Regulatory Docket File

SEMIANNUAL OPERATING REPORT
JULY 1, 1974 THROUGH DECEMBER 31, 1974
UNIT NOS. 1 AND 2
SURRY POWER STATION

DOCKET NOS. 50-280 AND 50-281
LICENSE NOS. DPR-32 AND DPR-37

Entered w/ltr Dated 3-3-75

2545

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DPR-37

REPORT NO.: SOR - 5

VIRGINIA ELECTRIC AND POWER COMPANY

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1.0 INTRODUCTION

This report is submitted to the Atomic Energy Commission pursuant to Surry Power Station, Unit Nos. 1 and 2, Technical Specification 6.6, "Station Reporting Requirements", which states:

"A. Routine Operating Reports

A report covering a six-month period shall be submitted in writing to the Director of the Regional Regulatory Operations Office within 60 days after January 1 and July 1 of each year. The due date of the first report shall be determined from the date of initial criticality and shall cover the period from the date the operating license was issued to the end of the report period. Such reports are due within 60 days after the end of each reporting period.

The information reported herein also satisfies additional reporting requirements established in other technical specifications and the Atomic Energy Commission. In order to facilitate the referencing of material in this report with the applicable reporting requirements, an index cross-referencing the report section number and the reporting requirement is given in Section 12.0.

2.0 NON-RADIOLOGICAL MONITORING PROGRAM - THERMAL AND PHYSICAL CHARACTERISTICS

The Non-radiological Monitoring Program - Thermal and Physical Characteristics applies to the monitoring of the temperature-salinity distribution in the ten (10) mile segment of the James River centered at Hog Island. The objective of the program is to determine the relationship between the thermal discharge and the physical-chemical characteristics of the water mass within the ten (10) mile tidal segment of the James River and the effects of the operation of the Surry Power Station on the physical and chemical variables of the James River Estuary.

2.1 TEMPERATURE MONITORING

Summary

The temperature monitoring program encompasses the segment of the James River Estuary which extends below the intake of the Surry Power Station upstream to the southern shore of Jamestown Island as shown in Figure 2.1-1. Temperatures have been continuously monitored and recorded at eight (8) locations located throughout the estuarine segment approximately as shown in Figure 2.1.1-1. Near surface and bottom temperatures are recorded as indicated on the figure.

Results

The results of the temperature monitoring program are summarized in Sections 2.1.1, 2.1.2, and 2.1.3. It should be noted that the attached data do not include the station in lower Cobham Bay (No. 12) and the three (3) monitoring stations on Transect 3 (Nos. 9, 10, 11) as shown in Figure 211-1. These four (4) monitoring stations were to be installed by December 31, 1972; however, due to circumstances beyond the control of the licensee these stations are not yet fully operational.

The licensee had installed monitoring equipment with direct readout capabilities at these twelve stations. However, this equipment, which was purchased from Westinghouse Electric Corporation, proved entirely unsatisfactory and unreliable and is being retired. A new system supplied by the Environmental Devices Corporation and consisting of individual temperature recording units is on order and should be installed in early 1975. The problems associated with the Westinghouse system and its replacement have been discussed in letters to the Directorate of Licensing.

The licensee is extending every reasonable effort to place the new system in operation and plans for it to be operational soon. In the interim period, data from the eight (8) existing recorders shall be maintained.

For a comparison of field data and physical model predictions see Thermal Effects of the Surry Nuclear Power Plant on the James River, Virginia, Part IV. Results of Monitoring Physical Parameters During the First Year of Plant Operation by G. C. Parker, E. A. Shearls, and C. S. Fang, Special Report No. 51 in Applied Marine Science and Ocean Engineering, Virginia Institute of Marine Science, February, 1974.

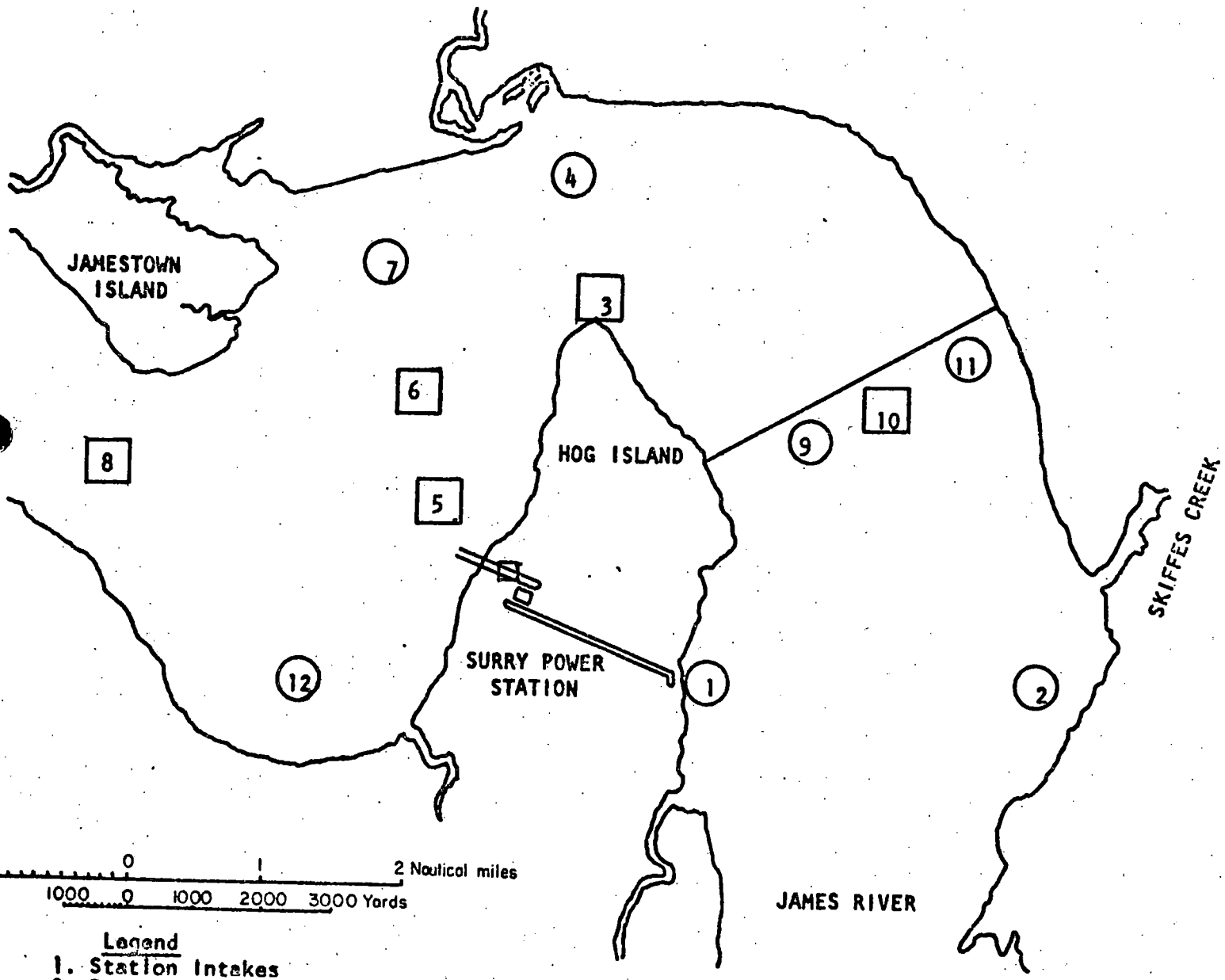
2.1.1 TEMPERATURE MONITORING STATIONS IN THE JAMES RIVER

Figures 2.1.1-1 through 2.1.1-5 summarize the results of the temperature monitoring program in the James River. The maximum and minimum river water temperature is indicated for each day of the report period. For the periods for which data are not provided, the monitoring equipment was inoperable or being repaired.

Figure 2.1.I-1

TEMPERATURE MONITORING STATIONS

SURRY POWER STATION



Legend

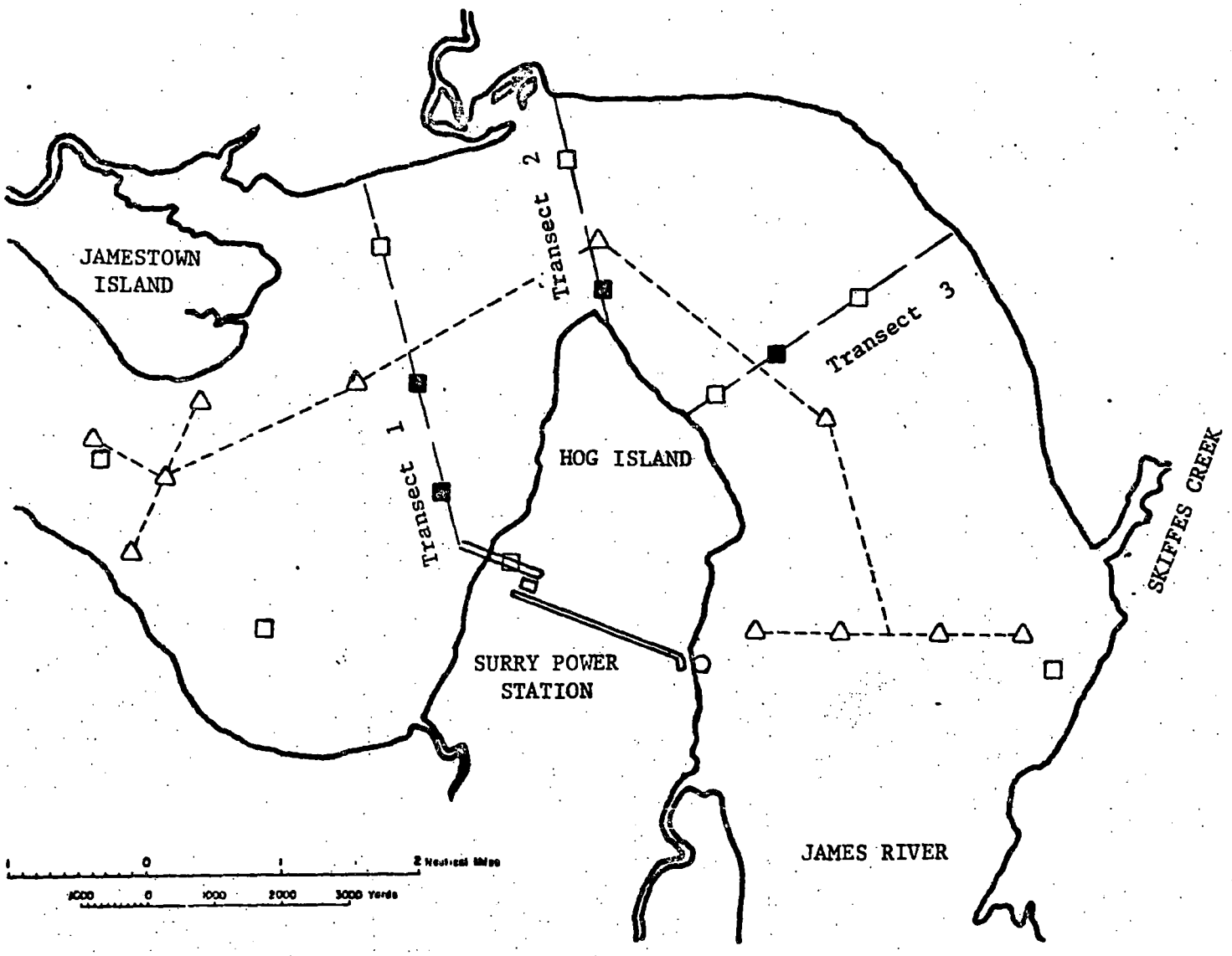
1. Station Intakes
2. Deepwater Shoals
3. Hog Point-South
4. Hog Point-North
5. Cobham Bay-South
6. Cobham Bay-Middle
7. Cobham Bay-North
8. Jamestown Island
9. Transect 3
10. Transect 3
11. Transect 3
12. Lower Cobham Bay

○ Near Surface Temperature

□ Near Surface and Bottom Temperature

Figure 2.1.1-2

TEMPERATURE AND SALINITY
MONITORING STATIONS



LEGEND:

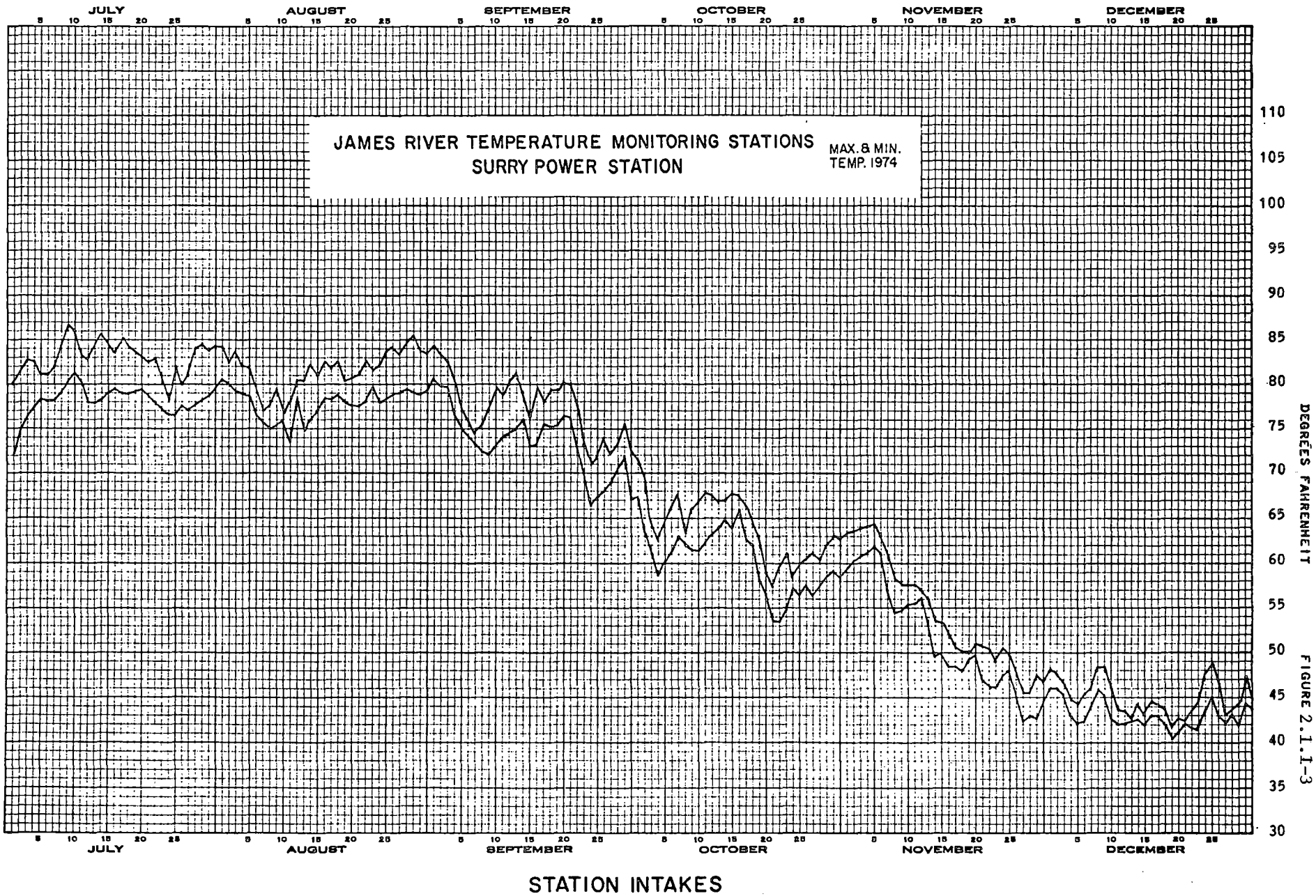
△ Monthly Salinity - Temperature Profile Station

○ Continuous Salinity - Temperature Monitoring Station

□ Near Surface Temperature Monitoring Station

■ Near Surface and Bottom Temperature Monitoring Station

--- Boat Cruise


JAMES RIVER TEMPERATURE MONITORING STATIONS
SURRY POWER STATION
MAX. & MIN.
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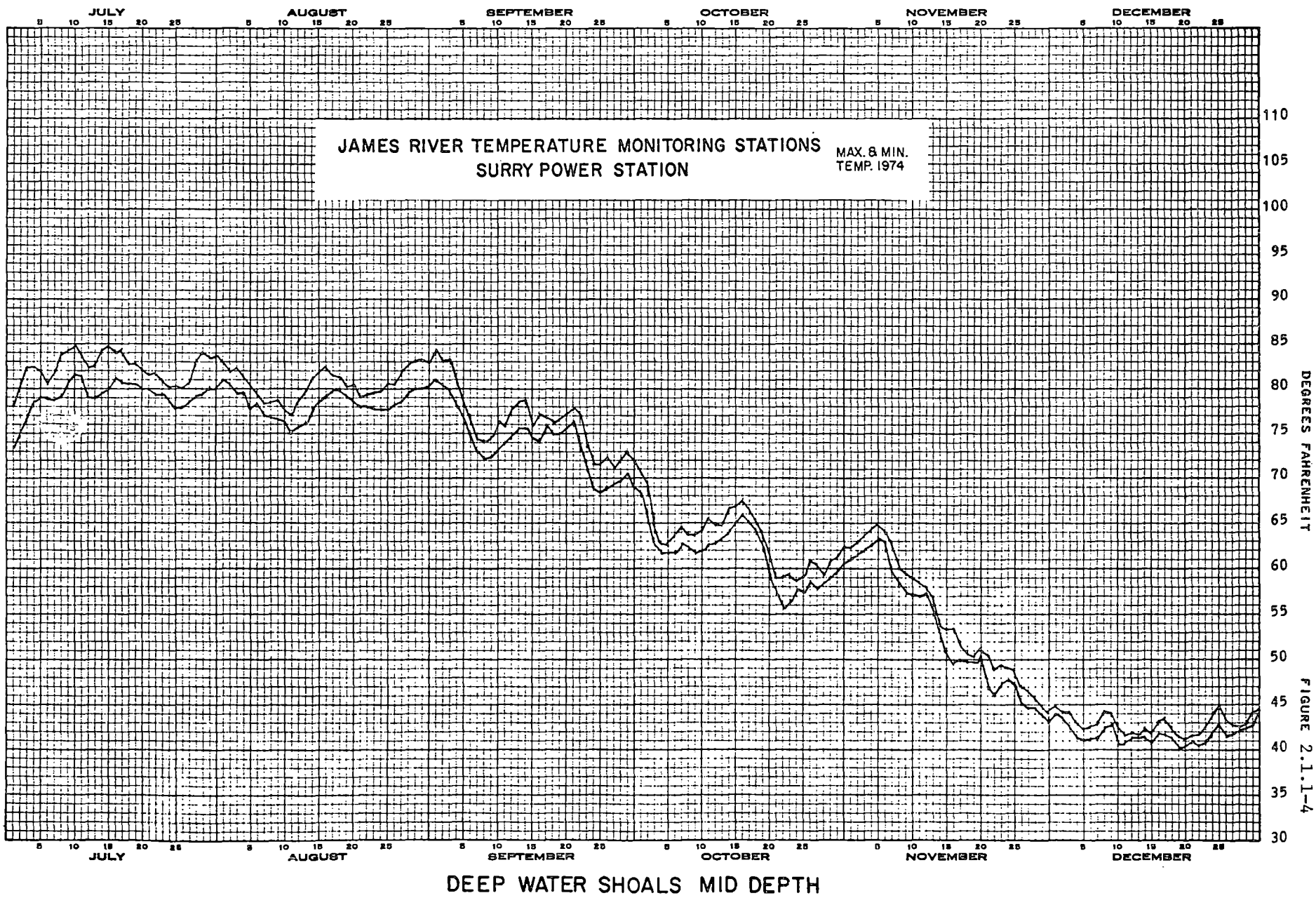
DEGREES FAHRENHEIT
STATION INTAKES

FIGURE 2.1.1-3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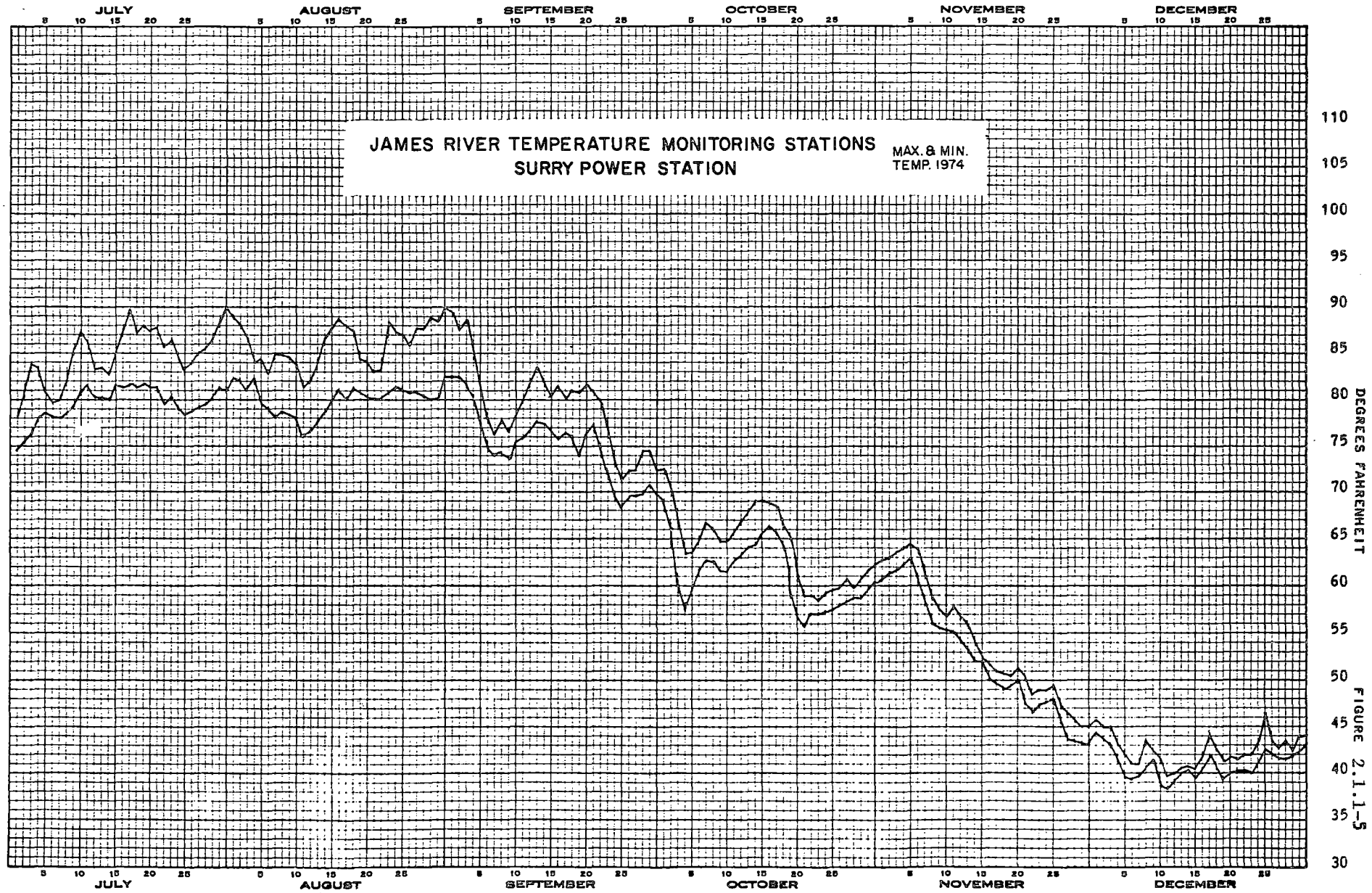
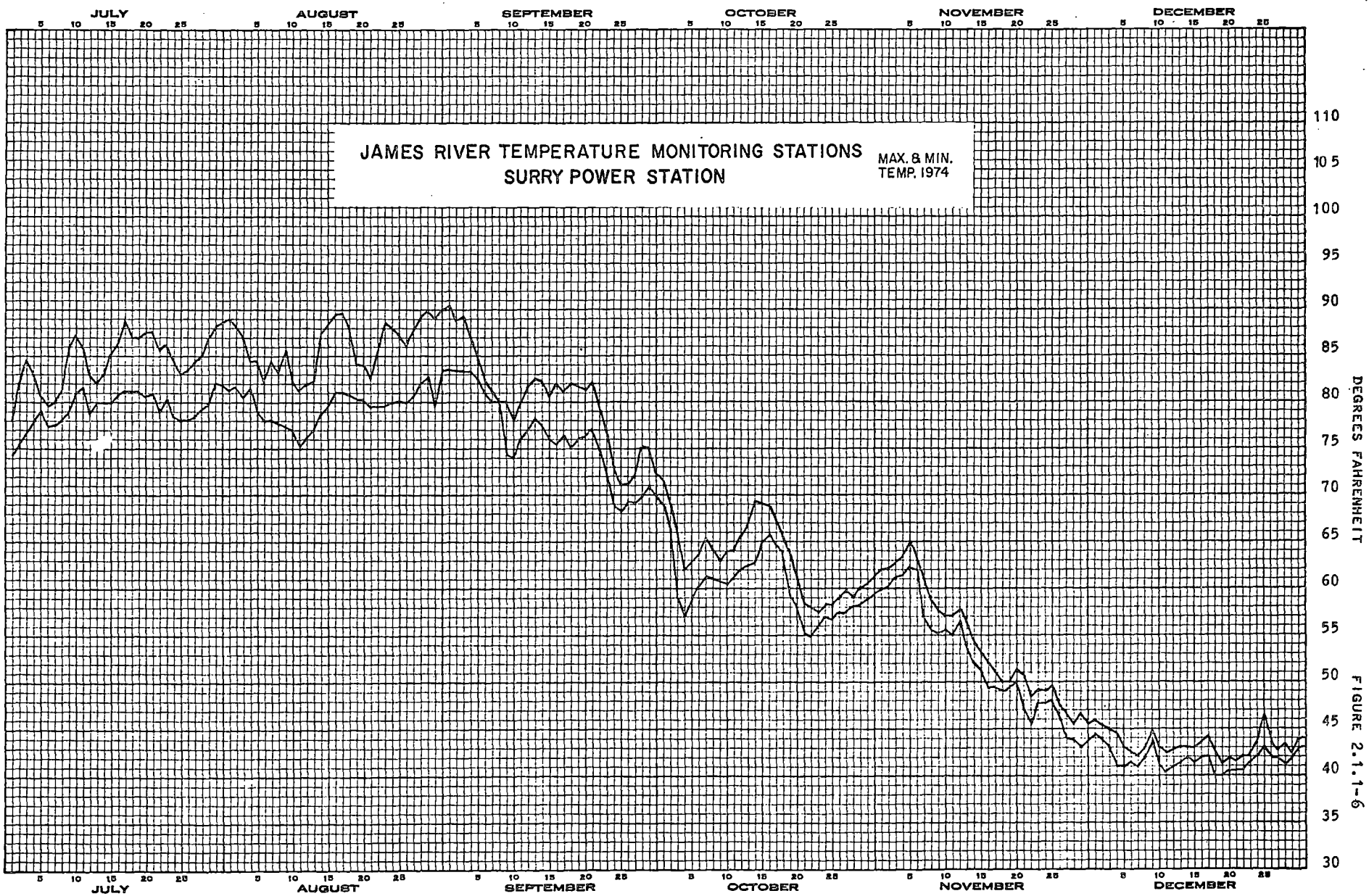
DEGREES FAHRENHEIT
DEEP WATER SHOALS MID DEPTH

