RCS Temperature (°F): T_{REF} ±1 Power Level(% F.P.): 95 +5/-0 Other (specify):
III Test Conditions (Actual)	Bank Positions (Steps) SDA: 228 SDB: 228 CA: 228 CB: 228 CC: 228 CD: AR	RCS Temperature (°F): 574°F Power Level (% F.P.): 100% Other (Specify): Power = 2433.6 mwt(T) (calc.)
	Date/Time Test Performed: 1-27-82 / 1301	

IV Test Results	Meas Parameter (Description)	F_{TOTAL}, Total RCS Flow Rate
	Measured Value	F_{TOTAL} = 305,568 gpm
	Design Value (Actual Cond)	Not Applicable
	Design Value (Design Cond)	Not Applicable
	Reference	Not Applicable
V Acceptance Criteria	FSAR/Tech Spec	F_{TOTAL} / 1.02(meas uncerty) ≥ 265,500 gpm
	Reference	FSAR Section 4.1.3; Letter from J.H. Ferguson (Vepco) to H.R. Denton (NRC) dated April 28, 1981 (Serial No. 232); Letter from C.M. Stallings (Vepco) to E.G. Case (NRC) dated November 16, 1977 (Serial No. 516).

VI Comments	Design Tolerance is met : X YES ___ NO Acceptance Criteria is met : X YES ___ NO

Completed By: ________________
Test Engineer

Evaluated By: ________________

Recommended for
Approval By: ________________
Engineer