FIGURE 2.1.1-4



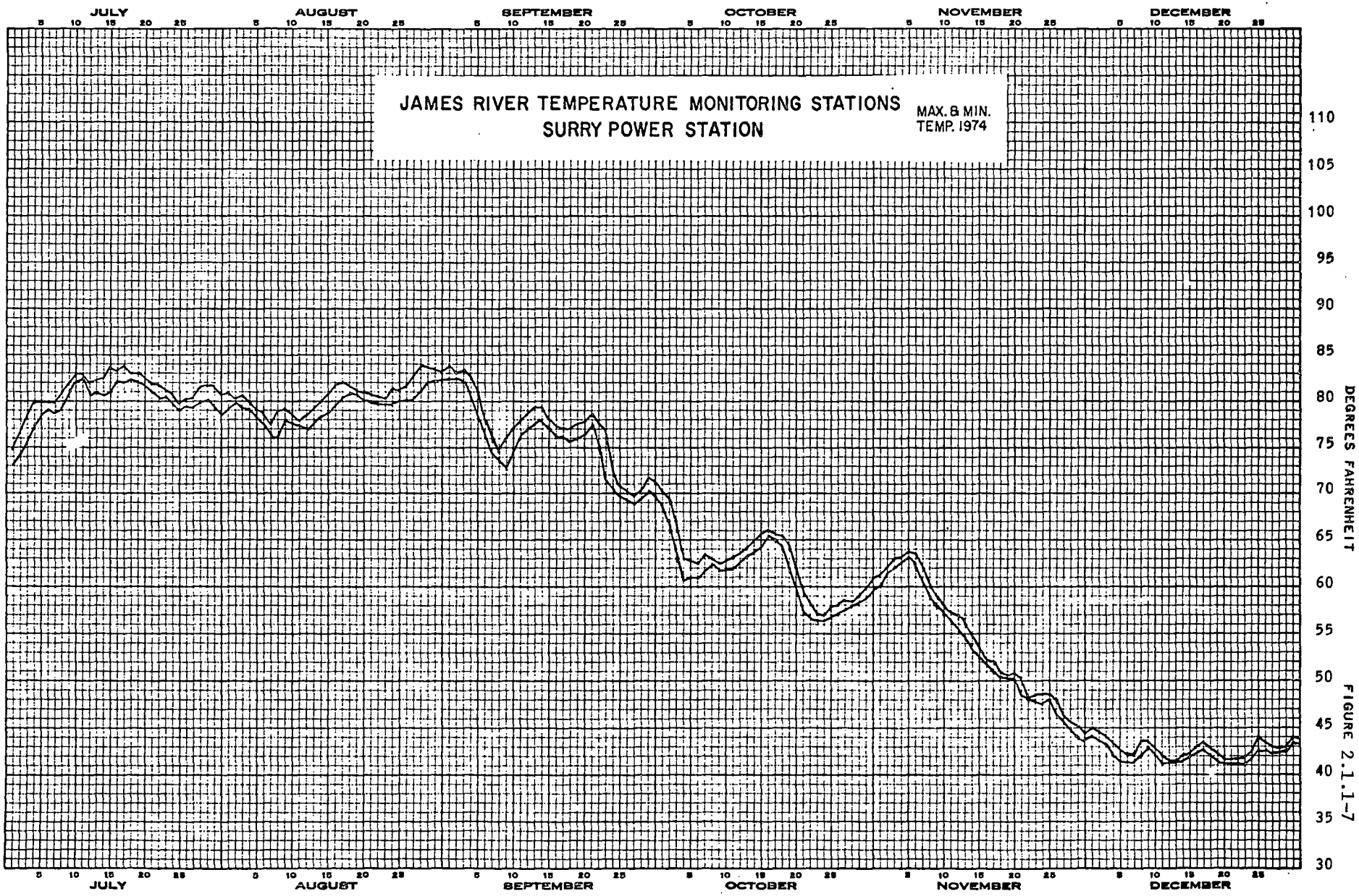
HOG POINT SOUTH MID DEPTH

FIGURE 2.1.1-5



HOG POINT SOUTH BOTTOM

FIGURE 2.1.1-6


JAMES RIVER TEMPERATURE MONITORING STATIONS
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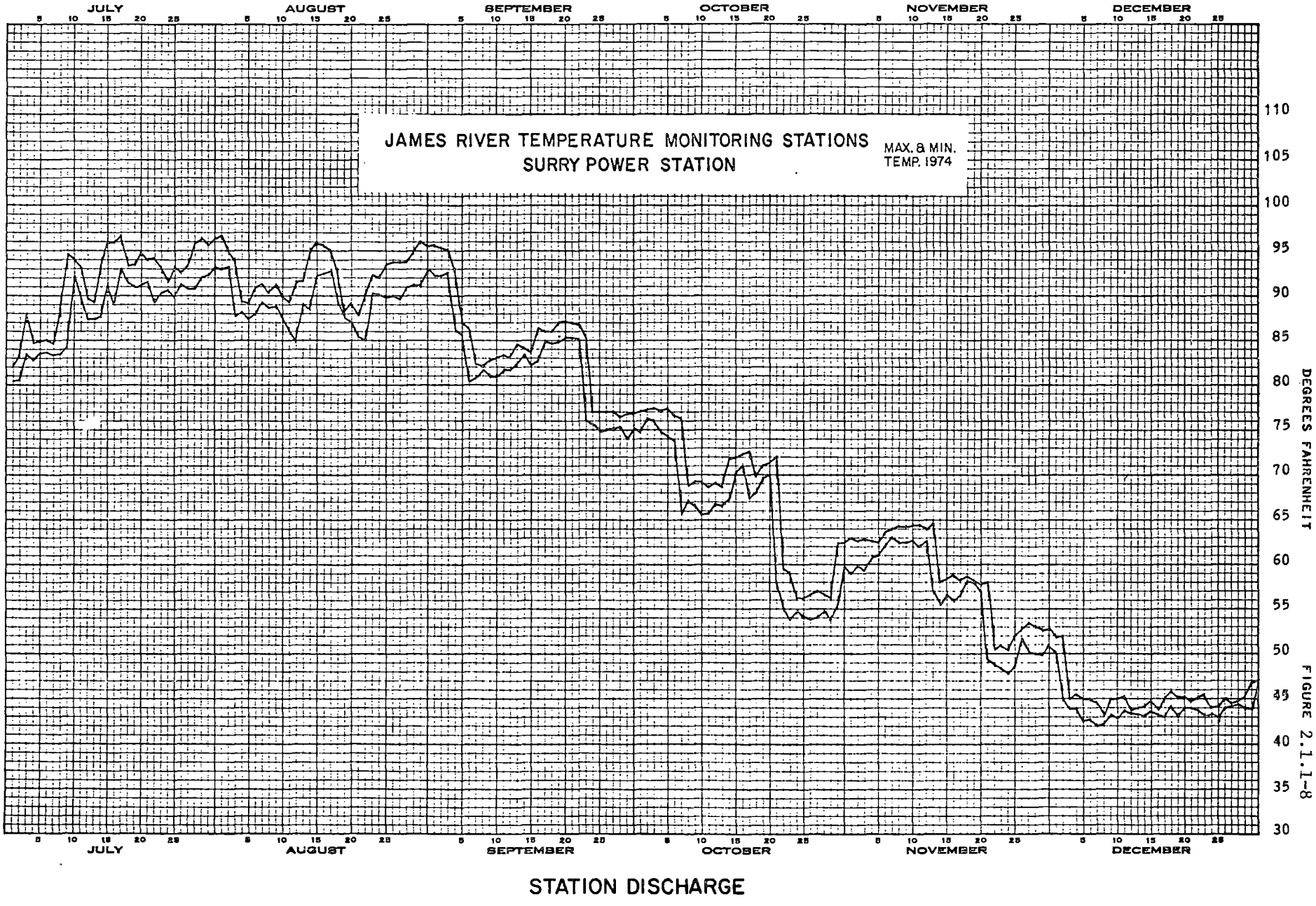
DEGREES FAHRENHEIT
HOG POINT NORTH MID DEPTH

FIGURE 2.1.1-7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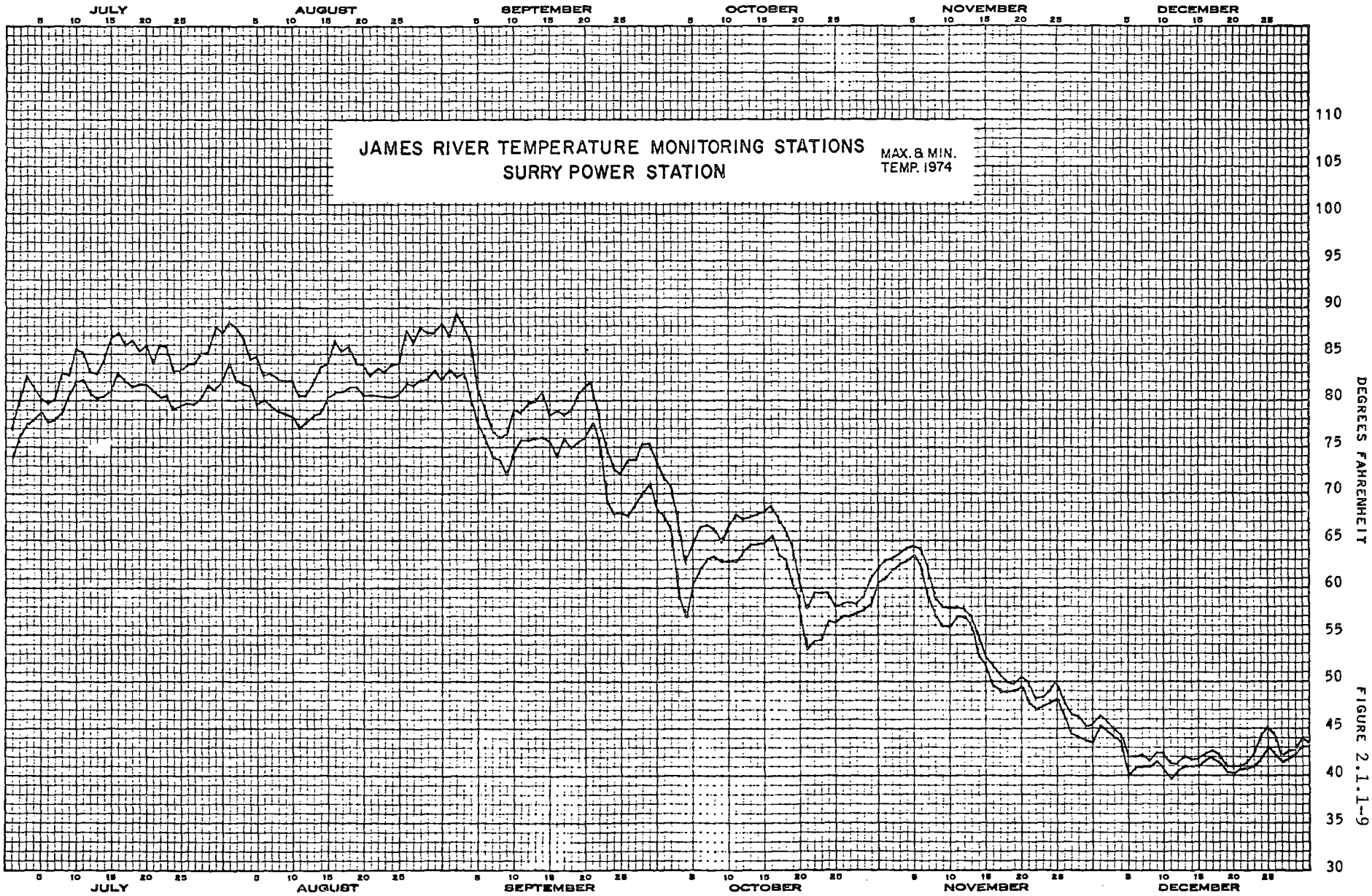
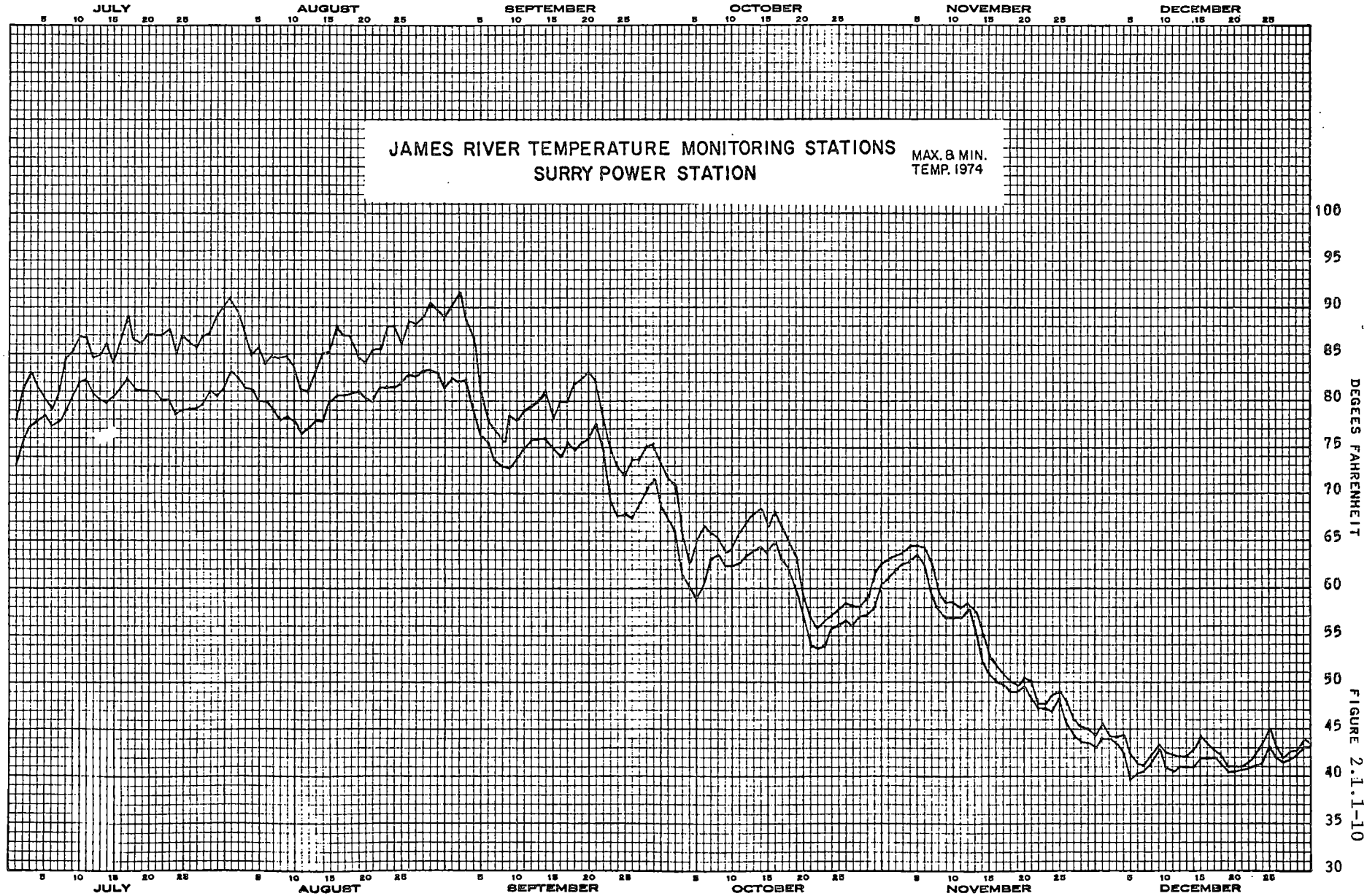
DEGREES FAHRENHEIT
STATION DISCHARGE

FIGURE 2.1.1-8



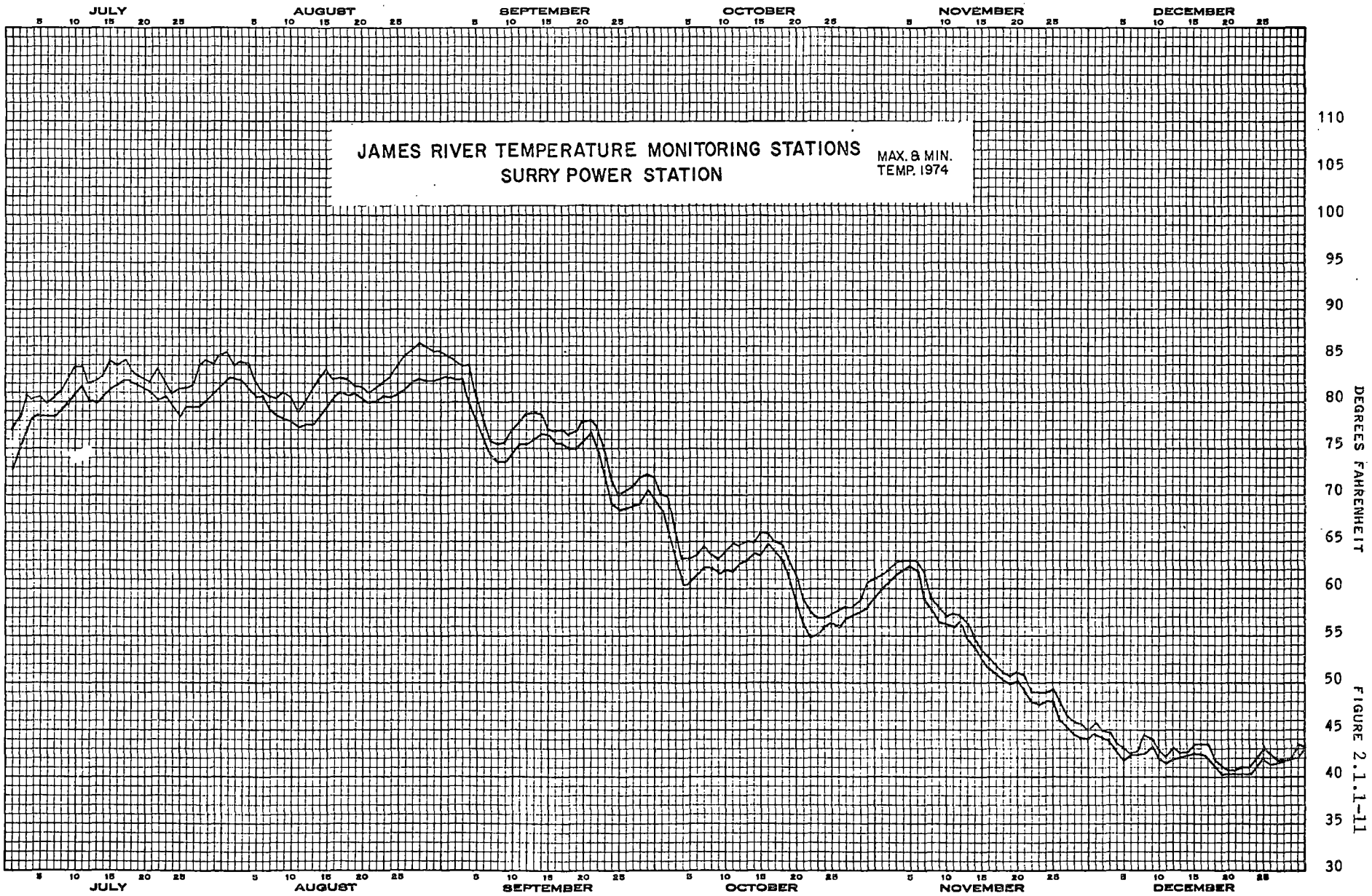
COBHAM BAY SOUTH BOTTOM

FIGURE 2.1.1-9



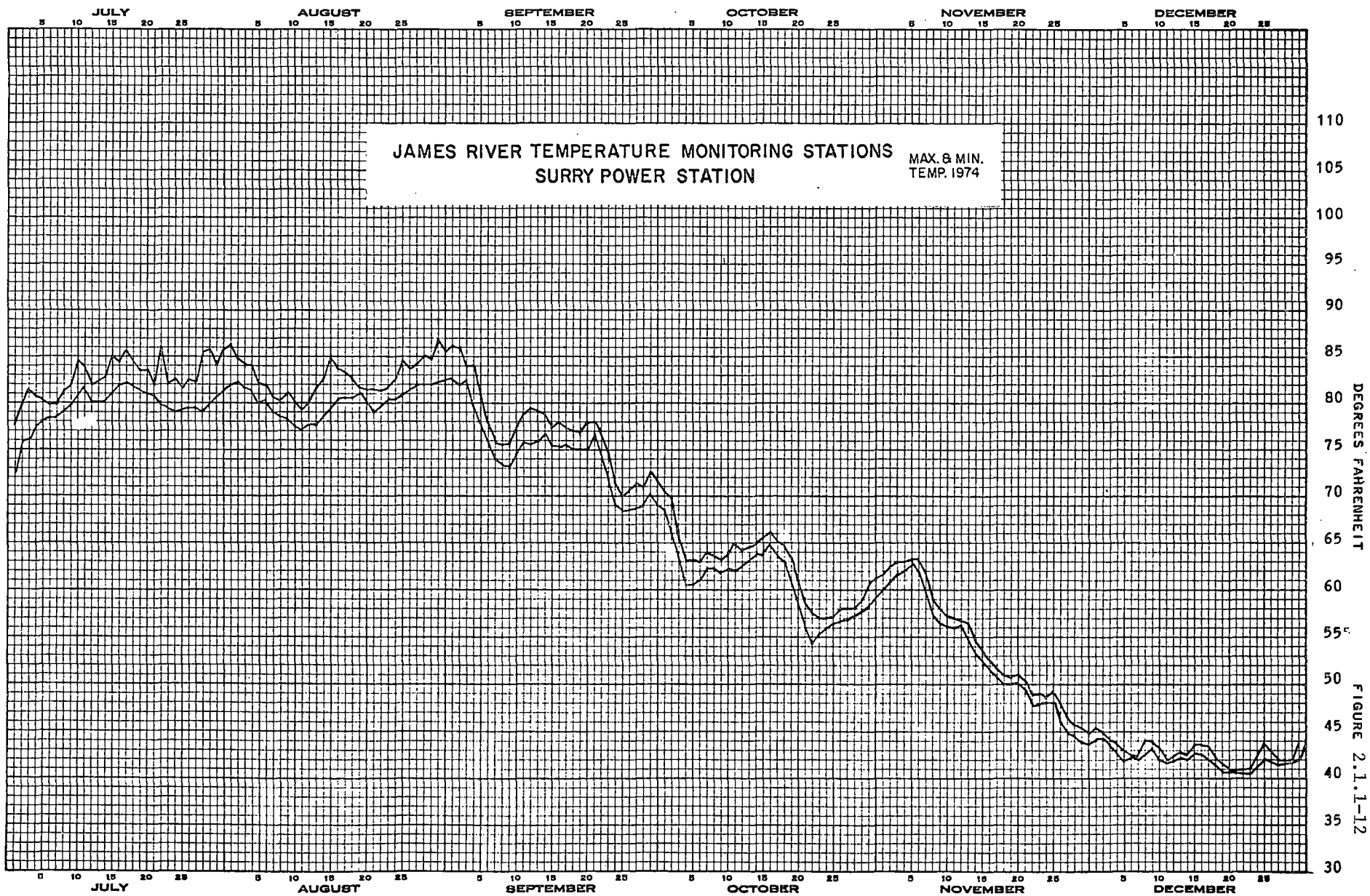
COBHAM BAY SOUTH MID DEPTH

FIGURE 2.1.1-10



COBHAM BAY MIDDLE BOTTOM

FIGURE 2.1.1-11



COBHAM BAY MIDDLE MID DEPTH

FIGURE 2.1.1-12

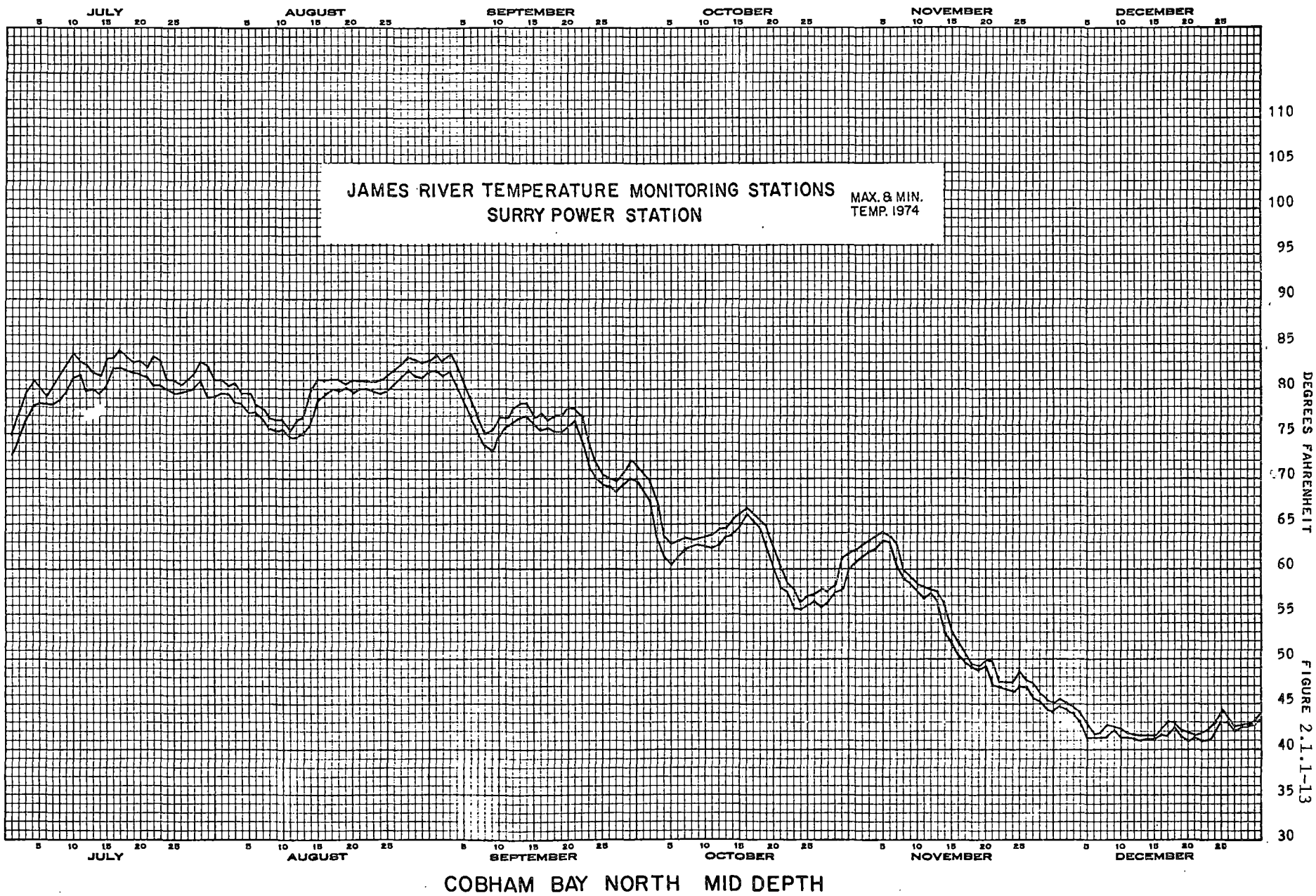
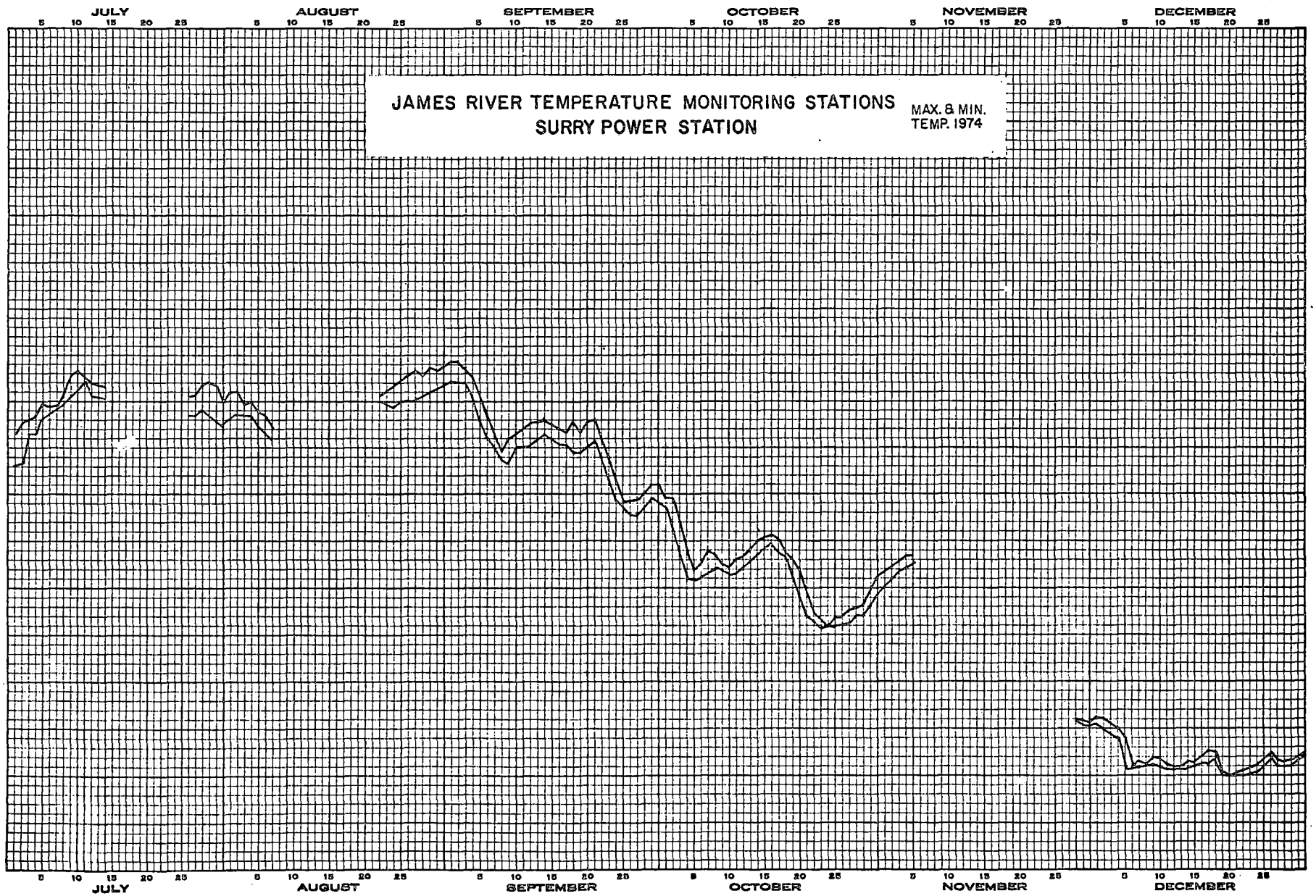
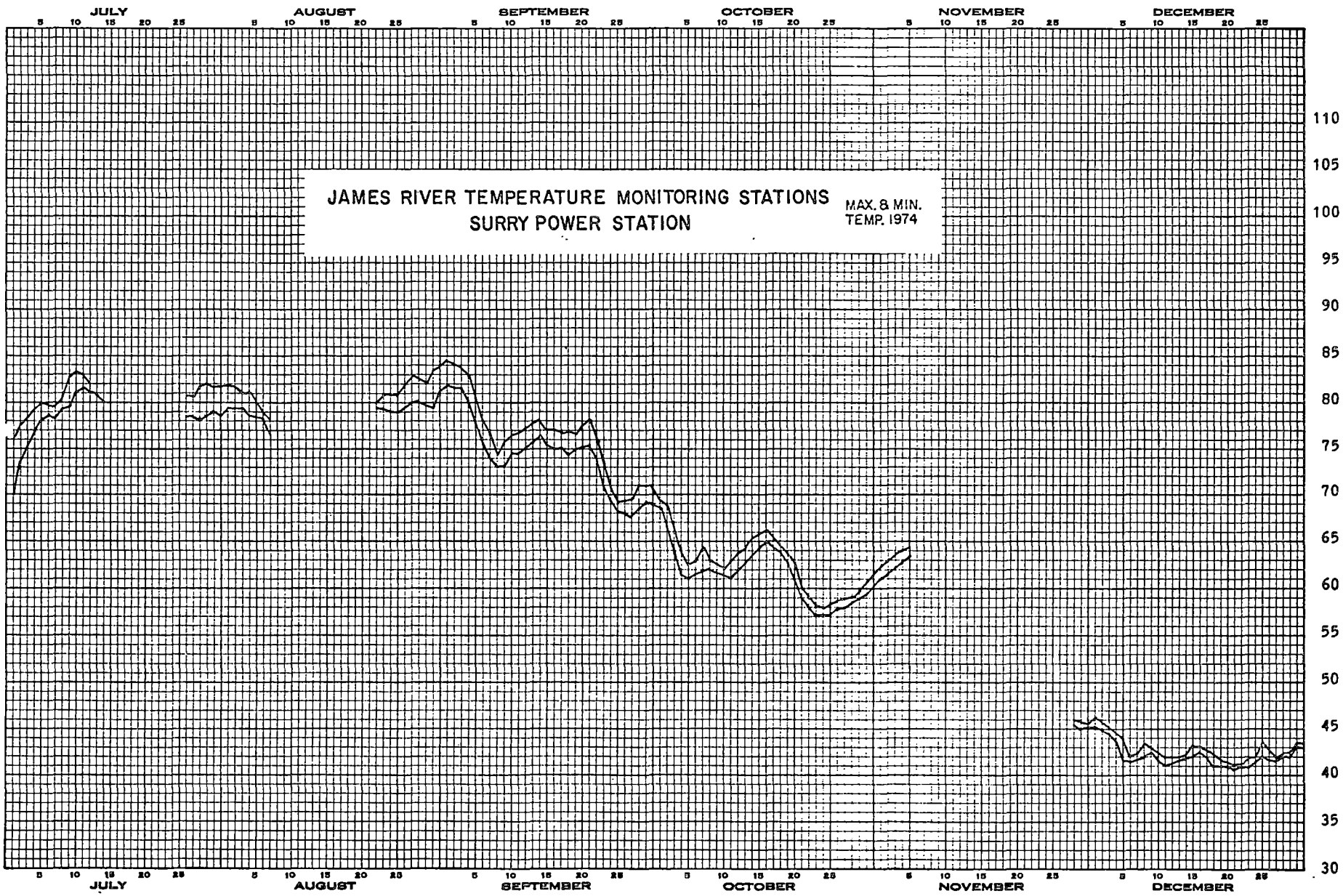


FIGURE 2.1.1-13



JAMESTOWN ISLAND MID DEPTH

FIGURE 2.1.1-14

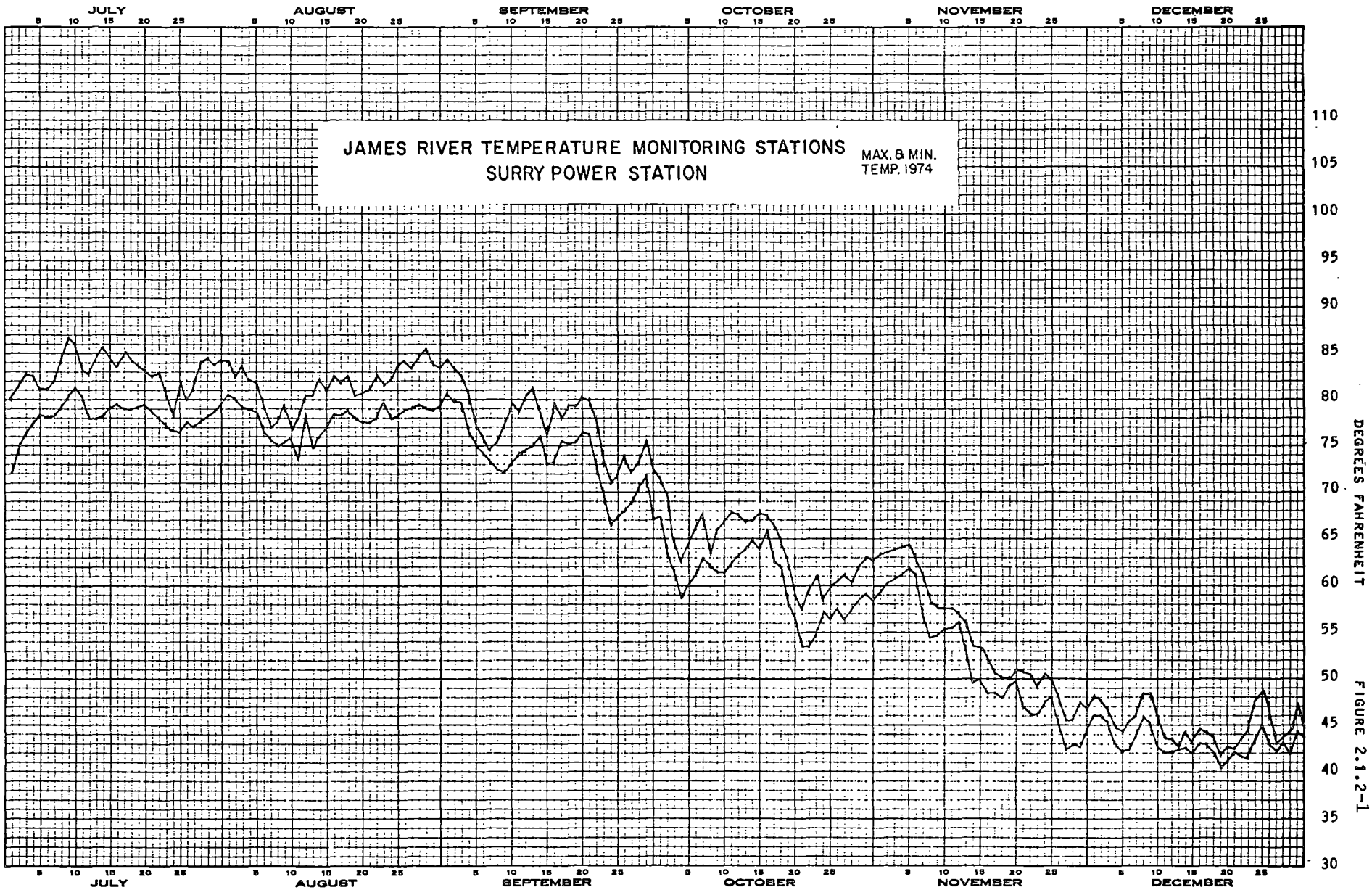


JAMESTOWN ISLAND BOTTOM

FIGURE 2.1.1-15

2.1.2 INTAKE CANAL MONITORING STATION

Figure 2.1.2-1 summarizes the data recorded at the intake canal monitoring station. The minimum and maximum river water temperature for each day in the report period is provided. For those days for which data are not provided the monitoring station was inoperable or under repair.

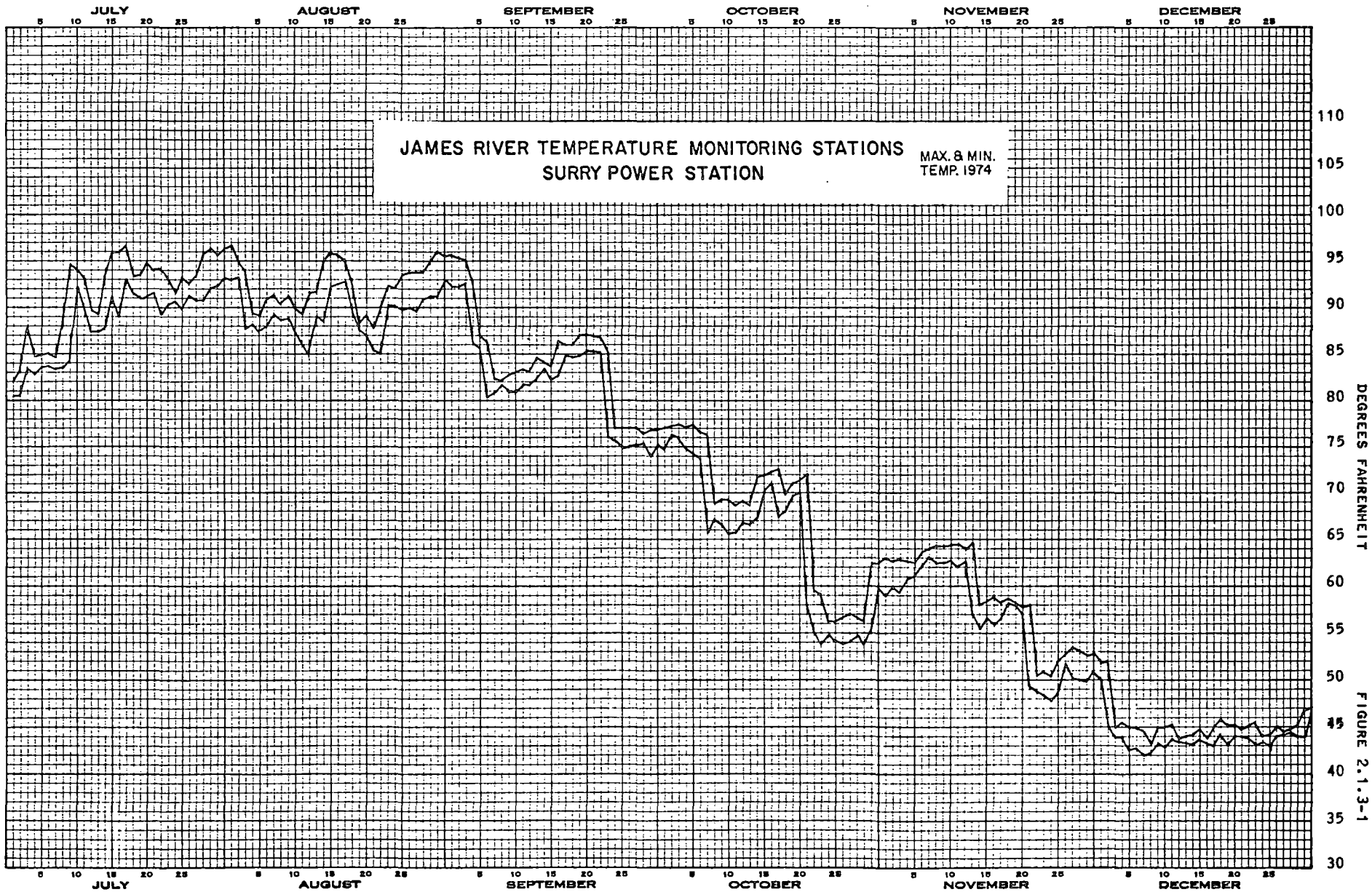


STATION INTAKES

FIGURE 2.1.2-1

2.1.3 DISCHARGE CANAL MONITORING STATION

Figure 2.1.3-1 summarizes the data recorded at the discharge canal monitoring station. The minimum and maximum river water temperature for each day in the report period is provided. For those days for which data are not provided, the monitoring station was inoperable or under repair.


JAMES RIVER TEMPERATURE MONITORING STATIONS
SURRY POWER STATION
MAX. & MIN.
TEMP. 1974
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DEGREES FAHRENHEIT
STATION DISCHARGE

FIGURE 2.1.3-1

2.2 SALINITY AND TEMPERATURE SPECIAL SURVEYS

Summary

The salinity and temperature monitoring program encompasses the segment of the James River Estuary which extends from the southern shore of Jamestown Island to below the intake of the Surry Power Station as shown in Figure 2.2-1. The horizontal and vertical salinity and temperature of this tidal segment is determined at monthly intervals as follows: Cruises are conducted at slack before flood tide. A four (4) station transect, which is between the intake structure and Skiffes Creek, is sampled from surface to bottom at two (2) meter intervals. A second transect is made near the upper limits of the segment, the exact location of which is based on the salinity regime of the system. The approximate locations of the sampling stations and the cruise route are shown on T.S. Figure 2.2-1.

Results

Monthly temperature and salinity surveys were conducted at eleven (11) sampling stations as shown in Figure 2.2-1. Data obtained from these surveys are summarized in graphical form in figures 2.2-2 through 2.2-5.

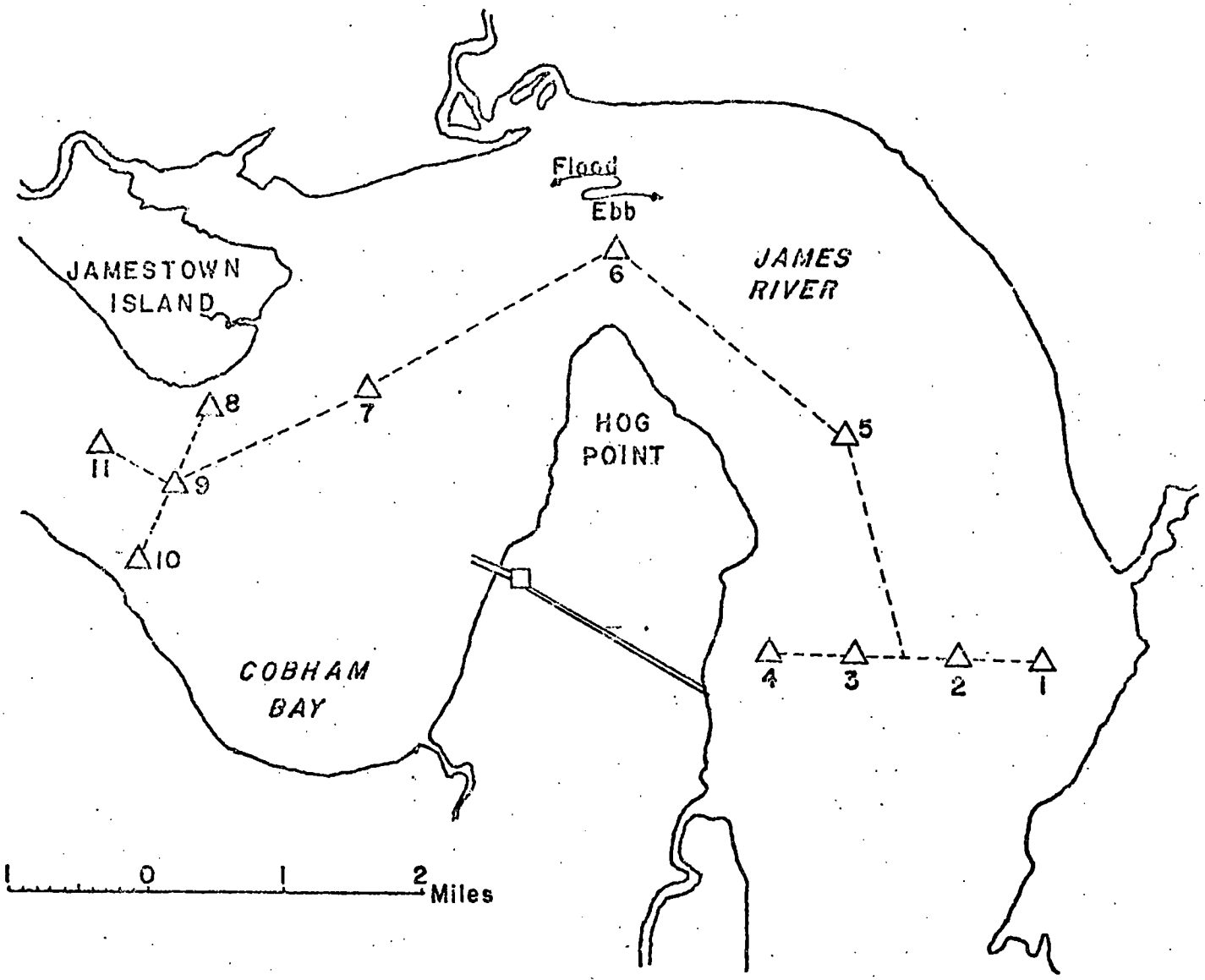
CONCLUSIONS

The salinity in this segment of the river varied between 0 and 10.1 parts per thousand during the reporting period. There is no measurable difference in salinity occurring as a result of the diversion of river water through the cooling system. Therefore, it is concluded that the operation of the station had no significant effect on the salinity structure of the James River.

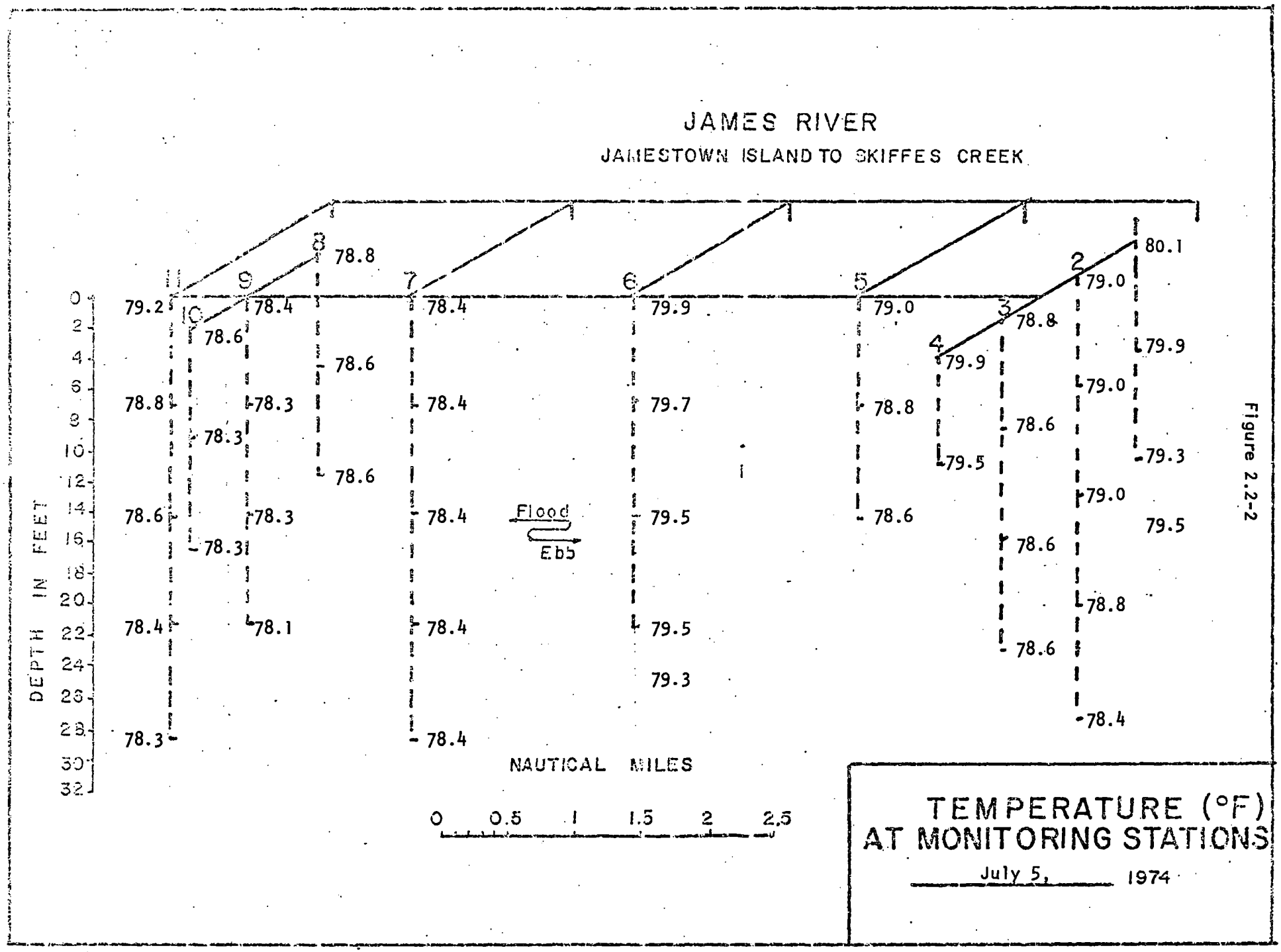
Temperature readings taken in conjunction with salinity surveys are also presented.

Figure 2.2-1

SURRY POWER STATION

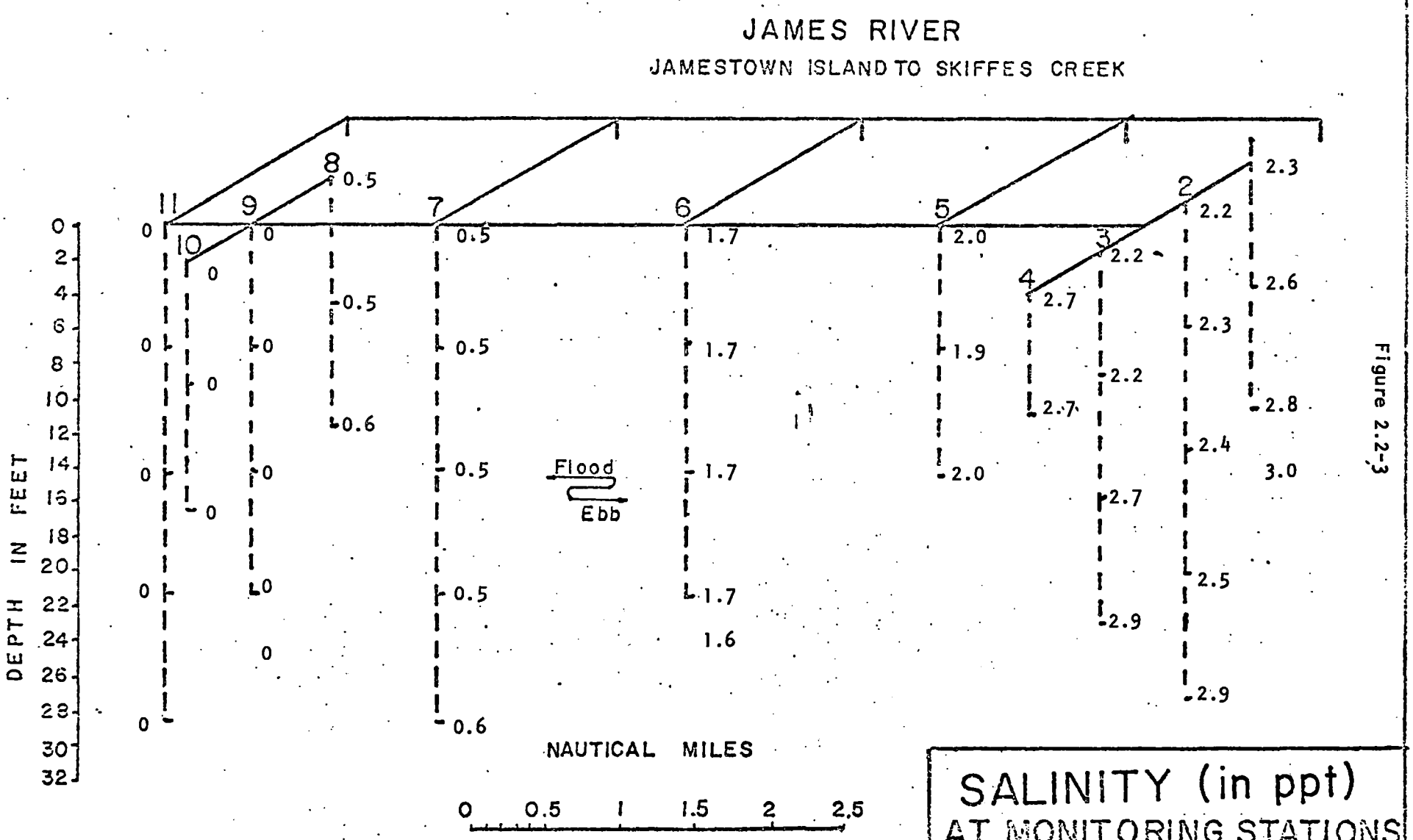


△ SAMPLING STATIONS



TEMPERATURE (°F)
AT MONITORING STATIONS
July 5, 1974

Figure 2.2-2



SALINITY (in ppt)
AT MONITORING STATIONS
July 5, 1974

Figure 2.2-3

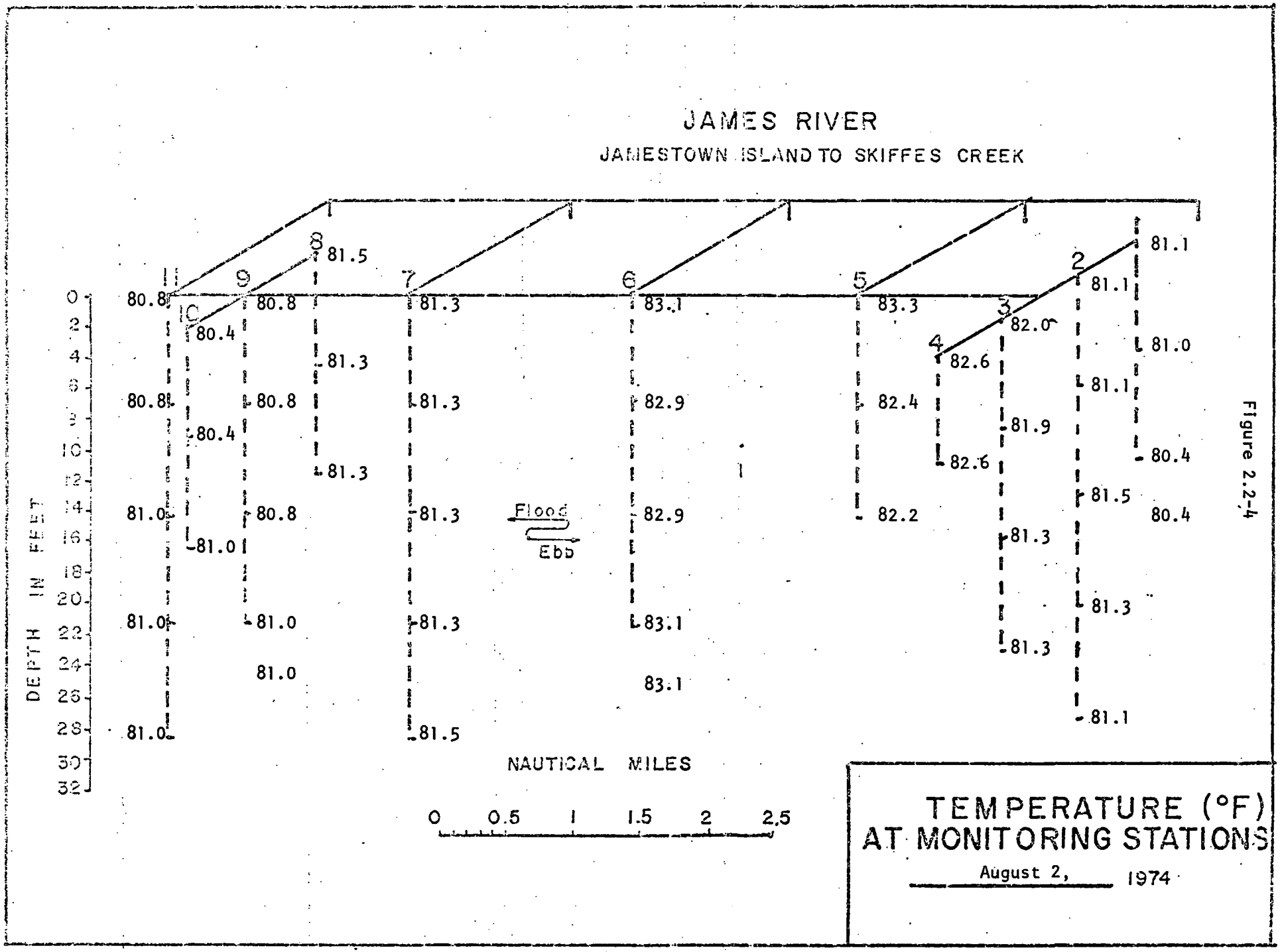
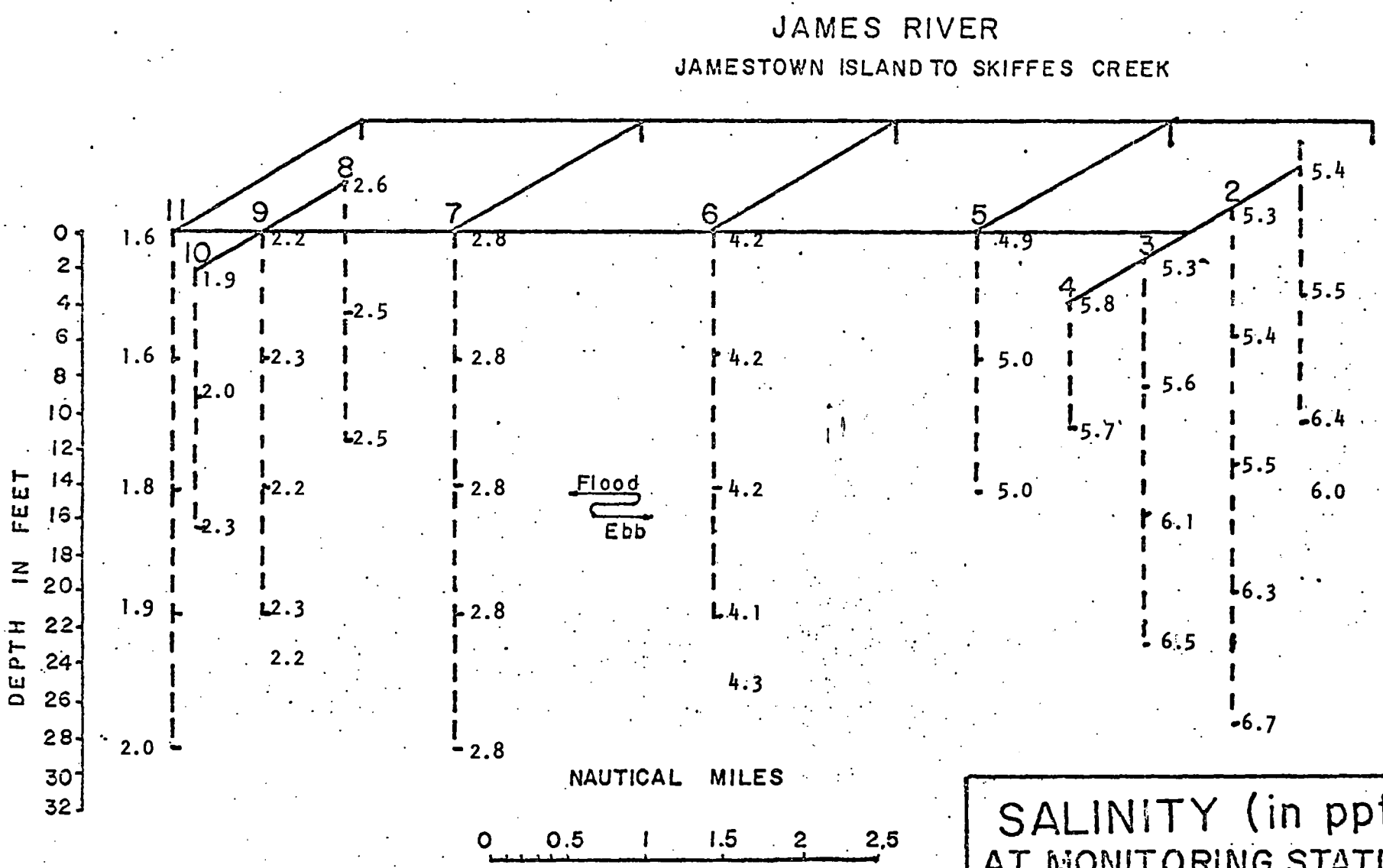
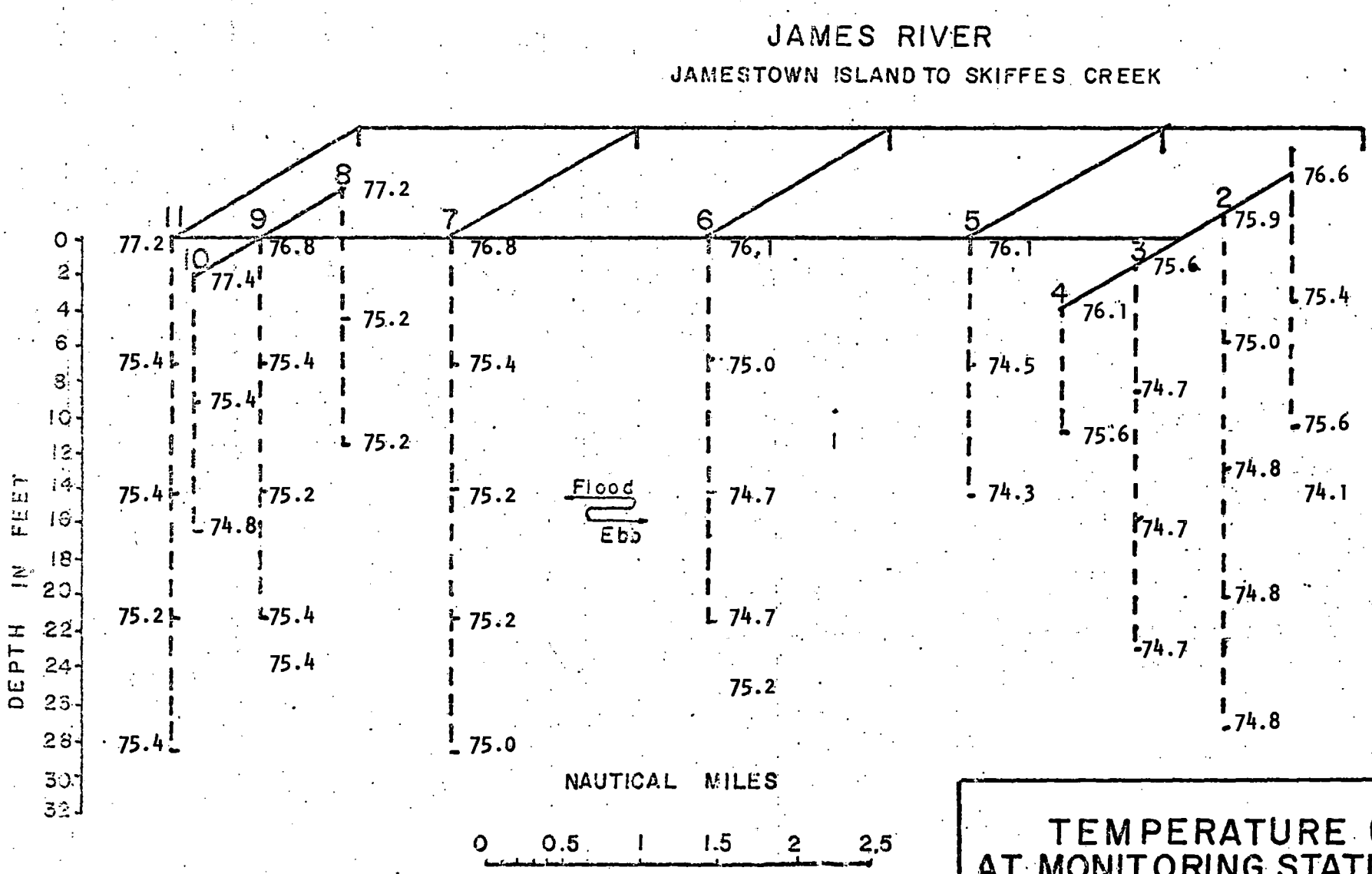

JAMES RIVER
JAMESTOWN ISLAND TO SKIFFES CREEK
DEPTH IN FEET
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
11
10
9
8
7
6
5
4
3
2
1
80.8
80.4
80.8
81.5
81.3
81.3
80.8
80.4
80.8
81.3
81.3
81.0
80.8
81.0
81.3
81.0
81.0
81.3
81.0
81.5
81.3
83.1
82.9
82.9
83.1
83.1
83.3
82.4
82.2
82.6
82.6
82.0
81.9
81.3
81.3
81.1
81.1
81.1
81.5
81.3
81.1
81.1
81.0
80.4
80.4
Flood
Ebb
NAUTICAL MILES
0
0.5
1
1.5
2
2.5
TEMPERATURE (°F)
AT MONITORING STATIONS
August 2, 1974

Figure 2.2-4



SALINITY (in ppt)
AT MONITORING STATIONS
August 2, 1974

Figure 2.2-5



TEMPERATURE (°F)
AT MONITORING STATIONS
September 9, 1974

Figure 2.2-6

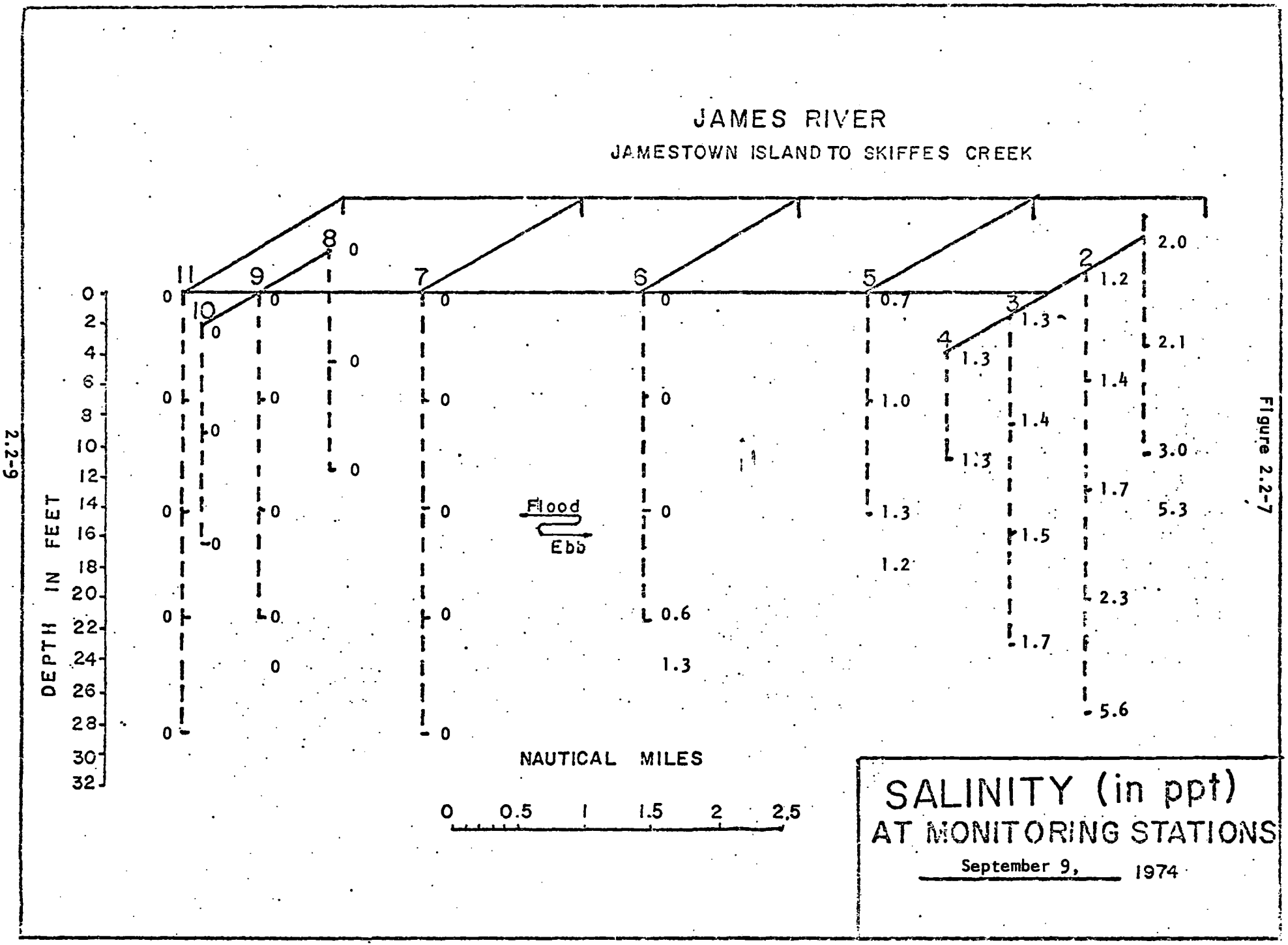
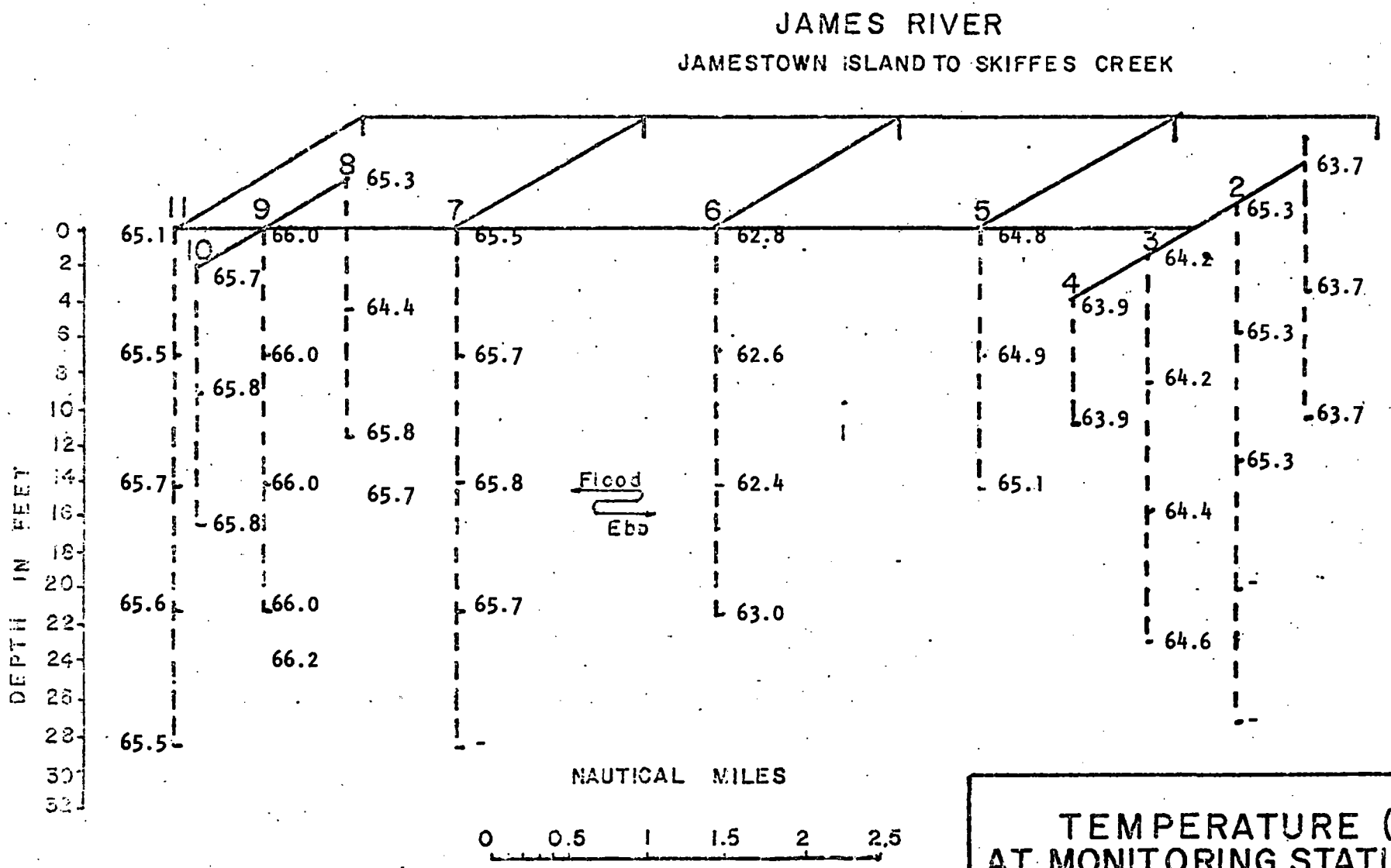
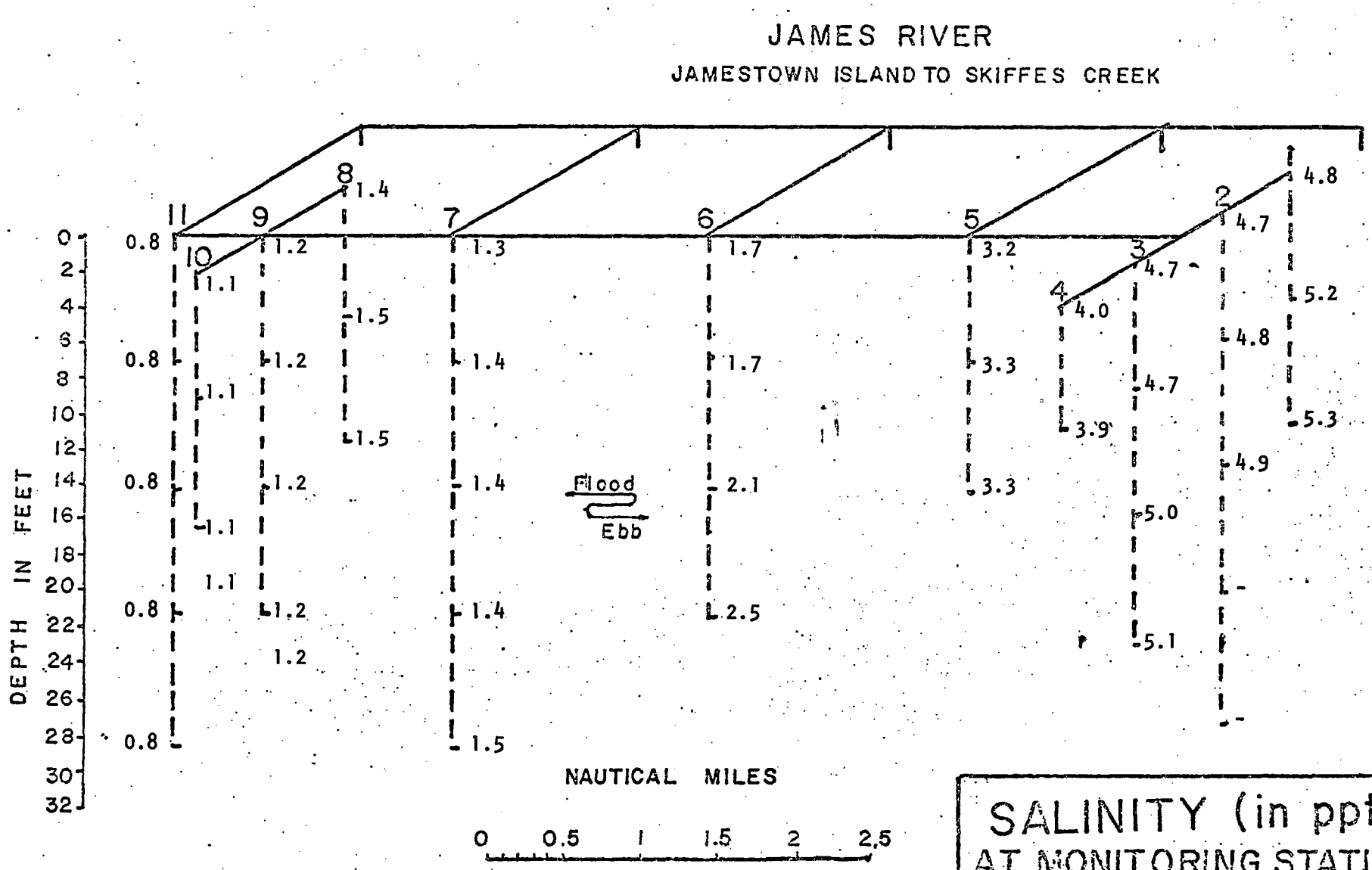

JAMES RIVER
JAMESTOWN ISLAND TO SKIFFES CREEK
DEPTH IN FEET
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
11
10
9
8
7
6
5
4
3
2
Flood
Ebb
NAUTICAL MILES
0
0.5
1
1.5
2
2.5
SALINITY (in ppt)
AT MONITORING STATIONS
September 9, 1974

Figure 2.2-7



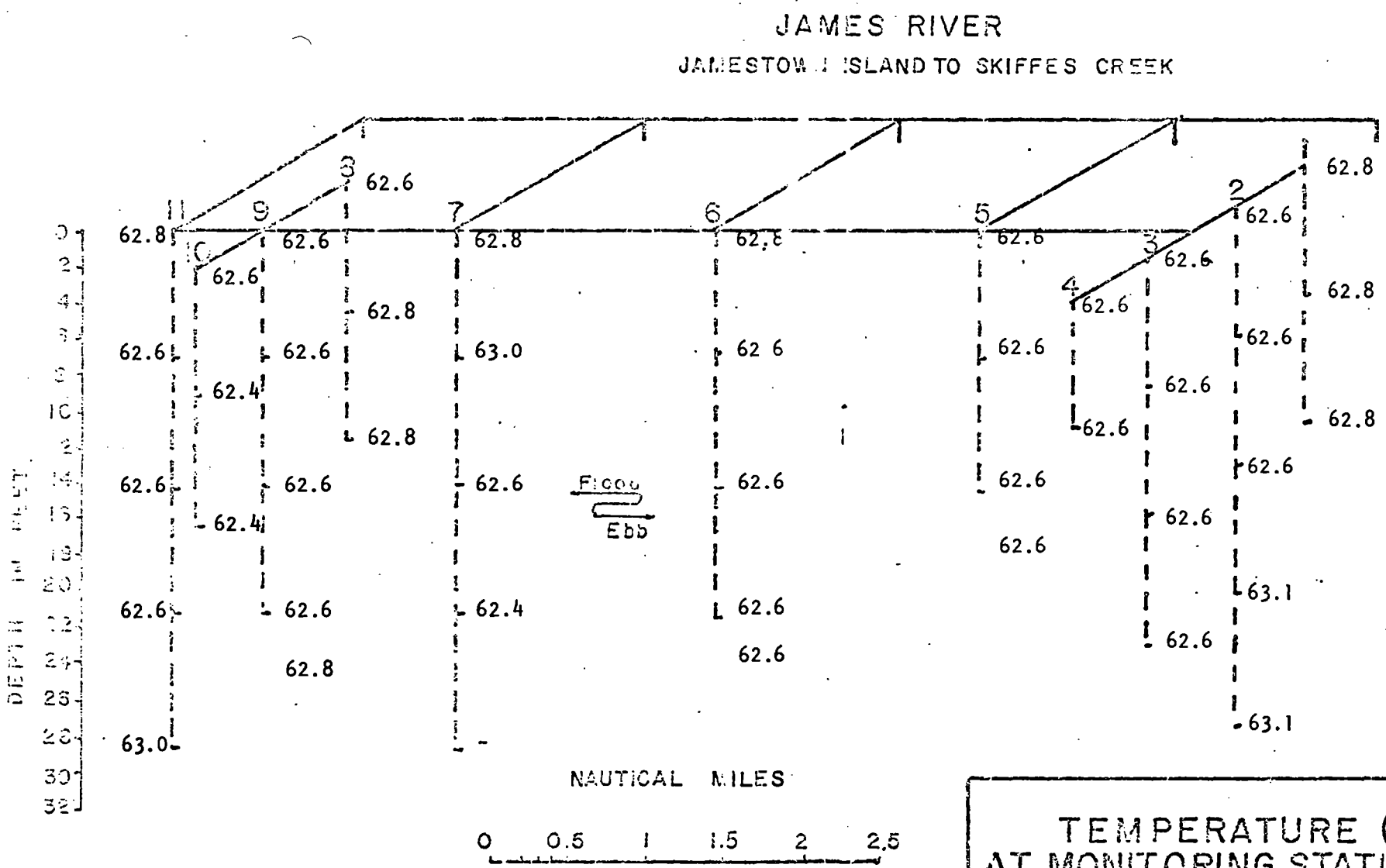
TEMPERATURE (°F)
AT MONITORING STATIONS
October 3, 1974

Figure 2.2-8



SALINITY (in ppt)
AT MONITORING STATIONS
October 3, 1974

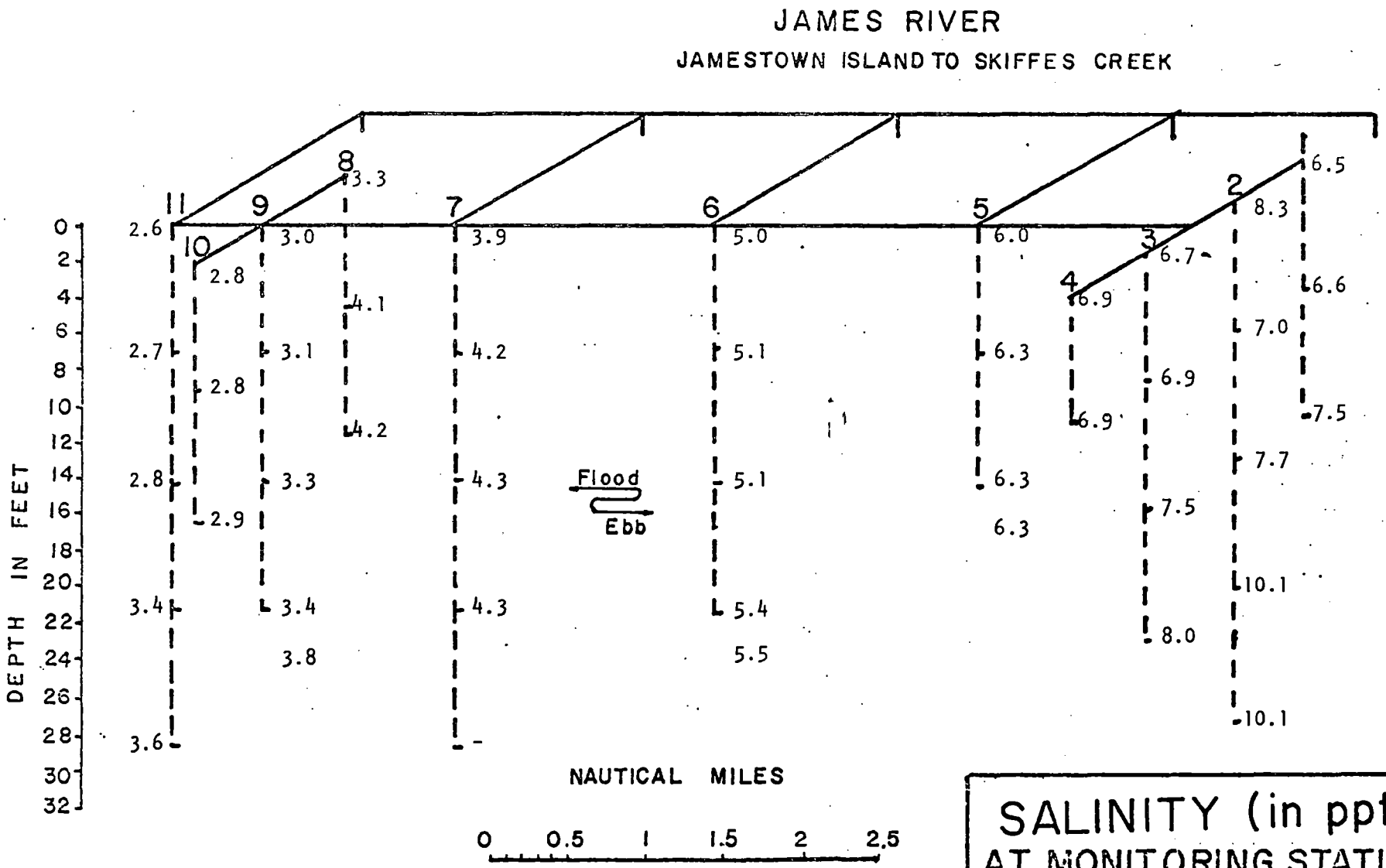
Figure 2.2-9



TEMPERATURE (°F) AT MONITORING STATIONS

November 6, 1974

Figure 2.2-10



SALINITY (in ppt)
AT MONITORING STATIONS
November 6, 1974

Figure 2.2-11

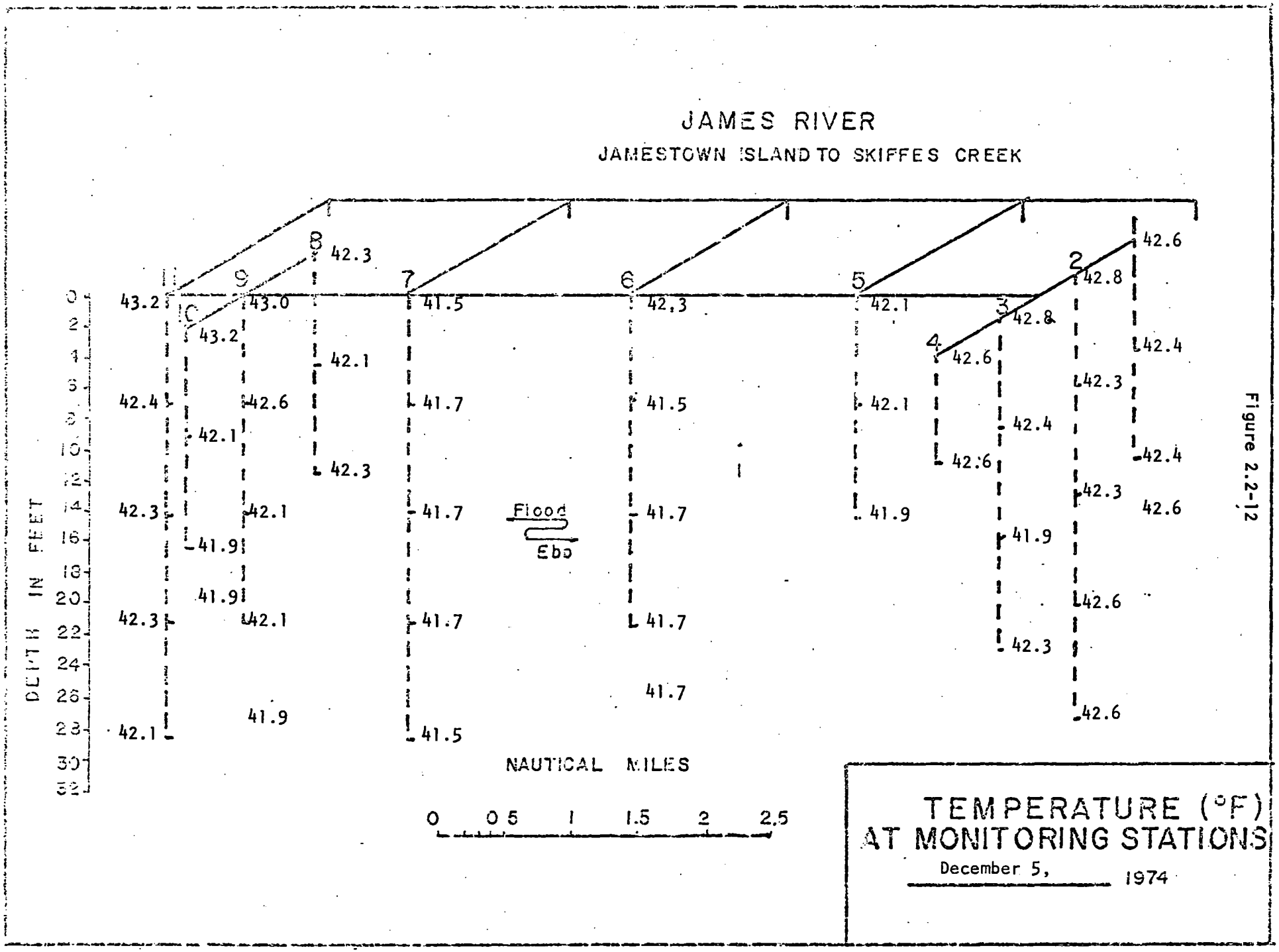
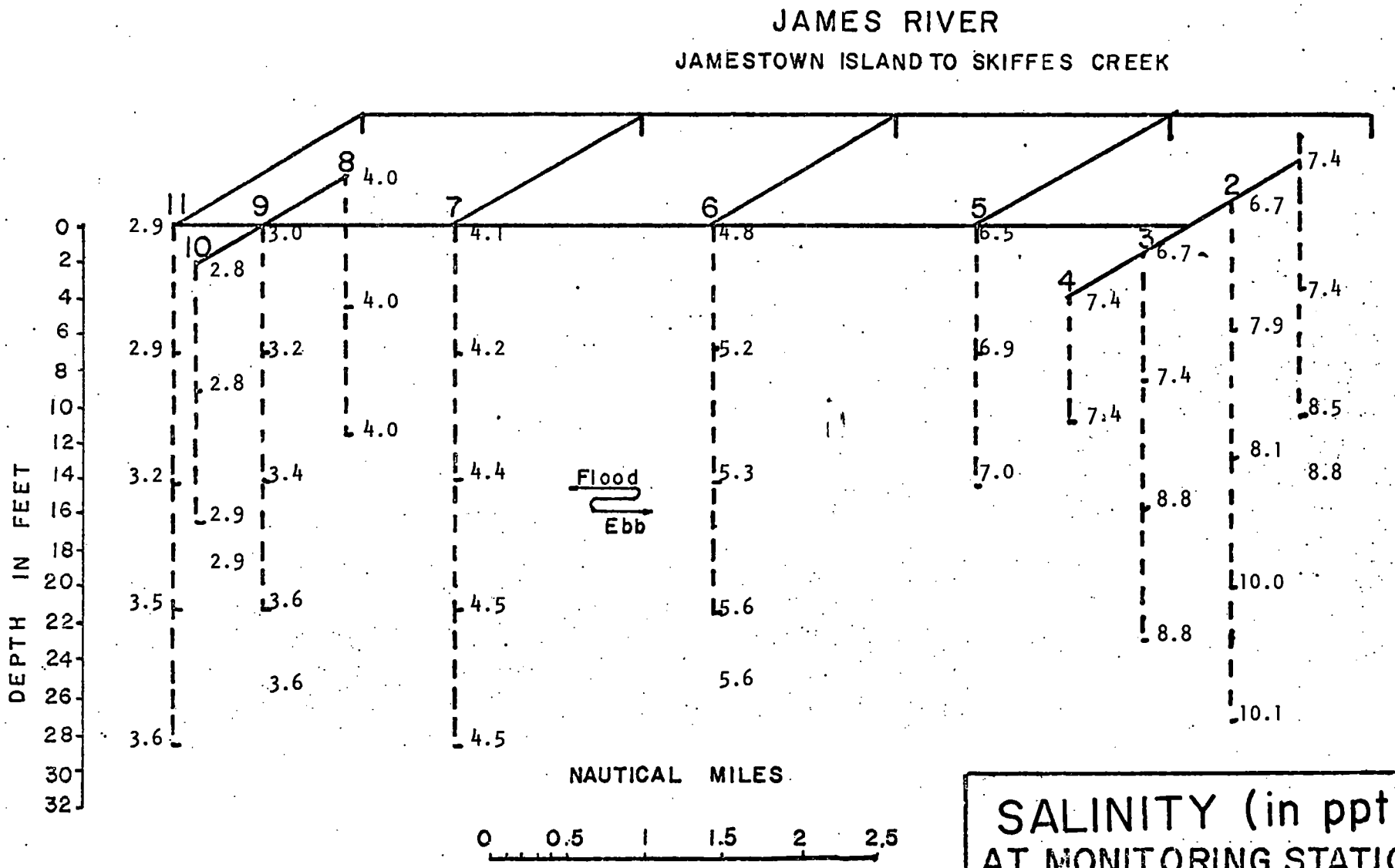

JAMES RIVER
JAMESTOWN ISLAND TO SKIFFES CREEK
DEPTH IN FEET
NAUTICAL MILES
0 0.5 1 1.5 2 2.5
Flood
Ebb
TEMPERATURE (°F)
AT MONITORING STATIONS
December 5, 1974

Figure 2.2-12



SALINITY (in ppt)
AT MONITORING STATIONS
December 5, 1974

Figure 2.2-13

2.3 FRESHWATER DISCHARGE OF THE JAMES RIVER AT RICHMOND AND HOG ISLAND

The daily freshwater discharge of the James River and Kanawha Canal gages at Richmond have been combined and tabulated in Table 2.3-1. The calculated freshwater flow at Hog Island is also tabulated in Table 2.3-1.

The freshwater flow of the James River at Hog Island has been calculated from the flow at Richmond and the relative drainage area of the James River above and below Richmond to Hog Island. The area above Richmond is 6757 square miles and the area from Richmond to Hog Island is 2760 square miles.

Therefore:

$$\text{Flow at Hog Island} = \text{Flow at Richmond} \times \frac{(6757 + 2760)}{6757}$$

The time of flow from Richmond to Hog Island is variable, being dependent upon the flow at Richmond.

TABLE 2.3-1

FRESHWATER DISCHARGE OF THE JAMES RIVER AT RICHMOND AND HOG ISLAND
JULY-NOVEMBER, 1974

DATE	JAMES RIVER DISCHARGE AT RICHMOND, C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT, C.F.S.
July 1, 1974	4,006	5,642
2	3,636	5,121
3	3,756	5,290
4	3,556	5,008
5	3,338	4,701
6	2,910	4,099
7	2,890	4,070
8	3,556	5,008
9	3,338	4,701
10	3,388	4,772
11	3,150	4,437
12	2,960	4,169
13	2,702	3,806
14	2,662	3,749
15	2,262	3,186
16	2,190	3,084
17	2,032	2,862
18	2,150	3,028
19	1,920	2,704
20	1,772	2,496
21	1,812	2,552
22	1,714	2,414
23	1,674	2,358
24	1,772	2,496
25	1,992	2,806
26	3,604	5,076
27	3,824	5,386
28	6,818	9,603
29	6,480	9,127
30	4,574	6,442
31	3,756	5,290
August 1, 1974	4,074	5,738
2	3,420	4,817
3	3,050	4,296
4	3,318	4,673
5	4,074	5,738
6	8,212	11,566
7	7,212	10,157
8	5,074	7,146
9	4,176	5,882
10	4,176	5,882
11	4,824	6,794
12	4,436	6,248

TABLE 2.3-1 (Cont'd)

DATE		JAMES RIVER DISCHARGE AT RICHMOND, C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT, C.F.S.
August	13, 1974	3,888	5,476
	14	3,220	4,535
	15	3,340	4,704
	16	3,130	4,408
	17	3,150	4,437
	18	2,792	3,932
	19	2,594	3,654
	20	2,244	3,161
	21	2,364	3,330
	22	2,614	3,682
	23	5,796	8,163
	24	5,534	7,794
	25	4,288	6,039
	26	3,440	4,845
	27	3,500	4,930
	28	7,882	11,101
	29	4,454	6,273
	30	5,092	7,172
	31	4,556	6,417
September	1, 1974	3,470	4,887
	2	3,080	4,338
	3	4,736	6,670
	4	12,692	17,876
	5	10,956	15,431
	6	8,858	12,476
	7	26,556	37,403
	8	4,974	7,006
	9	18,274	25,738
	10	10,714	15,090
	11	7,836	11,036
	12	8,212	11,566
	13	6,442	9,073
	14	5,194	7,316
	15	5,074	7,147
	16	4,556	6,417
	17	4,306	6,065
	18	3,938	5,546
	19	3,620	5,099
	20	3,500	4,930
	21	3,200	4,507
	22	3,112	4,383
	23	2,594	3,654
	24	2,892	4,073
	25	2,542	3,580
	26	2,752	3,876
	27	2,404	3,386
	28	2,402	3,383

TABLE 2.3-1 (Cont'd)

DATE	JAMES RIVER DISCHARGE AT RICHMOND, C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT†, C.F.S.
September 29, 1974	2,364	3,330
30	2,422	3,411
October 1, 1974	2,452	3,454
2	2,294	3,231
3	2,274	3,203
4	2,134	3,006
5	2,114	2,977
6	2,044	2,879
7	2,114	2,977
8	1,994	2,808
9	2,014	2,837
10	1,992	2,806
11	2,242	3,158
12	1,962	2,763
13	1,904	2,682
14	2,032	2,862
15	1,904	2,682
16	2,109	2,970
17	2,275	3,204
18	3,122	4,397
19	2,683	3,779
20	3,188	4,490
21	3,641	5,128
22	3,118	4,392
23	2,828	3,983
24	2,540	3,577
25	2,350	3,310
26	2,440	3,437
27	2,330	3,282
28	2,440	3,437
29	2,202	3,101
30	2,260	3,183
31	2,330	3,282
November 1, 1974	2,242	3,158
2	2,242	3,158
3	2,172	3,059
4	2,132	3,003
5	2,102	2,961
6	2,132	3,002
7	2,262	3,186
8	2,132	3,002
9	2,202	3,101
10	2,062	2,904
11	2,062	2,904
12	2,152	3,031
13	2,470	3,479
14	3,706	5,220

TABLE 2.3-1 (Cont'd)

DATE	JAMES RIVER DISCHARGE AT RICHMOND, C.F.S.	CALCULATED JAMES RIVER DISCHARGE AT HOG POINT, C.F.S.
November 15, 1974	3,188	4,490
16	2,700	3,803
17	2,580	3,634
18	2,470	3,479
19	2,400	3,380
20	2,382	3,355
21	2,362	3,327
22	2,420	3,408
23	2,948	4,152
24	2,580	3,634
25	2,292	3,228
26	2,510	3,535
27	2,560	3,606
28	2,650	3,732
29	2,560	3,606
30	2,452	3,454
December 1, 1974	2,718	3,828
2	5,154	7,259
3	7,684	10,822
4	5,324	7,499
5	4,324	6,090
6	3,856	5,431
7	3,636	5,121
8	4,074	5,738
9	10,992	15,482
10	13,092	18,440
11	14,392	20,271
12	11,792	16,609
13	9,092	12,806
14	6,902	9,721
15	6,152	8,665
16	6,424	9,048
17	12,392	17,454
18	11,792	16,609
19	10,592	14,918
20	10,212	14,383
21	8,552	12,045
22	7,532	10,608
23	6,320	8,902
24	6,012	8,468
25	5,342	7,524
26	5,212	7,340
27	4,842	6,820
28	4,972	7,003
29	5,872	8,270
30	5,872	8,270
31	5,472	7,707

2.5 CHEMICAL RELEASES TO THE COOLING WATER SYSTEM

Tables 2.5-1 through 2.5-6 identify and summarize the chemicals which were released to the cooling water system for the period July 1, 1974 - December 31, 1974.

SURRY POWER STATION

Table 2.5-1

CHEMISTRY REPORT

JULY ,19 74

T.S. 6.6.A.11

PRIMARY COOLANT ANALYSIS	UNIT NO. 1			UNIT NO. 2		
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE
Gross Radioact., µCi/ml	1.96E-1	1.07E-2	1.04E-1	1.31E-1	2.84E-3	7.73E-2
Suspended Solids, ppm	*0.4	0.0	0.1	*1.7	0.0	0.1
Gross Tritium, µCi/ml	5.13E-2	1.97E-2	3.70E-2	6.71E-2	7.91E-3	3.46E-2
Iodine-131, µCi/ml	2.60E-2	1.13E-3	1.29E-2	2.84E-2	4.23E-4	6.31E-3
I-131/I-133	.6784	.4869	.6119	.4877	.1682	.3464
Hydrogen, cc/kg	44.5	24.6	31.3	37.5	7.4	23.3
Lithium, ppm	.80	.25	.46	.45	.27	.36
Boron-10, ppm +	*156.6	49.4	100.6	154.4	58.2	106.3
Oxygen-16, ppb	0	0	0	*8600	0	668.9
Chloride, ppm	.09	.05	.06	.06	.05	.05
pH @ 25°C	6.85	6.25	6.85	*7.00	6.22	6.61

+ Boron-10 = Total Boron x 0.196

NON-RADIOACTIVE CHEMICAL
RELEASES, POUNDS
T.S. 4.13.A.8

Phosphate 896 Boron 189.1

Sulfate 708 Chromate 0

Remarks: * Unit Shutdown

SURRY POWER STATION

Table 2.5-2

CHEMISTRY REPORT

AUGUST ,19 74

T.S. 6.6.A.11

PRIMARY COOLANT ANALYSIS	UNIT NO. 1			UNIT NO. 2		
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE
Gross Radioact., µCi/ml	3.45E-1	1.57E-1	2.04E-1	1.30E-1	*1.48E-2	7.86E-2
Suspended Solids, ppm	0.1	0.0	.04	*7.3	0.0	0.5
Gross Tritium, µCi/ml	5.02E-2	2.02E-2	3.87E-2	2.14E-2	4.77E-3	1.43E-2
Iodine-131, µCi/ml	3.46E-2	1.93E-3	1.97E-2	8.32E-3	1.13E-3	4.41E-3
I-131/I-133	.9870	.4168	.7361	.6594	.1805	.3741
Hydrogen, cc/kg	36.5	26.2	31.6	34.1	23.4	28.2
Lithium, ppm	.58	.29	.46	.41	.26	.35
Boron-10, ppm +	54.1	39.9	44.0	*172.1	52.3	100.0
Oxygen-16, ppb	0	0	0	0	0	0
Chloride, ppm	.07	.05	.05	.06	.05	.05
pH @ 25°C	7.05	6.80	6.93	6.82	6.08	6.52

+ Boron-10 = Total Boron x 0.196

NON-RADIOACTIVE CHEMICAL
RELEASES, POUNDS
T.S. 4.13.A.8

Phosphate 2225 Boron 290

Sulfate 1239 Chromate 0

Remarks: * Unit Shutdown

SURRY POWER STATION

CHEMISTRY REPORT

SEPTEMBER ,19 74

T.S. 6.6.A.11

Table 2.5-3

PRIMARY COOLANT ANALYSIS	UNIT NO. 1			UNIT NO. 2		
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE
Gross Radioact., µCi/ml	2.95E-1	*1.51E-2	2.02E-1	1.32E-1	* 1.08E-2	4.42E-2
Suspended Solids, ppm	0.5	0.0	0.1	1.8	0.0	0.9
Gross Tritium, µCi/ml	4.05E-2	1.16E-2	2.22E-2	2.69E-2	8.17E-3	1.67E-2
Iodine-131, µCi/ml	7.75E-2	1.45E-2	3.68E-2	5.45E-3	3.45E-3	4.19E-3
I-131/I-133	.9853	.4061	.6851	.6082	.3033	.3949
Hydrogen, cc/kg	42.8	27.3	34.4	35.4	*4.3	20.4
Lithium, ppm	.47	.23	.29	.82	.27	.57
Boron-10, ppm +	*138	21.6	44.4	*154	48.4	124
Oxygen-16, ppb	0	0	0	*8300	0	2195
Chloride, ppm	.07	.05	.05	* .10	.05	.06
pH @ 25°C	7.05	*6.32	6.42	6.78	6.25	6.50

+ Boron-10 = Total Boron x 0.196

NON-RADIOACTIVE CHEMICAL
RELEASES, POUNDS
T.S. 4.13.A.8

Phosphate 485 Boron 573

Sulfate 885 Chromate 1.8

Remarks: * Unit Shutdown.

SURRY POWER STATION

CHEMISTRY REPORT

OCTOBER ,19 74

T.S. 6.6.A.11

Table 2.5-4

PRIMARY COOLANT ANALYSIS	UNIT NO. 1			UNIT NO. 2		
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE
Gross Radioact., µCi/ml	1.86E-1	*1.03E-2	1.35E-1	* 1.95E-2	2.72E-3	1.21E-2
Suspended Solids, ppm	*2.1	0.0	0.8	* 1.4	*0.2	0.6
Gross Tritium, µCi/ml	1.12E-2	*4.84E-3	8.49E-3	* 1.23E-2	*2.58E-3	8.10E-3
Iodine-131, µCi/ml	1.24E-2	*9.68E-4	7.13E-3	*	*	*
I-131/I-133	.7591	.2250	.4402	*	*	*
Hydrogen, cc/kg	49.9	*0.0	27.1	*	*	*
Lithium, ppm	.61	* .13	.38	.52	.41	.44
Boron-10, ppm +	*425	28.4	91.5	*176	*143.7	165
Oxygen-16, ppb	*2900	0	105	*8700	*4900	6867
Chloride, ppm	.07	.05	.05	* .14	* .05	.07
pH @ 25°C	7.30	*5.52	6.27	* 6.28	*5.95	6.15

+ Boron-10 = Total Boron x 0.196

NON-RADIOACTIVE CHEMICAL
RELEASES, POUNDS
T.S. 4.13.A.8

Phosphate 221 Boron 239.2

Sulfate 354 Chromate 66.5

Remarks: * Unit Shutdown

SURRY POWER STATION

Table 2.5-5

CHEMISTRY REPORT

NOVEMBER ,1974

T.S. 6.6.A.11

PRIMARY COOLANT ANALYSIS	UNIT NO. 1			UNIT NO. 2		
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE
Gross Radioact., µCi/ml	1.90E-2	2.10E-4	3.90E-3	9.14E-3	4.05E-3	7.27E-3
Suspended Solids, ppm	2.2	0.0	0.9	1.6	0.0	0.4
Gross Tritium, µCi/ml	6.26E-3	3.57E-3	4.90E-3	1.61E-2	8.70E-3	1.18E-2
Iodine-131, µCi/ml	*	*	*	*	*	*
I-131/I-133	*	*	*	*	*	*
Hydrogen, cc/kg	*	*	*	*	*	*
Lithium, ppm	0.0	0.0	0.0	.47	.40	.44
Boron-10, ppm +	461	406	440	192	163	189
Oxygen-16, ppb	3800	300	1648	10400	4300	7110
Chloride, ppm	.12	.05	.06	.08	.05	.05
pH @ 25°C	6.12	4.98	5.67	6.12	6.00	6.08

+ Boron-10 = Total Boron x 0.196

NON-RADIOACTIVE CHEMICAL
RELEASES, POUNDS
T.S. 4.13.A.8

Phosphate 0 Boron 447

Sulfate 0 Chromate 5.9

Remarks: * Unit Shutdown

SURRY POWER STATION

CHEMISTRY REPORT

DECEMBER ,19 74

T.S. 6.6.A.11

Table 2.5-6

PRIMARY COOLANT ANALYSIS	UNIT NO. 1			UNIT NO. 2		
	MAXIMUM	MINIMUM	AVERAGE	MAXIMUM	MINIMUM	AVERAGE
Gross Radioact., µCi/ml	3.20E-2	1.98E-4	8.51E-3	1.01E-2	1.58E-3	3.72E-3
Suspended Solids, ppm	0.5	0.0	0.4	0.4	0.0	0.2
Gross Tritium, µCi/ml	1.24E-2	8.11E-3	9.74E-3	1.10E-2	5.92E-3	8.52E-3
Iodine-131, µCi/ml	*	*	*	*	*	*
I-131/I-133	*	*	*	*	*	*
Hydrogen, cc/kg	*	*	*	*	*	*
Lithium, ppm	.99	.88	.90	.40	.25	.34
Boron-10, ppm +	428.8	404.3	422.5	188.1	139.2	169.8
Oxygen-16, ppb	3600	300	1478	16000	0	2880
Chloride, ppm	.09	.05	.06	.08	.05	.05
pH @ 25°C	5.50	5.92	5.85	6.36	6.08	6.38

+ Boron-10 = Total Boron x 0.196

NON-RADIOACTIVE CHEMICAL
RELEASES, POUNDS
T.S. 4.13.A.8

Phosphate 0 Boron 398

Sulfate 0 Chromate 49.2

Remarks: * Unit Shutdown

3.0 NON-RADIOLOGICAL MONITORING PROGRAM - BIOLOGICAL

The Non-radiological Monitoring Program - Biological applies to the monitoring of the biological variables in the ten (10) mile segment of the James River Estuary centered at Hog Island. The biological monitoring program which is closely related to the physical and chemical programs is conducted to determine the planktonic, nektonic, and benthic characteristics of the tidal segment centered at Hog Island and to determine biological changes that occur as a result of the operation of the Surry Power Station.

3.1 PLANKTON

Summary

Water samples for plankton analyses are collected at each of six (6) stations as indicated in Figure 3.1-1. Samples are also collected in the intake and discharge canals. Phytoplankton samples are taken monthly and are analyzed quantitatively in terms of sample volume to determine both the dominant genera of the community and the chlorophyll "a" content. Zooplankton samples are analyzed quantitatively in terms of sample volume to determine generic composition, life history stage and, where possible, species. The sampling interval is approximately monthly, taking into consideration life-history information about important species in the area which have planktonic stages in their life histories.

Results

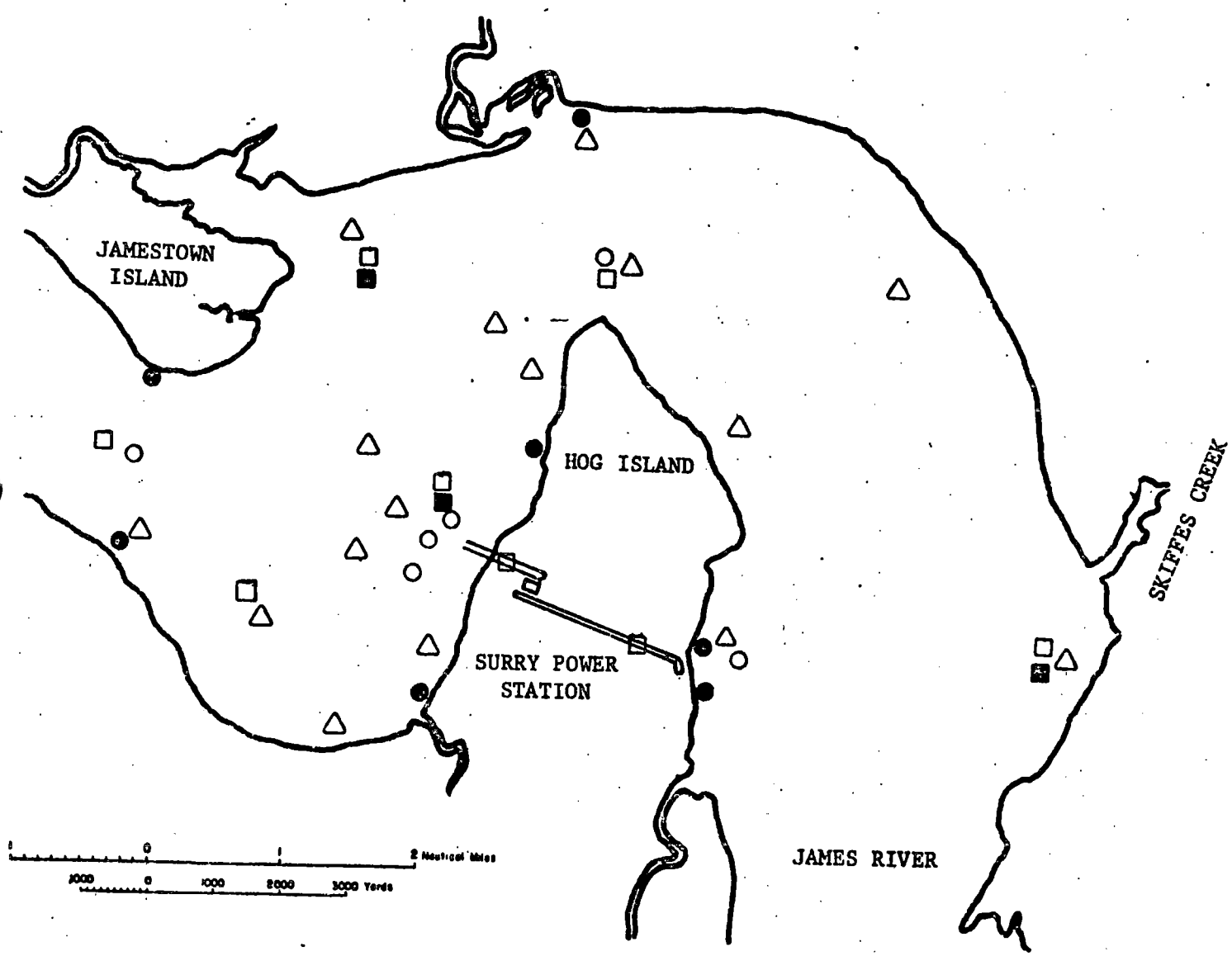
The results of this survey are contained in the report prepared by the Virginia Institute of Marine Science entitled, "Ecological Survey - Upper James River" dated January, 1975 which is appended to this section as Appendix 3.0.

Conclusions

Refer to the referenced report.

Figure 3.1-1

BIOLOGICAL SAMPLE STATIONS



LEGEND:

- ○ Trawl (Nekton)
- ● Seine (Nekton)
- □ Plankton
- ■ Fouling Plates
- △ Benthos

3.2 ATTACHED BENTHIC COMMUNITY

Summary

Fouling plates that are 125- by 75-mm asbestos boards are suspended 1 meter above the bottom at the instrument tower locations shown in Figure 3.1-1 are used to obtain samples. Two vertical and two horizontal plates are suspended at each indicated location. One of each pair is removed and replaced at quarterly intervals; the other pair is left in place for one year before being removed and replaced. The benthic communities attached to the plates are analyzed for species composition and diversity.

Results

The results of this survey are contained in the report prepared by the Virginia Institute of Marine Science entitled "Ecological Survey - Upper James River", dated January, 1975 which is appended to this section as Appendix 3.0.

Conclusions

Refer to the referenced report.

3.3 EPIBENTHOS

Summary

Replicate benthic grab samples are collected at the stations shown in Figure 3.1-1. Collection is made on a quarterly basis, except during June, July, and August when they are made monthly. Population characteristics such as species composition, diversity, evenness, redundancy, and richness are determined. The data are analyzed to detect changes in specific components of the epibenthic community including the brackish water clam *Rangia cuneata* and blue crab *Callinectes sapidus*.

Results

The results of this survey are contained in the report prepared by the Virginia Institute of Marine Science entitled, "Ecological Survey - Upper James River" dated January, 1975 which is appended to this report as Appendix 3.0.

Conclusions

Refer to referenced report.

3.4 NEKTON

Fisheries investigations will be reported separately as results from monthly surveys and as results from special seine surveys.

3.4.1 MONTHLY SURVEYS

Monthly surveys employing beach seines and otter trawls have been conducted since May, 1970. Four years of data were analyzed and reported in the Semiannual Operating Report, January 1, 1974 through June 30, 1974 as a comparison of pre- and postoperative conditions.

Data for July - December 1974 are presented as Tables 3.4.1-1 through 3.4.1-7. The cumulative account of the number of species, diversity, evenness, and richness by gear by season is presented as Figure 1. For purposes of this semiannual report, summer and fall (1974) points have been added to the figure.

It should be noted that the trawl data for July show abnormally low values. It was determined before the August sample date that the trawl boards were not fishing properly and the result of their repair is reflected in subsequent data.

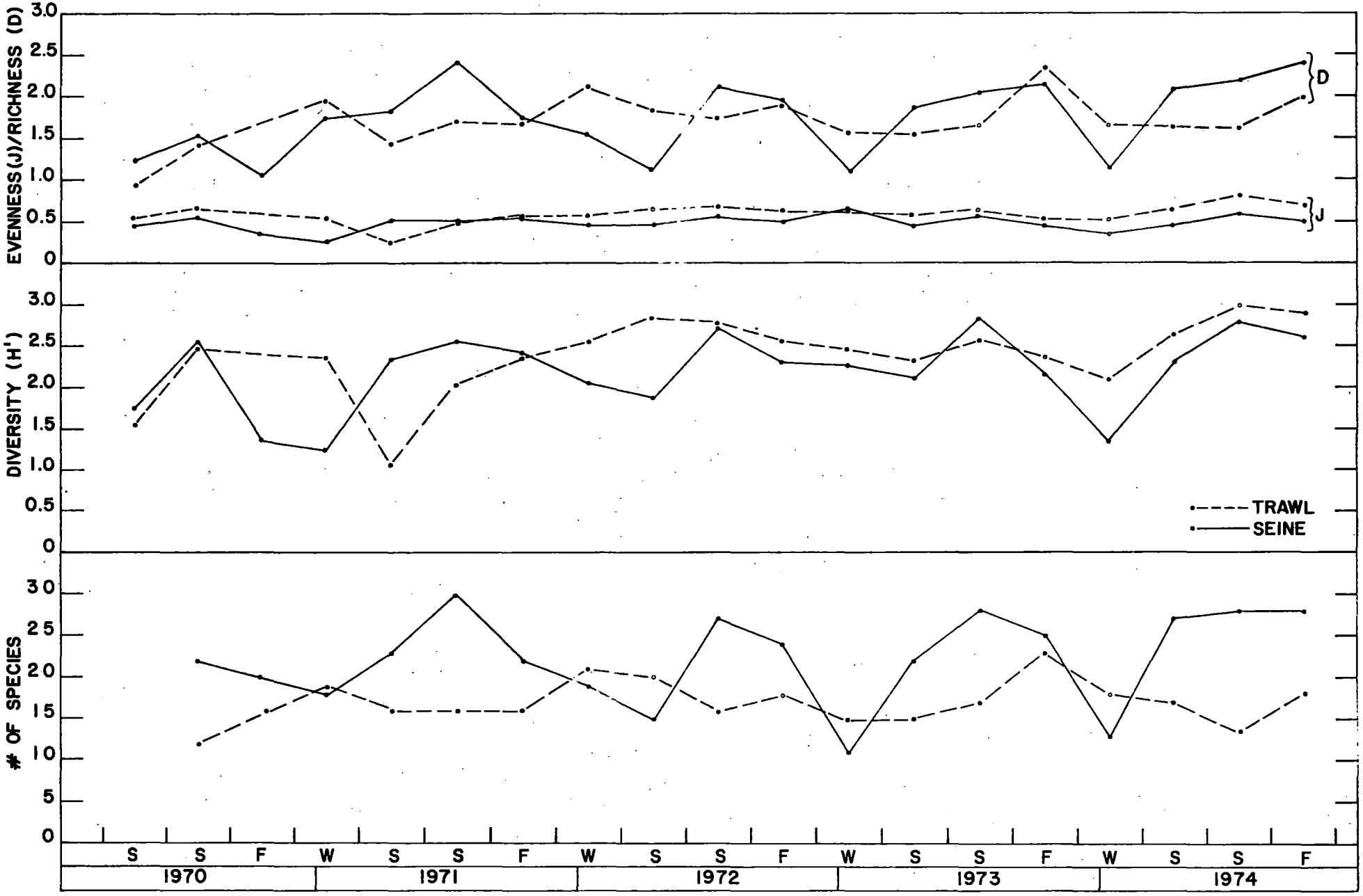


FIGURE 1: COMPOSITE OF NUMBERS OF SPECIES, DIVERSITY (H'), EVENNESS (J), AND RICHNESS (D) BY SEASON FOR SEINE AND TRAWL SAMPLES - SURRY POWER STATION.

TABLE 3.4.1-1 -- H', EVENNESS, AND RICHNESS: COMPOSITES BY SEASON

	SEINE			TRAWL		
	H'	J	D	H'	J	D
Summer 1974	2.8413	0.5910	2.1975	2.9926	0.8087	1.6087
Fall 1974	2.6208	0.5452	2.4091	2.8764	0.6898	2.0029

TABLE 3.4.1-2 -- H' FOR SEINE DATA - SURRY

STATION

DATE	INTAKE SOUTH	INTAKE NORTH	HOG POINT WEST	CHIPPOKES CREEK	GOOSE HILL	JAMESTOWN ISLAND	COLLEGE CREEK	COMPOSITE
7-74	1.9950	2.2902	1.9750	2.1453	2.0404	1.3970	2.3846	2.9236
8-74	2.4750	2.5216	2.0368	1.1211	1.4376	0.4679	2.3029	2.2630
9-74	0.9723	1.0162	1.3477	1.1780	1.1056	1.7113	2.2317	2.3076
10-74	0.9863	2.2382	1.7516	0.9752	1.3151	2.2671	1.7833	2.5307
11-74	1.2072	0.6960	2.3187	1.7131	1.9654	0.8910	2.1339	2.3830
12-74	2.3810	1.4711	1.6137	0.2128	0.2294	1.7294	2.2246	1.3142

TABLE 3.4.1-3 -- H' FOR TRAWL DATA - SURRY

STATION

DATE	HOG POINT	INTAKE	DISCHARGE NORTH	DISCHARGE MIDDLE	DISCHARGE SOUTH	GOOSE HILL	COMPOSITE
7-74	0.0000	0.0000	0.0000	0.0000	1.3710	0.0000	1.3245
8-74	0.7496	2.8424	2.4138	1.8138	2.6142	1.3245	2.9354
9-74	1.7296	2.1007	1.0263	2.0016	1.0219	1.2132	2.6787
10-74	0.5652	2.0514	1.4703	1.1981	0.9751	1.5971	1.5068
11-74	0.5608	1.3710	1.1771	1.9939	0.0000	1.2289	1.9277
12-74	1.5546	2.4382	1.8262	1.7612	2.9476	1.0525	2.5917

TABLE 3.4.1-4 -- EVENNESS FOR SEINE DATA - SURRY

STATION

DATE	INTAKE SOUTH	INTAKE NORTH	HOG POINT WEST	CHIPPOKES CREEK	GOOSE HILL	JAMESTOWN ISLAND	COLLEGE CREEK	COMPOSITE
7-74	0.6005	0.6894	0.7640	0.7151	0.8787	0.4976	0.7522	0.6656
8-74	0.8816	0.8405	0.6425	0.3737	0.5562	0.2339	0.8203	0.5427
9-74	0.3258	0.3931	0.6739	0.4196	0.6976	0.7370	0.6718	0.5907
10-74	0.6223	0.7973	0.6239	0.3773	0.4149	0.6825	0.6352	0.5762
11-74	0.3808	0.2998	0.6703	0.6102	0.6200	0.2970	0.9190	0.5610
12-74	0.8481	0.7355	0.8069	0.1064	0.0988	0.5765	0.8606	0.3552

TABLE 3.4.1-5 -- EVENNESS FOR TRAWL DATA - SURRY

STATION

DATE	HOG POINT	INTAKE	DISCHARGE NORTH	DISCHARGE MIDDLE	DISCHARGE SOUTH	GOOSE HILL	COMPOSITE
7-74	0.0000	0.0000	0.0000	0.0000	0.8650	0.0000	0.6622
8-74	0.7496	0.9474	0.9338	0.7812	0.8714	0.6622	0.7932
9-74	0.8648	0.6072	0.5132	0.6672	0.5110	0.5397	0.7035
10-74	0.2434	0.7307	0.7352	0.7559	0.9751	0.6178	0.4536
11-74	0.3538	0.8650	0.5886	0.7713	0.0000	0.6144	0.5377
12-74	0.7773	0.7692	0.9131	0.6813	0.8873	0.4533	0.6340

TABLE 3.4.1-6 -- RICHNESS FOR SEINE DATA - SURRY

STATION

DATE	INTAKE SOUTH	INTAKE NORTH	HOG POINT WEST	CHIPPOKES CREEK	GOOSE HILL	JAMESTOWN ISLAND	COLLEGE CREEK	COMPOSITE
7-74	1.1901	1.3008	0.9671	0.7916	1.1562	0.7186	1.1964	1.9452
8-74	1.3660	1.2340	1.1038	0.7587	0.6263	0.3906	0.9197	1.6336
9-74	1.2403	0.8500	0.5166	0.8116	0.4255	0.4555	1.4361	1.4322
10-74	0.2991	1.2000	1.3086	0.7741	1.0043	1.2500	1.1199	2.1232
11-74	1.1915	0.5854	1.5561	1.0332	1.0125	0.9238	1.0810	1.8651
12-74	1.3086	0.6175	0.4816	0.3951	0.4354	0.8133	1.0515	1.1575

TABLE 3.4.1-7 -- RICHNESS FOR TRAWL DATA - SURRY

STATION

DATE	HOG POINT	INTAKE	DISCHARGE NORTH	DISCHARGE MIDDLE	DISCHARGE SOUTH	GOOSE HILL	COMPOSITE
7-74	0.0000	0.0000	0.0000	0.0000	0.8614	0.0000	0.7500
8-74	0.2626	1.8385	1.3132	0.7622	1.2164	0.7500	1.6600
9-74	0.8368	1.6315	0.6460	1.2534	0.6941	0.7418	1.6749
10-74	0.5392	0.9412	0.6175	0.4160	0.2103	0.8618	1.0443
11-74	0.4076	0.8614	0.6460	1.0637	0.0000	0.5372	1.5385
12-74	0.7679	1.5244	0.8107	0.9214	1.7028	0.6208	2.0314

3.4.2 POPULATION ESTIMATES

Several fish species inhabit the waters of the James River around Hog Island at certain stages in their life cycle during certain times of the year. In an effort to estimate numbers of fish inhabiting the shore zone waters during times of expected high population density in an area from the intake structure to the discharge groin, three sample stations (Hog Point-West, Hog Point-North, Hog Point-East) were sampled.

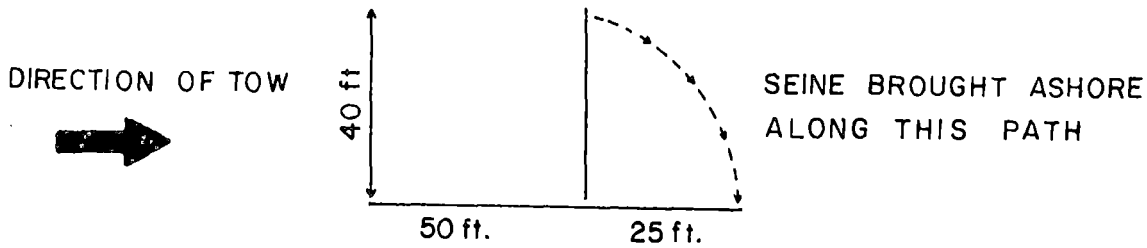
In order for population estimates to approach total populations of a species within a given area in any reliable manner, certain assumptions have to be made: (1) Fish are uniformly distributed throughout the area from the shoreline to 40 feet out from the shoreline; (2) Catch efficiency of a haul seine is about fifty percent; and (3) Sample station habitats, and therefore the entire multiplicity of shoreline habitats, are similar and equal in their ability to attract and support young fish.

That these assumptions do not hold true, especially in the oligohaline reaches of tidal estuaries, is shown by the high degree of variability between and within species, between and within stations, and between replicates of a station. However, to fulfill the requirements of this section of the Surry Technical Specifications, the following methodology was used in an attempt to estimate populations.

The shoreline between the discharge and intake, is about 30,000 feet long and provides 400 possible 75-foot sampling stations. Sample values for all species have been projected to reflect the numbers of fish occupying a 40-foot wide strip along this shore on the given sample days.

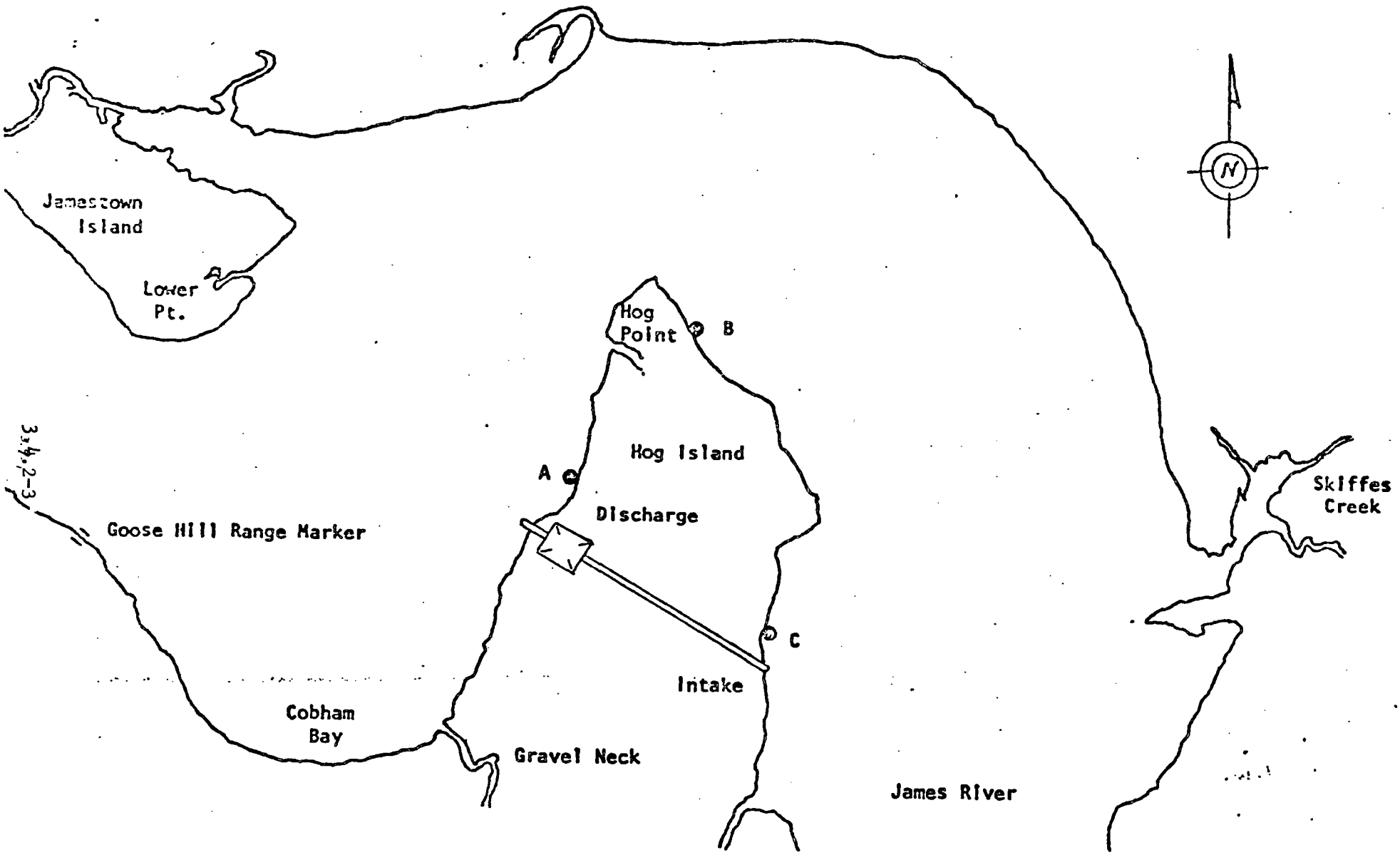
A fifty-foot haul seine having 1/4 inch bar mesh netting was used to sample a premeasured 75-foot stretch of beach. A replicate sample was taken within minutes of the first sample.

A sample consisted of stretching the seine perpendicular to the shore, hauling it 50 feet and then having the offshore man bring his end ashore in an arc about 25 feet further along the beach as shown below.



Hence, a small portion of the sample unit (about 8-10%) is not covered. The population estimates do not include an expansion for this unsampled area and thus should consistently underestimate the population values by a small amount.

It should be pointed out that all of the species sampled, within the size ranges taken, are schooling species except for possibly spottail shiner, golden shiner, channel catfish, and white perch. Schooling will also cause large variances to be associated with population estimates.



3.4.2-3

0 1 2 3 Nautical Miles

0 2000 5000 Yards

A--Hog Point-West
B--Hog Point-North
C--Hog Point-East

SURRY POWER STATION

Figure 3.4.2-1

TABLE 3.4.2-1

Date	# Fish	# Samples	Population Est.	Standard Deviation of Estimate	Life Stage
Elops saurus					
8/15/74	2	6	133	133	Age and
8/27/74	1	6	67	67	Size at
8/28/74	6	6	400	253	Maturity
9/03/74	1	6	67	67	Unknown
9/17/74	2	6	133	84	
11/04/74	1	6	67	67	
Anguilla rostrata					
7/19/74	1	6	67	67	Juvenile
8/12/74	2	6	133	133	Juvenile
8/27/74	1	6	67	67	Juvenile
9/06/74	1	6	67	67	Juvenile
9/30/74	1	6	67	67	Juvenile
Alosa aestivalis					
8/12/74	5	6	333	333	Juvenile
12/06/74	1	6	67	67	Juvenile
Alosa pseudoharengus					
9/30/74	1	6	67	67	Juvenile
Alosa sapidissima					
9/30/74	2	6	133	133	Juvenile
Brevoortia tyrannus					
7/19/74	2	6	133	84	Juvenile
9/03/74	9	6	600	524	Adult
Dorosoma cepedianum					
7/19/74	8	6	533	321	Adult
8/27/74	3	6	200	200	Adult
8/28/74	1	6	67	67	Adult
9/03/74	3	6	200	136	Adult
9/06/74	2	6	133	133	Adult
9/17/74	1	6	67	67	Adult
9/30/74	4	6	267	267	Juvenile/Adult
11/04/74	3	6	200	136	Adult
Dorosoma petenense					
9/03/74	4	6	267	169	Adult

TABLE 3.4.2-1 (Cont'd)

Date	# Fish	# Samples	Population Est.	Standard Deviation of Estimate	Life Stage
Anchoa mitchilli					
7/19/74	164	6	10,934	7,764	Juvenile/Adult
7/31/74	2	6	133	84	Adult
8/27/74	9	6	600	410	Juvenile/Adult
8/28/74	1	6	67	67	Adult?
9/03/74	135	6	9,000	7,316	Juvenile/Adult
9/06/74	3	6	200	137	Adult
9/17/74	24	6	1,600	1,446	Juvenile/Adult
9/30/74	50	6	3,334	2,123	Juvenile/Adult
10/18/74	39	6	2,600	2,600	Adult
10/22/74	1	6	67	67	Adult?
11/04/74	26	6	1,733	1,313	Adult
12/26/74	2	6	133	133	Adult
12/31/74	14	6	933	777	Juvenile/Adult
Cyprinus carpio					
7/19/74	1	6	67	67	Adult?
Hybognathus nuchalis					
8/15/74	1	6	67	67	Adult
Notemigonus crysoleucus					
7/19/74	43	6	2,867	1,300	Adult
7/31/74	15	6	1,000	1,000	Adult
8/12/74	11	6	733	364	Adult
8/15/74	5	6	333	333	Adult
9/03/74	6	6	400	326	Adult
9/06/74	1	6	67	67	Adult
9/30/74	2	6	133	84	Adult
10/18/74	3	6	200	200	Adult
11/04/74	47	6	3,133	2,753	Adult
11/19/74	1	6	67	67	Adult
12/03/74	3	6	200	137	Adult
12/06/74	1	6	67	67	Adult
Notropis analostanus					
11/19/74	1	6	67	67	Adult

TABLE 3.4.2-1 (Cont'd)

Date	# Fish	# Samples	Population Est.	Standard Deviation of Estimate	Life Stage
Notropis hudsonius					
7/19/74	23	6	1,533	998	Juvenile/Adult
7/31/74	70	6	4,667	2,100	Juvenile/Adult
8/12/74	185	6	12,334	8,221	Juvenile/Adult
8/15/74	40	6	2,667	2,202	Juvenile/Adult
8/27/74	18	6	1,200	1,048	Juvenile/Adult
8/28/74	18	6	1,200	1,200	Juvenile/Adult
9/03/74	3	6	200	200	Juvenile/Adult
9/06/74	1	6	67	67	Juvenile/Adult
9/17/74	7	6	467	262	Juvenile/Adult
9/30/74	10	6	667	470	Juvenile/Adult
10/10/74	18	6	1,200	918	Juvenile/Adult
10/18/74	12	6	800	516	Juvenile/Adult
10/22/74	13	6	867	640	Juvenile/Adult
11/04/74	38	6	2,467	2,375	Juvenile/Adult
11/19/74	7	6	467	240	Juvenile/Adult
12/03/74	1	6	67	67	Adult
12/06/74	1	6	67	67	Adult?
12/20/74	1	6	67	67	Juvenile?
12/26/74	2	6	133	133	Adult
12/31/74	4	6	267	198	Juvenile/Adult
Ictalurus catus					
7/19/74	1	6	67	67	Juvenile
Ictalurus nebulosus					
7/19/74	4	6	267	169	Adult
9/03/74	1	6	67	67	Juvenile
9/06/74	3	6	200	89	Juvenile/Adult
Ictalurus punctatus					
7/19/74	1	6	67	67	Adult
7/31/74	1	6	67	67	Juvenile
9/03/74	1	6	67	67	Juvenile
9/06/74	3	6	200	137	Juvenile/Adult
Cyprinodon variegatus					
11/19/74	9	6	600	524	Adult
Fundulus diaphanus					
7/19/74	1	6	67	67	Adult
8/28/74	1	6	67	67	Adult
11/19/74	1	6	67	67	Adult
12/06/74	1	6	67	67	Adult
12/20/74	3	6	200	137	Adult
12/26/74	1	6	67	67	Adult

TABLE 3.4.2-1 (Cont'd)

Date	# Fish	# Samples	Population Est.	Standard Deviation of Estimate	Life Stage
Fundulus heteroclitus					
12/06/74	1	6	67	67	Adult
Membras martinica					
9/17/74	7	6	467	467	Adult
9/30/74	1	6	67	67	Adult
Menidia sp.					
7/19/74	172	6	11,467	6,844	Juvenile/Adult
7/31/74	161	6	10,734	7,529	Juvenile/Adult
8/12/74	213	6	14,201	7,295	Juvenile/Adult
8/15/74	244	6	16,268	7,895	Juvenile/Adult
8/27/74	367	6	24,468	11,175	Juvenile/Adult
8/28/74	287	6	19,134	8,681	Juvenile/Adult
9/03/74	16	6	1,067	543	Juvenile/Adult
9/06/74	30	6	2,000	1,765	Juvenile/Adult
9/17/74	51	6	3,400	2,151	Juvenile/Adult
9/30/74	32	6	2,133	1,238	Juvenile/Adult
10/10/74	59	6	3,934	2,014	Juvenile/Adult
10/18/74	56	6	3,734	2,386	Juvenile/Adult
10/22/74	217	6	14,467	7,912	Juvenile/Adult
11/04/74	83	6	5,534	4,318	Juvenile/Adult
11/19/74	636	6	42,402	25,138	Juvenile/Adult
12/03/74	116	6	7,734	4,557	Juvenile/Adult
12/06/74	252	6	16,801	11,754	Juvenile/Adult
12/20/74	114	6	7,600	4,308	Juvenile/Adult
12/26/74	34	6	2,267	1,313	Juvenile/Adult
12/31/74	96	6	6,400	5,013	Juvenile/Adult
Morone americana					
7/19/74	1	6	67	67	Juvenile
7/31/74	3	6	200	200	Juvenile
8/15/74	2	6	133	84	Juvenile
8/27/74	5	6	333	262	Juvenile/Adult
8/28/74	5	6	333	262	Juvenile/Adult
9/03/74	2	6	133	84	Juvenile/Adult
9/06/74	1	6	67	67	Adult
9/17/74	6	6	400	206	Adult
10/18/74	1	6	67	67	Adult
Lepomis gibbosus					
8/27/74	2	6	133	133	Adult
9/03/74	2	6	133	84	Juvenile/Adult
9/06/74	2	6	133	133	Adult
10/22/74	1	6	67	67	Juvenile
11/04/74	2	6	133	84	Adult

TABLE 3.4.2-1 (Cont'd)

Date	# Fish	# Samples	Population Est.	Standard Deviation of Estimate	Life Stage
Perca flavescens					
9/06/74	1	6	67	67	Adult
Leiostomus xanthurus					
7/19/74	9	6	600	383	Juvenile/Adult
7/31/74	4	6	267	133	Juvenile
8/12/74	1	6	67	67	Adult
8/15/74	3	6	200	200	Juvenile
8/27/74	4	6	267	267	Juvenile/Adult
9/03/74	5	6	333	262	Juvenile/Adult
9/06/74	2	6	133	133	Juvenile/Adult
9/17/74	1	6	67	67	Adult
11/04/74	10	6	667	590	Adult
Micropogon undulatus					
12/06/74	1	6	67	67	Post Larval
12/26/74	4	6	267	267	Post Larval
12/31/74	45	6	3,000	2,693	Post Larval/ Juvenile
Mugil cephalus					
7/19/74	6	6	400	273	Juvenile/Adult
7/31/74	14	6	933	720	Adult
8/15/74	1	6	67	67	Adult
8/27/74	2	6	133	133	Adult
8/28/74	4	6	267	267	Adult
11/04/74	3	6	200	200	Adult
12/06/74	1	6	67	67	Adult?
Citharichthys spilopterus					
9/03/74	1	6	67	67	Adult?
Paralichthys dentatus					
8/27/74	1	6	67	67	Juvenile
8/28/74	2	6	133	133	Juvenile
9/03/74	1	6	67	67	Juvenile
9/30/74	1	6	67	67	Juvenile
10/22/74	2	6	133	84	Juvenile

3.5 PLANKTONIC ORGANISMS

Summary

Planktonic organisms, such as fish eggs, larvae and invertebrate larvae (both meroplanktonic and holoplanktonic), and post-larval and juvenile fish, or the motile food organisms (such as shrimp) on which these young fish feed, are sampled periodically in the intake and discharge canals, at locations within the thermal plume, and in a control area outside the thermal plume. The resulting data are analyzed to determine the cooling system passage and entrainment effects of station operation.

Results

The results of this survey are contained in the report prepared by the Virginia Institute of Marine Science entitled "Ecological Survey - Upper James River" dated January, 1975 which is appended to this report as Appendix 3.0.

Conclusions

Refer to the referenced report.

3.6 FISH MORTALITIES

Fish impingement estimates for the low-level screens for the time period of June 30, 1974 to January 4, 1975 are reported. These estimates are based on two five-minute replicates taken daily Monday through Friday and extrapolated to reflect weekly values.

The low-level screens, which were specifically designed to reduce fish impingement mortality, stopped an estimated 959,904 fish from entering the high level canal during this time period. Of this total, an estimated 857,160 individuals were returned to the river alive and an estimated 102,744 were killed. The average 6 month survival was 89.3% with a range of 64% to 99%.

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of June 30, 1974 Through July 6, 1974 Survival Percentage 88 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	140-199	2,256	0
039	White catfish	Ictalurus catus	200-299	864	288
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas	60-79	528	0
110	Spottail shiner	Notropis hudsonius	80-99	3,456	0
060	American eel	Anguilla rostrata	300-399	672	0
051	Gizzard shad	Dorosoma cepedianum	300-399	720	192
275	Threadfin shad	Dorosoma petenense	100-119	0	192
026	Alewife	Alosa pseudoharengus	60-79	432	0
027	Blueback herring	Alosa aestivalis	80-99	864	288
037	Atlantic menhaden	Brevoortia tyrannus	40-59	14,832	1,728
103	Bay anchovy	Anchoa mitchilli	60-79	4,512	1,920
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus	120-139	672	0
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	80-99	3,744	0
005	Atlantic croaker	Micropogon undulatus	120-139	768	0
151	Hogchoker	Trinectes maculatus	40-59	384	0
028	Hickory shad	Alosa mediocris	40-59	0	288
030	American shad	Alosa sapidissima	60-79	288	0
144	Naked gobie	Gobiosoma bosci	40-59	576	0
009	Bluefish	Pomatomus saltatrix	60-79	432	288
136	Bluegill	Lepomis macrocirus	140-199	384	0
304	Northern creek chub	Semotilus atromaculatus	80-99	192	0
			TOTAL	36,576	5,184

Salinity (0/00) min.-max. 3.6-4.1
Temperature (C°) min.-max 23.7-28.3

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of July 7, 1974 Through July 13, 1974 Survival Percentage 89%

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	140-199	2,016	0
039	White catfish	Ictalurus catus	200-299	864	0
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas	100-119	432	0
110	Spottail shiner	Notropis hudsonius	80-99	4,032	0
060	American eel	Anguilla rostrata	400-499	288	0
051	Gizzard shad	Dorosoma cepedianum	140-199	288	288
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	40-59	2,304	288
103	Bay anchovy	Anchoa mitchilli	60-79	1,728	1,440
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	80-99	5,184	0
005	Atlantic croaker	Micropogon undulatus	100-119	720	288
151	Hogchoker	Trinectes maculatus			
003	Summer flounder	Paralichthys dentatus	100-119	144	0
144	Naked goby	Gobiosoma bosci	40-59	1,008	0
213	Silver perch	Bairdiella chrysura	140-199	288	0
			TOTAL	19,296	2,304

Salinity (0/00) min.-max.4.4-5.5
Temperature (C°) min-max. 26.1-29.7

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of July 14, 1974 Through July 20, 1974 Survival Percentage 83 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	1,152	288
039	White catfish	Ictalurus catus	140-199	3,024	0
116	Brown bullhead	Ictalurus nebulosus	40-59	576	0
108	Golden shiner	Notemigonus crysoleucas	80-99	2,016	0
110	Spottail shiner	Notropis hudsonius	100-119	720	288
060	American eel	Anguilla rostrata	400-499	576	0
051	Gizzard shad	Dorosoma cepedianum	400-499	288	0
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	60-79	288	144
027	Blueback herring	Alosa aestivalis	80-99	1,584	576
037	Atlantic menhaden	Brevoortia tyrannus	60-79	1,296	144
103	Bay anchovy	Anchoa mitchilli	60-79	3,888	2,016
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	80-99	288	0
135	Pumpkinseed	Lepomis gibbosus	140-199	144	0
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	80-99	3,024	432
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	60-79	0	288
028	Hickory shad	Alosa mediocris	80-99	288	0
144	Naked goby	Gobiosoma bosci	20-39	720	0
009	Bluefish	Pomatomus saltatrix	100-119	288	0

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of July 21, 1974 Through July 27, 1974 Survival Percentage 91 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	1,296	0
039	White catfish	Ictalurus catus	140-199	31,824	0
116	Brown bullhead	Ictalurus nebulosus	140-199	869	144
108	Golden shiner	Notemigonus crysoleucas	80-99	432	0
110	Spottail shiner	Notropis hudsonius	80-99	1,296	288
060	American eel	Anguilla rostrata	200-299	864	0
051	Gizzard shad	Dorosoma cepedianum	200-299	288	144
275	Threadfin shad	Dorosoma petenense	140-199	288	0
026	Alewife	Alosa pseudoharengus	100-119	2,304	0
027	Blueback herring	Alosa aestivalis	80-99	1,296	864
037	Atlantic menhaden	Brevoortia tyrannus	60-79	720	0
103	Bay anchovy	Anchoa mitchilli	60-79	6,768	3,600
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	80-99	288	0
135	Pumpkinseed	Lepomis gibbosus	120-139	864	0
032	White perch	Morone americana	60-79	2,448	0
033	Spot	Leiostomus xanthurus	100-119	4,032	0
005	Atlantic croaker	Micropogon undulatus	100-119	720	288
151	Hogchoker	Trinectes maculatus	40-59	144	0
028	Hickory shad	Alosa mediocris	80-99	144	0
030	American shad	Alosa sapidissima	60-79	144	0
144	Naked goby	Gobiosoma bosci	40-59	144	0
052	Carp	Cyprinus carpio	100-119	576	0
009	Bluefish	Pomatomus saltatrix	140-199	720	0
058	Spotted seatrout	Cynoscion nebulosus	200-299	144	0
042	Spanish mackerel	Scomberomorus maculatus	80-99	0	432
			TOTAL	58,464	5,760

Salinity (0/00) min.-max.7.0-7.6
Temperature (C°) min-max 25.2-27.5

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of July 28, 1974 Through August 3, 1974 Survival Percentage 92 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	1,440	0
039	White catfish	Ictalurus catus	140-199	4,464	0
116	Brown bullhead	Ictalurus nebulosus	60-79	144	0
108	Golden shiner	Notemigonus crysoleucas	140-199	432	0
110	Spottail shiner	Notropis hudsonius	80-99	144	0
060	American eel	Anguilla rostrata	200-299	144	0
051	Gizzard shad	Dorosoma cepedianum	200-299	432	0
275	Threadfin shad	Dorosoma petenense	100-119	288	0
026	Alewife	Alosa pseudoharengus	60-79	432	0
027	Blueback herring	Alosa aestivalis	80-99	4,752	432
037	Atlantic menhaden	Brevoortia tyrannus	80-99	720	0
103	Bay anchovy	Anchoa mitchilli	60-79	6,336	2,304
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus	120-139	576	0
032	White perch	Morone americana	60-79	864	0
033	Spot	Leiostomus xanthurus	80-99	11,952	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus			
028	Hickory shad	Alosa mediocris	60-79	288	0
003	Summer flounder	Paralichthys dentatus	80-99	144	0
009	Bluefish	Pomatomus saltatrix	140-199	0	288
			TOTAL	31,392	3,024

Salinity (0/00) min-max. 6.4-6.9
Temperature (C°) min-max 26.6-28.5

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of August 4, 1974 Through August 10, 1974 Survival Percentage 92 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	1,296	0
039	White catfish	Ictalurus catus	200-299	720	0
116	Brown bullhead	Ictalurus nebulosus	60-79	288	0
108	Golden shiner	Notemigonus crysoleucas	80-99	1,152	0
110	Spottail shiner	Notropis hudsonius	80-99	576	0
060	American eel	Anguilla rostrata	200-299	1,296	0
051	Gizzard shad	Dorosoma cepedianum	200-299	432	288
275	Threadfin shad	Dorosoma petenense	140-199	432	0
026	Alewife	Alosa pseudoharengus	60-79	0	1,152
027	Blueback herring	Alosa aestivalis	80-99	864	0
037	Atlantic menhaden	Brevoortia tyrannus	60-79	5,472	720
103	Bay anchovy	Anchoa mitchilli	60-79	13,248	1,152
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	60-79	144	144
135	Pumpkinseed	Lepomis gibbosus	80-99	144	0
032	White perch	Morone americana	60-79	7,920	0
033	Spot	Leiostomus xanthurus	80-99	11,664	576
005	Atlantic croaker	Micropogon undulatus	80-99	1,584	0
151	Hogchoker	Trinectes maculatus			
028	Hickory shad	Alosa mediocris	60-79	2,304	288
030	American shad	Alosa sapidissima	80-99	144	0
003	Summer flounder	Paralichthys dentatus	200-299	144	0
009	Bluefish	Pomatomus saltatrix	140-199	576	144
			TOTAL	50,400	4,464

Salinity (0/00) min-max.4.8-5.7
Temperature (C°) min-max. 24.8-28.1

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of August 11, 1974 Through August 17, 1974 Survival Percentage 95 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	1,008	0
039	White catfish	Ictalurus catus	200-299	2,880	0
116	Brown bullhead	Ictalurus nebulosus	60-79	720	0
108	Golden shiner	Notemigonus crysoleucas	120-139	576	0
110	Spottail shiner	Notropis hudsonius	100-119	144	0
060	American eel	Anguilla rostrata	200-299	432	0
051	Gizzard shad	Dorosoma cepedianum	200-299	720	0
275	Threadfin shad	Dorosoma petenense	60-79	8,532	0
026	Alewife	Alosa pseudoharengus	60-79	4,608	144
027	Blueback herring	Alosa aestivalis	80-99	2,592	144
037	Atlantic menhaden	Brevoortia tyrannus	80-99	6,624	0
103	Bay anchovy	Anchoa mitchilli	60-79	10,512	2,016
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	80-99	144	0
135	Pumpkinseed	Lepomis gibbosus	120-139	288	0
032	White perch	Morone americana	80-99	576	0
033	Spot	Leiostomus xanthurus	120-139	4,752	0
005	Atlantic croaker	Micropogon undulatus	140-199	864	0
151	Hogchoker	Trinectes maculatus			
144	Naked goby	Gobiosoma bosci	40-59	144	0
			TOTAL	45,936	2,304

Salinity (0/00) min-max. 6.0-6.6
Temperature (C°) min-max 24.9-28.8

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of August 18,1974 Through August 24, 1974 Survival Percentage 92 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	576	0
039	White catfish	Ictalurus catus	200-299	864	0
116	Brown bullhead	Ictalurus nebulosus	80-99	5,616	0
108	Golden shiner	Notemigonus crysoleucas	120-139	288	0
110	Spottail shiner	Notropis hudsonius	80-99	432	0
060	American eel	Anguilla rostrata	300-399	1,440	0
051	Gizzard shad	Dorosoma cepedianum	200-299	864	0
275	Threadfin shad	Dorosoma petenense	80-99	576	0
026	Alewife	Alosa pseudoharengus	60-79	2,016	0
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	100-119	1,872	0
103	Bay anchovy	Anchoa mitchilli	60-79	7,056	2,592
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	60-79	288	0
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	80-99	1,584	0
033	Spot	Leiostomus xanthurus	120-139	5,760	0
005	Atlantic croaker	Micropogon undulatus	120-139	1,440	0
151	Hogchoker	Trinectes maculatus	120-139	288	0
028	Hickory shad	Alosa mediocris	100-119	288	288
188	Redbreast sunfish	Lepomis auritus	120-139	288	0
003	Summer flounder	Paralichthys dentatus	100-119	144	0
007	Weakfish	Cynoscion regalis	60-79	144	0
			TOTAL	31,824	2,880

Salinity (0/00) min.-max.6.2-7.0
Temperature (C°) min-max. 26.7-28.0

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of August 25,1974 Through August 31, 1974 Survival Percentage 92 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	432	0
039	White catfish	Ictalurus catus	140-199	720	0
116	Brown bullhead	Ictalurus nebulosus	200-299	432	288
108	Golden shiner	Notemigonus crysoleucas	120-149	288	0
110	Spottail shiner	Notropis hudsonius	80-99	432	0
060	American eel	Anguilla rostrata	200-299	576	0
051	Gizzard shad	Dorosoma cepedianum	200-299	720	144
275	Threadfin shad	Dorosoma petenense	80-99	2,448	0
026	Alewife	Alosa pseudoharengus	80-99	1,296	0
027	Blueback herring	Alosa aestivalis	40-59	0	144
037	Atlantic menhaden	Brevoortia tyrannus	120-139	7,056	0
103	Bay anchovy	Anchoa mitchilli	20-39	3,456	576
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	100-119	2,160	0
005	Atlantic croaker	Micropogon undulatus	120-139	576	0
151	Hogchoker	Trinectes maculatus			
003	Summer flounder	Paralichthys dentatus	100-119	144	0
011	Harvestfish	Peprilus alepidotus	60-79	0	144
144	Naked goby	Gobiosoma bosci	40-59	864	0
148	Rough silverside	Membras martinica	60-79	0	576
			TOTAL	21,600	1,872

Salinity (0/00) min-max 5.6-6.7
Temperature (C°) min-max. 27.2-29.5

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of September 1 Through September 7, 1974 Survival Percentage 89%

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	1,440	0
039	White catfish	Ictalurus catus	140-199	2,160	0
116	Brown bullhead	Ictalurus nebulosus	80-99	3,312	288
108	Golden shiner	Notemigonus crysoleucas	100-119	1,296	0
110	Spottail shiner	Notropis hudsonius	80-99	1,152	0
060	American eel	Anguilla rostrata	300-399	1,152	0
051	Gizzard shad	Dorosoma cepedianum	200-299	720	0
275	Threadfin shad	Dorosoma petenense	80-99	1,296	0
026	Alewife	Alosa pseudoharengus	60-79	1,008	0
027	Blueback herring	Alosa aestivalis			
037	Atlantic menhaden	Brevoortia tyrannus	100-119	2,160	144
103	Bay anchovy	Anchoa mitchilli	60-79	14,544	3,456
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	80-99	576	288
135	Pumpkinseed	Lepomis gibbosus	140-199	432	0
032	White perch	Morone americana	80-99	864	0
033	Spot	Leiostomus xanthurus	100-119	4,896	0
005	Atlantic croaker	Micropogon undulatus	140-199	1,152	0
151	Hogchoker	Trinectes maculatus	120-139	288	0
052	Carp	Cyprinus carpio	200-299	1,872	0
030	American shad	Alosa sapidissima	80-99	432	0
148	Rough Silverside	Membras martinica	60-79	576	1,008
204	Crevalle jack	Caranx hippos	40-59	288	0
144	Naked goby	Gobiosoma bosci	40-59	288	0
			TOTAL	41,904	5,184

Salinity (0/00) min-max-4.5-6.3
Temperature (C°) min-max. 23.1-28.3

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of September 8 Through September 14, 1974 Survival Percentage 88 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	2,736	0
039	White catfish	Ictalurus catus	140-199	2,160	0
116	Brown bullhead	Ictalurus nebulosus	80-99	1,728	0
108	Golden shiner	Notemigonus crysoleucas	100-119	576	0
110	Spottail shiner	Notropis hudsonius	80-99	4,752	432
060	American eel	Anguilla rostrata	300-399	432	0
051	Gizzard shad	Dorosoma cepedianum	200-299	864	0
275	Threadfin shad	Dorosoma petenense	80-99	22,608	3,312
026	Alewife	Alosa pseudoharengus	60-79	864	0
027	Blueback herring	Alosa aestivalis	40-59	576	0
037	Atlantic menhaden	Brevoortia tyrannus	80-99	8,640	1,152
103	Bay anchovy	Anchoa mitchilli	60-79	15,408	4,752
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	80-99	720	432
135	Pumpkinseed	Lepomis gibbosus	140-199	864	0
032	White perch	Morone americana	80-99	864	0
033	Spot	Leiostomus xanthurus	100-119	4,608	0
005	Atlantic croaker	Micropogon undulatus	140-199	864	144
151	Hogchoker	Trinectes maculatus	100-199	2,448	0
052	Carp	Cyprinus carpio	140-199	144	0
148	Rough Silverside	Membras martinica	60-79	0	144
009	Bluefish	Pomatomus saltatrix	140-199	432	0
136	Bluegill	Lepomis macrochirus	120-139	288	0
144	Naked Goby	Gobiosoma bosci	40-59	864	0
			TOTAL	73,152	10,368

Salinity (0/00) min-max. 1.2-3.2
Temperature (C°) min.-max. 23.1-27.2

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of September 15 Through September 21, 1974 Survival Percentage 88 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	120-139	1,584	0
039	White catfish	Ictalurus catus	140-200	1,584	288
116	Brown bullhead	Ictalurus nebulosus	80-99	4,896	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius	80-99	6,048	144
060	American eel	Anguilla rostrata	200-299	1,440	0
051	Gizzard shad	Dorosoma cepedianum	120-139	1,152	144
275	Threadfin shad	Dorosoma petenense	80-99	6,480	432
026	Alewife	Alosa pseudoharengus	60-79	864	288
027	Blueback herring	Alosa aestivalis	40-59	0	288
037	Atlantic menhaden	Brevoortia tyrannus	100-119	4,752	144
103	Bay anchovy	Anchoa mitchilli	60-79	1,440	2,160
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	80-99	576	432
135	Pumpkinseed	Lepomis gibbosus	120-139	288	0
032	White perch	Morone americana	140-199	288	0
033	Spot	Leiostomus xanthurus	120-139	3,600	0
005	Atlantic croaker	Micropogon undulatus	120-139	288	0
151	Hogchoker	Trinectes maculatus	120-139	144	0
030	American Shad	Alosa sapidissima	80-99	288	0
148	Rough Silverside	Membras martinica	80-99	288	0
007	Gray Trout	Cynoscion regalis	40-59	0	864
144	Naked goby	Gobiosoma bosci	20-39	1,584	144
			TOTAL	37,584	5,328

Salinity (0/00) min-max 1.4-2.5
Temperature (C°) min-max 23.5-26.0

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of September 22 Through September 28, 1974 Survival Percentage 94 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	720	0
039	White catfish	Ictalurus catus	200-299	1,008	0
116	Brown bullhead	Ictalurus nebulosus	80-99	1,440	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius	80-99	3,888	144
060	American eel	Anguilla rostrata	200-299	1,296	0
051	Gizzard shad	Dorosoma cepedianum	100-119	432	720
275	Threadfin shad	Dorosoma petenense	80-99	18,000	576
026	Alewife	Alosa pseudoharengus	60-79	576	0
027	Blueback herring	Alosa aestivalis	40-59	576	0
037	Atlantic menhaden	Brevoortia tyrannus	100-119	3,600	144
103	Bay anchovy	Anchoa mitchilli	60-79	4,032	864
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	80-99	720	0
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	120-139	432	0
005	Atlantic croaker	Micropogon undulatus	140-199	432	0
151	Hogchoker	Trinectes maculatus	120-139	1,008	0
107	Silvery minnow	Hybognathus nuchalis	80-99	288	0
030	American shad	Alosa sapidissima	80-99	1,008	0
148	Rough silverside	Membras martinica	60-79	144	0
003	Summer flounder	Paralichthys dentatus	140-199	144	0
			TOTAL	39,744	2,448

Salinity (0/00) min-max 2.9-5.3
Temperature (C°) min-max. 19.8- 23.0

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of September 29 Through October 5, 1974 Survival Percentage 93 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	140-199	864	0
039	White catfish	Ictalurus catus	140-199	1,440	0
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas	140-199	144	0
110	Spottail shiner	Notropis hudsonius	80-99	1,728	0
060	American eel	Anguilla rostrata	400-499	432	0
051	Gizzard shad	Dorosoma cepedianum	140-199	4,032	0
275	Threadfin shad	Dorosoma petenense	80-99	3,744	432
026	Alewife	Alosa pseudoharengus	60-79	1,440	288
027	Blueback herring	Alosa aestivalis	40-59	1,728	576
037	Atlantic menhaden	Brevoortia tyrannus	100-119	2,016	0
103	Bay anchovy	Anchoa mitchilli	60-79	6,336	576
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	80-99	0	288
135	Pumpkinseed	Lepomis gibbosus	120-139	432	0
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	120-139	1,584	0
005	Atlantic croaker	Micropogon undulatus	140-199	144	0
151	Hogchoker	Trinectes maculatus	100-119	1,584	0
107	Silvery minnow	Hybognathus nuchalis	140-199	144	0
148	Rough silverside	Membras martinica	60-79	1,008	144
007	Gray trout	Cynoscion regalis	40-59	144	0
144	Naked goby	Gobiosoma bosci	20-39	4,464	0
003	Summer flounder	Paralichthys dentatus	120-139	1,008	0
030	American shad	Alosa sapidissima	80-99	720	432
			TOTAL	35,136	2,736

Salinity(0/00)min.-max: 4.8-5.6
Temperature (C°) min.-max. 16.2°-19.5°

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of October 6 Through October 12, 1974 Survival Percentage 88 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	140-199	1656	0
039	White catfish	Ictalurus catus	200-299	360	0
116	Brown bullhead	Ictalurus nebulosus	80-99	288	0
108	Golden shiner	Notemigonus crysoleucas	120-139	72	0
110	Spottail shiner	Notropis hudsonius	80-99	72	0
060	American eel	Anguilla rostrata	200-299	864	0
051	Gizzard shad	Dorosoma cepedianum	140-199	2,232	576
275	Threadfin shad	Dorosoma petenense	80-99	1,728	0
026	Alewife	Alosa pseudoharengus	80-99	288	0
027	Blueback herring	Alosa aestivalis	40-59	5,256	1,728
037	Atlantic menhaden	Brevoortia tyrannus	120-139	1,584	0
103	Bay anchovy	Anchoa mitchilli	60-79	8,640	1,152
149	Tidewater silverside	Menidia beryllina	40-59	288	0
150	Atlantic silverside	Menidia menidia	100-119	72	0
135	Pumpkinseed	Lepomis gibbosus	100-119	216	0
032	White perch	Morone americana	200-299	288	0
033	Spot	Leiostomus xanthurus	80-99	1,080	0
005	Atlantic croaker	Micropogon undulatus	140-199	144	0
151	Hogchoker	Trinectes maculatus	120-139	4,032	0
265	Lady fish	Elops saurus	200-299	72	0
030	American shad	Alosa sapidissima	100-119	2,088	432
148	Rough silverside	Membras martinica	80-99	4,320	1,224
009	Bluefish	Pomatomus saltatrix	140-199	144	0
144	Naked goby	Gobiosoma bosci	40-59	864	0
003	Summer flounder	Paralichthys dentatus	120-139	648	0
213	Silver prech	Bairdiella chrysura	80-99	288	0
			TOTAL	37,584	5,112

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of October 13 Through October 19, 1974 Survival Percentage 91 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	140-199	1,224	0
039	White catfish	Ictalurus catus	140-199	72	0
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius	80-99	432	0
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	100-119	792	0
275	Threadfin shad	Dorosoma petenense	80-99	576	72
026	Alewife	Alosa pseudoharengus	80-99	720	0
027	Blueback herring	Alosa aestivalis	60-79	1,296	648
037	Atlantic menhaden	Brevoortia tyrannus	100-119	1,800	0
103	Bay anchovy	Anchoa mitchilli	60-79	8,064	1,224
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	80-99	1,080	0
135	Pumpkinseed	Lepomis gibbosus	100-119	288	0
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	120-139	576	0
005	Atlantic croaker	Micropogon undulatus	140-199	432	0
151	Hogchoker	Trinectes maculatus	120-139	1,008	0
007	Weakfish	Cynoscion regalis	60-79	144	0
030	American shad	Alosa sapidissima	80-99	72	72
148	Rough silverside	Membras martinica	80-99	3,096	432
011	Harvestfish	Peprilus alepidotus	60-79	288	0
144	Summer flounder	Paralichthys dentatus	80-99	72	0
003	Naked goby	Gobiosoma bosci	20-39	1,368	0
			TOTAL	23,400	2,448

Salinity (0/00) min.-max. 6.1-8.5
Temperature (°C) min.- max: 17.8 - 20.7

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of October 20 Through October 26, 1974 Survival Percentage 97 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	140-199 210	5,040	0
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	140-199	576	0
275	Threadfin shad	Dorosoma petenense	80- 99	2,160	144
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis	40- 59	14,112	720
037	Atlantic menhaden	Brevoortia tyrannus			
103	Bay anchovy	Anchoa mitchilli	60- 79	1,008	0
149	Tidewater silverside	Menidia beryllina	60- 79	432	0
150	Atlantic silverside	Menidia menidia	80- 99	720	0
135	Pumpkinseed	Lepomis gibbosus	100-119	1,584	0
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus			
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	120-139	864	0
030	American shad	Alosa sapidissima	100-119	720	0
052	Carp	Cyprinus carpio	300-399	288	0
144	Naked goby	Gobiosoma bosci	40-59	1,008	0
003	Summer flounder	Paralichthys dentatus	120-139	288	0

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of October 27, Through November 2, 1974 Survival Percentage 90 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	1,152	0
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius	100-119	144	0
060	American eel	Anguilla rostrata			
051	Gizzard shad	Dorosoma cepedianum	140-199	0	144
275	Threadfin shad	Dorosoma petenense	100-119	432	0
026	Alewife	Alosa pseudoharengus	80-99	144	0
027	Blueback herring	Alosa aestivalis	60-79	10,080	1,872
037	Atlantic menhaden	Brevoortia tyrannus	100-119	1,152	0
103	Bay anchovy	Anchoa mitchilli	60-79	288	0
149	Tidewater silverside	Menidia beryllina	40-59	288	0
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus	140-199	288	0
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	100-119	1,440	432
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus			
148	Rough silverside	Membras martinica	60-79	2,016	0
144	Naked goby	Gobiosoma bosci	40-59	5,184	0
			TOTAL	22,608	2,448

Salinity (0/00) min-max. : 7.9-8.7
Temperature (°C.) min-max. :15.4-16.4

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Ave. operating circ. pumps : 6
Salinity min.-max. : 7.3-8.6
Temperature min.-max. : 13.4-17.4
Survival Percentage 93 %

Week Of November 3 Through NOvember 9, 1974

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	1,584	0
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus	80-99	144	0
108	Golden shiner	Notemigonus crysoleucas	120-139	144	0
110	Spottail shiner	Notropis hudsonius	80-99	864	0
060	American eel	Anguilla rostrata	400-499	144	0
051	Gizzard shad	Dorosoma cepedianum	300-399	576	0
275	Threadfin shad	Dorosoma petenense	80-99	1,584	0
026	Alewife	Alosa pseudoharengus	80-99	576	144
027	Blueback herring	Alosa aestivalis	60-79	6,912	1,296
037	Atlantic menhaden	Brevoortia tyrannus	120-139	1,728	288
103	Bay anchovy	Anchoa mitchilli	60-79	4,320	0
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	100-119	144	0
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	210-139	1,008	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	100-119	864	0
122	Mummichog	Fundulus heteroditus	60-79	864	0
148	Rough silverside	Membras martinica	60-79	144	0
144	Naked goby	Gobiosoma bosci	40-59	3,024	0
030	American shad	Alosa sapidissima	120-139	144	0
			TOTAL	24,768	1,728

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Circ. pump ave. : 5
Sal. min.-max. : 8.0 - 11.1
Temp. min.-max. : 12.1 - 14.2

Week Of November 10 Through November 16, 1974

Survival Percentage 91 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	864	0
039	White catfish	Ictalurus catus	140-199	144	
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius	80- 99	288	0
060	American eel	Anguilla rostrata	200-299	1,152	0
051	Gizzard shad	Dorosoma cepedianum	300-399	0	144
275	Threadfin shad	Dorosoma petenense	80- 99	1,584	0
026	Alewife	Alosa pseudoharengus	80- 99	144	0
027	Blueback herring	Alosa aestivalis	60- 79	2,016	288
037	Atlantic menhaden	Brevoortia tyrannus	100-119	432	0
103	Bay anchovy	Anchoa mitchilli	60-79	432	432
149	Tidewater silverside	Menidia beryllina	60- 79	288	0
150	Atlantic silverside	Menidia menidia			
135	Pumpkinseed	Lepomis gibbosus	140-199	144	0
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	120-139	576	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus			
265	Ladyfish	Elops saurus	200-299	288	0
030	American Shad	Alosa sapidissima	100-119	288	288
122	Mummichog	Fundulus heteroclitus	60- 79	1,152	0
144	Naked goby	Gobiosoma bosci	20- 39	1,296	0
120	Sheepshead minnow	Cyprinodon variegatus	40- 59	288	0
			TOTAL	11,376	1,152

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Circ. pump ave. : 4
Sal. min. -max. : 7.3 - 8.4
Temp. min.-max. : 9.6 - 14.2

Week Of November 17 Through November 23, 1974

Survival Percentage 94 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	120-139	288	0
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus			
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	300-399	288	0
051	Gizzard shad	Dorosoma cepedianum			
275	Threadfin shad	Dorosoma petenense	60-79	288	0
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis	60-79	18,576	1,584
037	Atlantic menhaden	Brevoortia tyrannus	80-99	144	0
103	Bay anchovy	Anchoa mitchilli	40-59	432	0
149	Tidewater silverside	Menidia beryllina	60-79	720	0
150	Atlantic silverside	Menidia menidia	80-99	144	0
135	Pumpkinseed	Lepomis gibbosus	100-119	1,728	0
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	140-199	288	0
005	Atlantic croaker	Micropogon undulatus			
151	Hogchoker	Trinectes maculatus	100-119	576	0
030	American shad	Alosa sapidissima	80-99	144	144
122	Mummichog	Fundulus heteroclitus	60-79	144	0
120	Sheephead minnow	Cyprinodon variegatus	40-59	288	0
144	Naked goby	Bogiosoma bosci	20-39	864	0
003	Summer flounder	Paralichthys dentatus	300-399	144	0
			TOTAL	25,056	1,728

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Circ. pump ave. : 4
Sal. min.-max. : 7.4 - 9.8
Temp. min.-max. : 6.9 - 10.5

Week Of November 24, Through November 30, 1974

Survival Percentage 87 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	120-139	1,728	0
039	White catfish	Ictalurus catus	200-299	144	0
116	Brown bullhead	Ictalurus nebulosus	60-79	288	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius	80-99	2,880	0
060	American eel	Anguilla rostrata	200-299	864	0
051	Gizzard shad	Dorosoma cepedianum	200-299	0	288
275	Threadfin shad	Dorosoma petenense			
026	Alewife	Alosa pseudoharengus	100-119	0	288
027	Blueback herring	Alosa aestivalis	60-79	5,904	864
037	Atlantic menhaden	Brevoortia tyrannus	120-139	288	0
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina	60-79	0	288
150	Atlantic silverside	Menidia menidia	100-119	432	0
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus			
005	Atlantic croaker	Micropogon undulatus	40-59	0	288
151	Hogchoker	Trinectes maculatus	140-199	288	0
030	American shad	Alosa sapidissima	100-119	288	0
144	Naked goby	Gobiosoma bosci	20-39	288	0
121	Banded killifish	Fundulus diaphanus	60-79	288	0
			TOTAL	13,680	2,016

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of **December 1** Through **December 7, 1974** Survival Percentage **99 %**

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	5,616	0
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus	100-119	720	
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius	100-119	1,296	0
060	American eel	Anguilla rostrata	300-399	864	0
051	Gizzard shad	Dorosoma cepedianum	100-119	432	0
275	Threadfin shad	Dorosoma petenense	80-99	432	0
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis	60-79	1,728	0
037	Atlantic menhaden	Brevoortia tyrannus			
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	100-119	14,544	432
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	140-199	864	0
033	Spot	Leiostomus xanthurus			
005	Atlantic croaker	Micropogon undulatus	120-139	432	0
151	Hogchoker	Trinectes maculatus	100-119	576	0
052	Carp	Cyprinus carpio	140-199	432	0
122	Mummichog	Fundulus heteroclitus	60-79	288	0
144	Naked Goby	Gobiosoma bosci	20-39	1,872	0
003	Summer Flounder	Paralichthys dentatus	100-119	288	0
			TOTAL	30,384	432

Salinity min.-max.: 8.0-12.1
Temperature (°C) min.-max.: 6.9°-7.0°
Ave. # Circ. Pumps in operation: 4

Ave. operating circ. pumps:3
Salinity min-max: 5.0-9.2
Temp. min-max: 5.6-8.2

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of December 8 Through December 14, 1974 Survival Percentage 86 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	200-299	288	0
039	White catfish	Ictalurus catus	140-199	144	0
116	Brown bullhead	Ictalurus nebulosus	60-79	576	288
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	300-399	576	0
051	Gizzard shad	Dorosoma cepedianum	300-399	144	0
275	Threadfin shad	Dorosoma petenense	80-99	1,872	1,440
026	Alewife	Alosa pseudoharengus	80-99	1,008	0
027	Blueback herring	Alosa aestivalis	60-79	3,024	0
037	Atlantic menhaden	Brevoortia tyrannus	100-119	288	0
103	Bay anchovy	Anchoa mitchilli			
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	100-119	3,168	144
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	80-99	144	0
033	Spot	Leiostomus xanthurus			
005	Atlantic croaker	Micropogon undulatus	40-59	288	0
151	Hogchoker	Trinectes maculatus			
030	American shad	Alosa sapidissima	80-99	288	0
			TOTAL	11,808	1,872

AVE. # CIRC. PUMPS ON : 3
SALINITY MIN.-MAX. : 4.1-7.6
TEMPERATURE MIN.-MAX. : 5.8-7.6

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of December 15 Through December 21, 1974 Survival Percentage 90 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus	140 - 199	288	0
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus	60 - 79	576	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius	100 - 119	288	0
060	American eel	Anguilla rostrata	300 - 399	432	0
051	Gizzard shad	Dorosoma cepedianum	100 - 119	144	0
275	Threadfin shad	Dorosoma petenense	80 - 99	6,480	432
026	Alewife	Alosa pseudoharengus	80 - 99	288	0
027	Blueback herring	Alosa aestivalis	60 - 79	9,360	576
037	Atlantic menhaden	Brevoortia tyrannus	120 - 139	288	0
103	Bay anchovy	Anchoa mitchilli	60 - 79	1,296	1,152
149	Tidewater silverside	Menidia beryllina	60 - 79	432	0
150	Atlantic silverside	Menidia menidia	80 - 99	1,296	144
135	Pumpkinseed	Lepomis gibbosus	120 - 139	288	0
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus	140 - 199	432	0
005	Atlantic croaker	Micropogon undulatus	40 - 59	576	0
151	Hogchoker	Trinectes maculatus			
030	American shad	Alosa sapidissima	80 - 99	432	288
121	Banded killiefish	Fundulus diaphanus	80 - 99	288	0
			TOTAL	23,184	2,592

AVE. # CIRC. PUMPS ON : 3
SALINITY MIN. - MAX. : 4.2-5.5
TEMPERATURE MIN. - MAX. : 5.2-6.5

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of December 22 Through December 28,1974 Survival Percentage 64 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus	60 - 79	144	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius			
060	American eel	Anguilla rostrata	200 - 299	288	0
051	Gizzard shad	Dorosoma cepedianum	100 - 119	1,584	0
275	Threadfin shad	Dorosoma petenense	60 - 79	13,104	1,440
026	Alewife	Alosa pseudoharengus	80 - 99	0	144
027	Blueback herring	Alosa aestivalis	60 - 79	7,920	864
037	Atlantic menhaden	Brevoortia tyrannus	60 - 79	1,728	0
103	Bay anchovy	Anchoa mitchilli	60 - 79	1,296	288
149	Tidewater silverside	Menidia beryllina			
150	Atlantic silverside	Menidia menidia	100 - 119	5,040	144
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana			
033	Spot	Leiostomus xanthurus			
005	Atlantic croaker	Micropogon undulatus	0 - 19	576	14,976
151	Hogchoker	Trinectes maculatus			
030	American shad	Alosa sapidissima	80 - 99	288	0
144	Naked goby	Gobiosoma bosci	20 - 39	432	0
			TOTAL	32,400	17,856

AVE. # CIRC. PUMPS ON : 3
SALINITY MIN. - MAX. : 2.1-5.7
TEMPERATURE MIN. -MAX. : 4.8-8.2

SURRY POWER STATION
LOW LEVEL WEEKLY REPORT

Week Of December 29,1974 Through January 4,1975

Survival Percentage 87 %

VIMS CODE	COMMON NAME	SCIENTIFIC NAME	MODAL SIZE (mm)	ALIVE	DEAD
040	Channel catfish	Ictalurus punctatus			
039	White catfish	Ictalurus catus			
116	Brown bullhead	Ictalurus nebulosus	60 - 79	144	0
108	Golden shiner	Notemigonus crysoleucas			
110	Spottail shiner	Notropis hudsonius	60 - 79	288	0
060	American eel	Anguilla rostrata	+500	1,008	0
051	Gizzard shad	Dorosoma cepedianum	140 - 199	1,440	144
275	Threadfin shad	Dorosoma petenense	60 - 79	7,056	1,584
026	Alewife	Alosa pseudoharengus			
027	Blueback herring	Alosa aestivalis	60 - 79	14,544	576
037	Atlantic menhaden	Brevoortia tyrannus	80 - 99	720	144
103	Bay anchovy	Anchoa mitchilli	60 - 79	864	144
149	Tidewater silverside	Menidia beryllina	60 - 79	144	0
150	Atlantic silverside	Menidia menidia	80 - 99	1,008	0
135	Pumpkinseed	Lepomis gibbosus			
032	White perch	Morone americana	60 - 79	288	0
033	Spot	Leiostomus xanthurus	80 - 99	288	0
005	Atlantic croaker	Micropogon undulatus	20 - 39	864	1,872
151	Hogchoker	Trinectes maculatus			
231	Striped mullet	Mugil cephalus	+ 500	288	0
			TOTAL	28,944	4,464

PROGRESS REPORT

to

Virginia Electric and Power Company

ECOLOGICAL SURVEY - UPPER JAMES RIVER

SURRY NUCLEAR POWER STATION SITE

January 1975

Submitted by:

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Introduction

In May of 1969 field surveys to characterize selected biological communities in the Hog Island area of the James River were begun. The objective of these surveys has been to determine if significant changes occurred in the species composition or population levels of certain communities which could be related to the operation of the nuclear power generation station. Although during the period of study, methods and stations have been changed to adjust the study to changing regulations, its basic character has remained. Communities studied have included benthos, zoo- and phytoplankton and fouling organisms.

The primary emphasis during the study has been centered on the benthic community which has been continuously monitored since the spring of 1969. Beginning in June of 1972, zooplankton were sampled on a monthly basis at seven stations and in January of 1973 a similar program for phytoplankton was initiated. Previous plankton monitoring had been accomplished through productivity determinations.

This report presents the data collected from June 1974 through December 1974. An analysis of the data will be made in the yearly report.

Phytoplankton

Tables 1-5 present the phytoplankton cell counts and dominant organisms found in the samples for the period July-December 1974. Cell counts were highest in August, with totals for all stations exceeding 1500 per ml. In October the lowest counts were obtained (most station totals below 1000 per ml). The community composition changed little during the six month period, with flagellates of the genus *Chroomonas* being among the dominants in all months, the centric diatom *Skeletonema costatum* important July-October, and pennate diatoms of the genera *Gyrosigma* and *Nitzschia* significant throughout the period.

No consistent quantitative differences among the stations were observed. The Jamestown Island community differed qualitatively from the communities at the other stations in August, October, and December.

Zooplankton

The zooplankton data are presented in Tables 6-12, expressed in numbers per 100 liters. August and September population densities generally exceeded the October and November densities, with November densities lowest at all stations. Copepod nauplii accounted for the largest fractions of the total numbers in almost all samples.

Benthos

Collections of benthos made during June, July, August and December are tabulated in Tables 13-16. Dominant organisms in terms of numbers were: the mollusks *Rangia cuneata*, *Hydrobia* sp., *Congeria leucophaeta* and *Corbicula manilensis* ; the annelids *Scolecolepides viridis* and *Peloscolex heterochaetus*; and the amphipods *Leptochirus*

plumulous, *Gammarus* spp. and *Corophium lacustre*.

Fouling Plates

Collections of organisms made from fouling plates are tabulated in Tables 17-19. The heaviest set of barnacles was found at the Cobham Bay North tower with the other two stations having about half the set of that station during the period of July-December.

Table 1

James River Phytoplankton

July 1974

Station	Total Cells/ml	Dominant Organisms
DWS	1500	Chroomonas sp. Unknown chrysophyte Skeletonema costatum Leptocylindrus sp.
Intake-River	1800	Pyramimonas sp. Chroomonas sp. Cyclotella sp. Gyrosigma sp.
Intake-Canal	2700	Pyramimonas sp. Chroomonas spp. Gyrosigma sp. Skeletonema costatum
HPS	900	Skeletonema costatum Chroomonas sp. Nitzschia Küzingiana Gyrosigma sp.
Discharge-River (CBS)	2200	Unknown chrysophyte Cyclotella sp. Skeletonema costatum Chroomonas sp.
Discharge-Canal	2300	Pyramimonas sp. Chroomonas sp. Skeletonema costatum Gyrosigma sp.
CBN	1200	Skeletonema costatum Unknown chrysophyte Pyramimonas sp. Gyrosigma sp.
Cobham Bay	1200	Skeletonema costatum Cyclotella sp. Chroomonas sp.
J. I.	2200	Skeletonema costatum Chroomonas sp. Pyramimonas sp.

Table 2

James River Phytoplankton

August 1974

Station	Total cells/ml	Dominant Organisms
DWS	2750	Chroomonas spp. Skeletonema costatum Nitzschia Kutzingiana
Intake-River	4150	Chroomonas spp. Skeletonema costatum Nitzschia spp. Gyrosigma sp.
Intake-Canal		
HPS	3600	Pyramimonas sp. Chroomonas spp. Skeletonema costatum Gyrosigma sp.
Discharge-River (CBS)	2500	Chroomonas spp. Pyramimonas sp. Skeletonema costatum
Discharge-Canal		
CBN	3050	Pyramimonas sp. Chroomonas sp. Skeletonema costatum Gyrosigma sp.
Cobham Bay	5200	Chroomonas spp. Pyramimonas sp. Skeletonema costatum
J.I.	1550	Chroomonas spp. Cyclotella sp. Skeletonema costatum

Table 3

James River Phytoplankton

September 1974

Station	Total Cells/ml	Dominant Organisms
DWS	650	*Chroomonas* spp. *Skeletonema costatum* *Gyrosigma* sp.
Intake-River	1450	*Chroomonas* spp. *Pyramimonas* sp. *Skeletonema costatum* *Gyrosigma* sp.
Intake-Canal	850	*Chroomonas* spp. *Skeletonema costatum* *Gyrosigma* sp.
HPS	1250	*Chroomonas* spp. *Skeletonema costatum* *Gyrosigma* sp.
Discharge-River (CBS)	1250	*Chroomonas* sp. *Skeletonema costatum* *Gyrosigma* sp.
Discharge-Canal	1400	*Chroomonas* spp. *Skeletonema costatum* *Gyrosigma* sp.
CBN	900	*Chroomonas* spp. *Skeletonema costatum* *Gyrosigma* sp.
Cobham Bay	850	*Chroomonas* spp. *Skeletonema costatum* *Gyrosigma* sp.
J. I.	1350	*Chroomonas* spp. *Skeletonema costatum*

Table 4

James River Phytoplankton

October 1974

Station	Total Cells/ml	Dominant Organisms
DWS	350	Chroomonas spp. Skeletonema costatum
Intake-River	700	Chroomonas spp. Skeletonema costatum Nitzschia spp.
Intake-Canal	950	Chroomonas spp. Skeletonema costatum Nitzschia longissima
HPS	850	Chroomonas spp. Skeletonema costatum Nitzschia longissima
Discharge-River (CBS)	800	Chroomonas spp. Skeletonema costatum Gyrosigma sp.
Discharge-Canal	1350	Chroomonas spp. Skeletonema costatum Nitzschia longissima
CBN	700	Chroomonas spp. Skeletonema costatum Nitzschia longissima
Cobham Bay	650	Chroomonas spp. Skeletonema costatum Nitzschia Kützingiana
J. I.	1000	Chroomonas spp. Skeletonema costatum 5-10 μ Flagellates

Table 5

James River Phytoplankton

December 1974

Station	Total Cells/ml	Dominant Organisms
DWS	850, 800	Chroomonas spp. Nitzschia Kützingiana
Intake-River	800, 800	Chroomonas spp. Nitzschia Kützingiana
Intake-Canal		
HPS	450, 850	Chroomonas spp. Nitzschia Kützingiana
Discharge-River (CBS)	1150, 1500	Chroomonas spp. Pyramimonas sp. Nitzschia Kützingiana
Discharge-Canal		
CBN	1050, 700	Chroomonas spp. Katodinium rotundatum Nitzschia Kützingiana
Cobham Bay	850, 850	Chroomonas spp. Nitzschia Kützingiana
J. I.	1100, 650	Chroomonas spp. Pyramimonas sp.

Table 6

Deep Water Shoals

Organisms/100-l	August	September	October	November
			1974	
Acartia clausi				
Acartia sp.	136.43	246.13	33.18	52.28
Acartia tonsa				
Barnacle nauplii	37.07	19.69	7.65	
Cladocerans			11.47	
Copepod nauplii	631.83	336.38	193.94	45.09
Cyclopoid copepod				5.13
Decapod larvae				
Eurytemora sp.		1.65	2.55	34.83
Gastropod larvae	31.13	6.56	2.55	
Harpacticoid copepod	7.40	1.65		1.03
Pelecypod larvae	51.91	16.42	8.93	
Polychaete larvae	1.49	11.47	37.01	88.14
Rotifers			93.14	
Total/100-l	897.26	639.95	390.42	226.50

Table 7

Intake

Organisms/100-l	August	September	October	November
	1974			
Acartia clausi				
Acartia sp.	577.18	450.14	64.00	237.82
Acartia tonsa				
Barnacle nauplii	127.95	238.72	6.59	2.30
Cladocerans			15.05	
Copepod nauplii	12.00	337.96	362.31	122.38
Cyclopoid copepod	1.49			6.93
Decapod larvae	2.99			
Eurytemora sp.		18.69		50.79
Gastropod larvae	95.20	15.83		
Harpacticoid copepod	4.45	5.75	1.87	5.78
Pelecypod larvae	107.11	5.75	0.93	
Polychaete larvae	4.45	14.37	20.71	20.77
Rotifers			49.88	
Total/100-l	932.89	1087.21	521.34	446.77

Table 8

Hog Point South

1974

Organisms/100-1	August	September	October	November
Acartia clausi				
Acartia sp.	699.03	334.54	264.16	68.64
Acartia tonsa				
Barnacle nauplii	173.57	21.74	75.48	0.96
Cladocerans				
Copepod nauplii	2235.62	434.59	570.93	61.76
Cyclopoid copepod				
Decapod larvae				
Eurytemora sp.		39.12	1.21	55.89
Gastropod larvae	235.67	56.48	2.43	
Harpacticoid copepod	93.95	10.85	2.43	4.91
Pelecypod larvae	33.43	17.38	9.73	1.96
Polychaete larvae	28.67	39.12	47.49	19.59
Rotifers			99.83	
Total/100-1	3499.94	953.82	1073.69	213.71

Table 9

Cobham Bay North

Organisms/100-1	August	September	October	November
		1974		
Acartia clausi	2.18			
Acartia sp.		250.23	30.91	61.36
Acartia tonsa	24.07			
Barnacle nauplii	24.07	1.90		
Cladocerans			1.15	
Copepod nauplii	380.57	1195.76	438.60	96.94
Cyclopoid copepod				1.21
Decapod larvae				
Eurytemora sp.		171.92	6.87	38.03
Gastropod larvae	8.74	3.83		1.21
Harpacticoid copepod	10.95	17.20		
Pelecypod larvae	78.75	9.55	2.30	1.21
Polychaete larvae		19.09	6.87	9.83
Rotifers			18.32	
Total/100-1	529.33	1669.48	505.02	209.79

Table 10

Cobham Bay South

Organisms/100-1	1974 August	September	October	November
Acartia clausi				
Acartia sp.	35.02	36.08	168.31	56.94
Acartia tonsa				
Barnacle nauplii	132.17	22.21	14.77	
Cladocerans			9.86	
Copepod nauplii	823.22	778.68	436.83	59.31
Cyclopoid copepod				1.18
Decapod larvae	1.59			
Eurytemora sp.		5.53	1.65	42.70
Gastropod larvae	4.79	18.04	1.65	
Harpacticoid copepod	4.79	2.77	1.65	56.94
Pelecypod larvae	23.88	19.44	2.46	
Polychaete larvae	11.13	8.33	20.53	30.85
Rotifers			68.14	
Total/100-1	1036.59	891.08	725.85	247.92

Table 11

Cobham Bay

Organisms/100-l	1974 August	September	October	November
Acartia clausi				
Acartia sp.	194.13	48.95	13.03	13.12
Acartia tonsa				
Barnacle nauplii	263.63	12.22	1.99	0.99
Cladocerans			0.99	
Copepod nauplii	1952.74	968.02	186.41	42.42
Cyclopoid copepod	5.78			5.04
Decapod larvae				
Eurytemora sp.	14.49	16.30	0.99	28.30
Gastropod larvae	57.94	9.52		
Harpacticoid copepod	107.20	16.30	0.99	13.12
Pelecypod larvae	134.73	4.07		
Polychaete larvae	7.25	2.71	0.99	21.21
Rotifers			3.02	
Total/100-l	2737.89	1078.09	208.41	124.20

Table 12

Jamestown Island

Organisms/100-1	1974 August	September	October	November
Acartia clausi				
Acartia sp.	275.39	74.70	34.99	22.27
Acartia tonsa				
Barnacle nauplii	56.32	5.63		
Cladocerans				
Copepod nauplii	2547.46	1209.45	377.09	101.60
Cyclopoid copepod	1.55			1.40
Decapod larvae				
Eurytemora sp.	62.57	38.07	4.85	40.27
Gastropod larvae	37.57	8.46	0.96	
Harpacticoid copepod	43.82	16.92		12.53
Pelecypod larvae	283.23	4.23	12.63	
Polychaete larvae		7.06	0.96	13.90
Rotifers			17.48	
Total/100-1	3307.91	1364.52	448.96	191.97

Table 13

Species, Number of Individuals and Total Wet Weight
(Without Clam Shell) in Grams at Each Station (Benthos)
June 1974

Species	Stations 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mollusks																
Rangia cuneata	5	19		12	15	15	6	18	2	7	43	2	10	6	9	38
Congeria leucophaeta								13			2					
Macoma mitchelli								1			1					
Macoma balthica																
Corbicula manilensis						1	1	1				10				
Hydrobia sp.		7		25		47	1			3		4	4	1	1	5
Mya arenaria																
Brachidontes recurvus											2	3				
Annelids																
Polychaetes																
Scolecolepides viridis		2			1			3								
Nereis succinea	1		2				1		2						1	
Lysipiddes grayi																
Polydora ligni																
Laeonereis culveri																
Heteromastus filiformis																
Unid. capitellids																
Oligochaetes																
Peloscolex heterochaetus	1	2	3	3	5	9	3	1	14	6		8	2			
Limnodrilus sp.																

Table 13
June 1974
-2-

Species	Stations 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Amphipods																
Gammarus daiberi																
Gammarus fasciatus				1							12	1				
Corophium lacustre				1		1	1	19	14	1	5				7	
Lepidactylus dytiscus												1				
Leptochirus plumulosus	2	6		3	2	3							9	6	1	1
Monoculodes edwardsi							1									
Caprella sp.																
Isopods																
Cyathura polita									1							
Edotea triloba																
Chiridotea almyra																
Dipteran larvae	1	3	6	5	3	2	1	2		2			5			
Nemerteans											2		1		1	1
Hydroids					x			x	x				x	x	x	x
Barnacles																
Balanus sp.								1								
Nematods				2		5					1	18				
Cuinaceans																
Leucon americanus																
Biomass (grams)	3.5	4.4	0.2	2.3	0.9	4.8	0.2	1.6	0.2	0.2	3.4	0.3	2.9	0.6	0.8	2.4

Table 14

Species, Number of Individuals and Total Wet Weight
(Without Clam Shell) in Grams at Each Station (Benthos)

July 1974

Species	Stations 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mollusks																
Rangia cuneata	11	12	2	24	12	21	8	20	2	17	16	1	1	2	6	23
Congeria leucophaeta								10				1				
Macoma mitchelli				1							1		1		3	1
Macoma balthica																
Corbicula manilensis			2	1	1	3			1		2	240	1	1		
Hydrobia sp.	1	4	86	4		20	115	3	9	7		31	9	6		6
Mya arenaria																
Brachidontes recurvus												5				
Annelids																
Scolecolepides viridis	1	1	1	1	8	4		5	1	1	1	1	2	2	2	2
Nereis succinea	1		1				1		2						1	1
Lysipiddes grayi										1						
Polydora ligni																
Laeonereis culveri																
Heteromastus filiformis					1											
Unid. capitellids																
Oligochaetes																
Peloscolex heterochaetus			7	12	2	6	14	1		10		5	1			
Limnodrilus sp.	4		1	1												

Table 14
July 1974
-2-

Species	Stations 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Amphipods																
Gammarus daiberi												2	1		5	
Gammarus fasciatus		5		1	2	7				3	1	2				
Corophium lacustre	7	10		26		2	3	35			1	28		1	1	1
Lepidactylus dytiscus			1				5	1	10							
Leptochirus plumulous	16	214	65	32		114	37	5	4	8	1	7	82	12	79	145
Monoculodes edwardsi					1	1			1				2		1	
Caprella sp.																
Isopods																
Cyathura polita																
Edotea triloba																
Chiridotea almyra								1								
Dipteran larvae	4		21	2	3	11	8	5	1		2	9	3			
Nemerteans					7					12	1	1	1			
Hydroids					x	x		x		x	x					
Barnacles																
Balanus sp.								1								
Nematods		1				4							39			
Cuinaceans																
Leucon americanus																
Biomass (grams)	5.5	4.3	0.5	5.6	1.6	2.9	6.4	7.6	0.2	0.4	2.1	0.5	0.4	0.6	2.9	4.4

Table 15

Species, Number of Individuals and Total Wet Weight
(Without Clam Shell) in Grams at Each Station (Benthos)
August 1974

Species	Stations 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mollusks																
Rangia cuneata	9	10	4	11	3	96	5	8	2		49	1	4	4	1	44
Congeria leucophaeta	1	2		24		11		27			6		1			2
Macoma mitchelli				1					1	6				2		2
Macoma balthica																
Corbicula manilensis	3		2	1		3	1		2	2	1	109			2	
Hydrobia sp.	9		12	1		7	14			1		2		10		9
Mya arenaria																
Brachidontes recurvus																
Annelids																
Polychaetes																
Scolecolepides viridis												1	1		1	1
Nereis succinea	2										1		1		6	1
Lysipiddes grayi							1									1
Polydora ligni											1					
Laeonereis culveri																
Heteromastus filiformis																
Unid. capitellids																
Oligochaetes																
Peloscolex heterochaetus	1	3	2	7		7	1				2	3		8		
Limnodrilus sp.																

Table 15
August 1974
-2-

Species	Stations 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Amphipods																
Gammarus daiberi												1	1			1
Gammarus fasciatus												3	3			4
Corophium lacustre						5	1	3	1			1			11	
Lepidactylus dytiscus			3				3		12		1					
Leptochirus plumulous	1	6	19	1	1	1	7		1			1	34		39	57
Monoculodes edwardsi																
Caprella sp.																
Isopods																
Cyathura polita																1
Edotea triloba																
Chiridotea almyra												1				
Dipteran larvae	1		1	2		1						3	1			
Nemerteans	2		1					1								2
Hydroids	x	x		x	x	x		x			x	x		x		x
Barnacles																
Balanus sp.				1						10						
Nematods																
Cuinaceans																
Leucon americanus																
Biomass (grams)	3.7	2.5	0.2	2.2	0.2	18.9	2.0	0.6	0.2	0.3	12.2	0.3	1.8	0.2	0.2	6.8

Table 16

Species, Number of Individuals and Total Wet Weight

(Without Clam Shell) in Grams at Each Station (Benthos)

November 1974

Species	Stations 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mollusks																
Rangia cuneata	3	4	2	24	8	24	3	15	1	21	31	2	3	3	2	12
Congeria leucophaeta				3	1		1	82		1	20	1		1	1	2
Macoma mitchelli				2		2					1		1	2	3	3
Macoma balthica																
Corbicula manilensis									1		1	8				
Hydrobia sp.														1		
Mya arenaria																
Brachidontes recurvus								1		1	4					
Annelids																
Polychaetes																
Scolecolepides viridis	1				4	2		10		1	2	2				2
Nereis succinea	6							1			1				2	3
Lysipiddes grayi								1		3		3				1
Polydora ligni								1								
Laeonereis culveri																1
Heteromastus filiformis																
Unid. capitellids																
Oligochaetes																
Peloscolex heterochaetus	3	4		20	2	27	2				4	36	5	21		
Limnodrilus sp.																

Table 16
November 1974
-2-

Species	Stations 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Amphipods																
Gammarus daiberi								1			14	1	1			
Gammarus fasciatus		1			1					1	1	1		1		
Corophium lacustre		1				2					7	6			7	3
Lepidactylus dytiscus			3				2		3			2				
Leptochirus plumulous		5				1					14	31	24	15	41	64
Monoculodes edwardsi									1			3	1			
Caprella sp.																
Isopods																
Cyathura polita												1				2
Edotea triloba																
Chiridotea almyra																
Dipteran larvae				1	4							7	1	1	2	1
Nemerteans					1					2	1			1	1	1
Hydroids				x	x	x		x			x			x	x	
Barnacles																
Balanus sp.								12			15					
Nematods								1								
Cuinaceans																
Leucon americanus												2				
Biomass (grams)	1.9	0.9	1.7	6.3	1.1	6.7	0.6	2.7	0.7	0.3	5.3	1.2	0.6	0.4	0.9	1.5

Table 17

Fouling Organisms

		Station CBN	No. organisms/dm^2	
Horizontal Plate		July-Aug.	Sep.-Oct.	Nov.-Dec.
Barnacles	*Balanus* sp.	547	563	211
Bivalves	*Brachidontes recurvus*	---	---	---
	Congeria leucophaeta	2	---	1
Amphipods	*Corophium lacustre*	376	521	105
	Gammarus sp.	10	56	2
Polychaetes	*Nereis succinea*	1	---	1
	Scolecolepides viridis	---	1	---
Flatworms	*Stylochus ellipticus*	---	---	2
Crabs	*Rhithopanopeus horrisii*	---	1	---
Bryozoans	*Membranipora tenuis*	x	x	x
Hydroids		x	x	x
Total No. of Genera (not including Hydroids)		6	6	7
Total No. of Organisms (not including Bryozoans or Hydroids)		936	1142	322
Vertical Plate				
Barnacles	*Balanus* sp.	617	667	543
Bivalves	*Brachidontes recurvus*	---	---	---
	Congeria leucophaeta	3	7	6
Amphipods	*Corophium lacustre*	463	603	217
	Gammarus sp.	3	41	7
Polychaetes	*Nereis succinea*	---	---	---
	Scolecolepides viridis	---	---	1
Flatworms	*Stylochus ellipticus*	---	---	1
Crabs	*Rhithopanopeus horrisii*	1	2	---
Bryozoans	*Membranipora tenuis*	x	x	x
Hydroids		x	x	x
Total No. of Genera (not including Hydroids)		6	6	7
Total No. of Organisms (not including Bryozoans or Hydroids)		1087	1320	775

Table 18

Fouling Organisms
Station CBS

Horizontal Plate		No. organisms/dm^2 July-Aug.	Sep.-Oct.	Nov.-Dec.
Barnacles	*Balanus* sp.	202	261	198
Bivalves	*Brachidontes recurvus*	1	4	---
	Congeria leucophaeta	1	---	3
Amphipods	*Corophium lacustre*	167	301	77
	Gammarus sp.	2	11	24
Polychaetes	*Nereis succinea*	1	1	---
	Scolecolepides viridis	---	1	---
Flatworms	*Stylochus ellipticus*	---	---	3
Crabs	*Rhithopanopeus horrisii*	---	1	---
Bryozoans	*Membranipora tenuis*	x	x	x
Hydroids		x	x	x
Total No. of Genera (not including Hydroids)		7	8	6
Total No. of Organisms (not including Bryozoans or Hydroids)		374	580	305
Vertical Plate				
Barnacles	*Balanus* sp.	196	241	121
Bivalves	*Brachidontes recurvus*	1	---	1
	Congeria leucophaeta	4	1	---
Amphipods	*Corophium lacustre*	94	237	54
	Gammarus sp.	6	21	10
Polychaetes	*Nereis succinea*	---	---	---
	Scolecolepides viridis	1	1	---
Flatworms	*Stylochus ellipticus*	---	2	---
Crabs	*Rhithopanopeus horrisii*	2	---	---
Bryozoans	*Membranipora tenuis*	x	x	x
Hydroids		x	x	x
Total No. of Genera (not including Hydroids)		8	7	5
Total No. of Organisms (not including Bryozoans or Hydroids)		304	503	186

Table 19

Fouling Organisms

Station DWS

Horizontal Plate		July-Aug.	Sep.-Oct.	Nov.-Dec.
Barnacles	*Balanus* sp.	63	184	196
Bivalves	*Brachidontes recurvus*	---	4	---
	Congeria leucophaeta	2	13	16
Amphipods	*Corophium lacustre*	37	58	96
	Gammarus sp.	15	3	47
Polychaetes	*Nereis succinea*	---	---	1
	Scolecolepides viridis	---	---	---
Flatworms	*Stylochus ellipticus*	4	---	---
Crabs	*Rhithopanopeus horrisii*	---	---	---
Bryozoans	*Membranipora tenuis*	x	x	x
Hydroids		x	x	x
Total No. of Genera (not including Hydroids)		6	6	6
Total No. of Organisms (not including Bryozoans or Hydroids)		121	262	356

Vertical Plate				
Barnacles	*Balanus* sp.	51	196	219
Bivalves	*Brachidontes recurvus*	---	2	1
	Congeria leucophaeta	21	10	2
Amphipods	*Corophium lacustre*	40	63	109
	Gammarus sp.	---	17	55
Polychaetes	*Nereis succinea*	1	0	1
	Scolecolepides viridis	---	1	---
Flatworms	*Stylochus ellipticus*	---	1	---
Crabs	*Rhithopanopeus horrisii*	---	---	---
Bryozoans	*Membranipora tenuis*	---	x	x
Hydroids		x	x	x
Total No. of Genera (not including Hydroids)		5	7	7
Total No. of Organisms (not including Bryozoans or Hydroids)		113	290	387

4.0 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

The Surry Station of the Virginia Electric and Power Company is located on a peninsula in the James River, 25 miles upstream of the junction of the river with the Chesapeake Bay. The site is on the west bank of the river in Surry County, Virginia. Two (2) pressurized water reactors are located at the site with a design output of 824 MWe (gross) per unit. Cooling water for the condensers is taken in downstream of the site and discharged 5.7 miles upstream of the intake. The flow of the river at the site is complex, influenced by the amount of fresh water run-off, the back-and-forth flow of the tide, upstream flow of more saline water near the bottom, and downstream flow of less saline water near the top.

During plant operation, low levels of radioactivity are released with the cooling water to the James River and with ventilation air to the atmosphere. These releases are limited to the "lowest practicable level" and are measured to assure compliance with AEC Regulations and the Surry Power Station Technical Specifications. The environmental monitoring program provides confirmatory surveillance.

The low levels of radionuclides released to the air and water from Surry Station contribute to the radiation background through both external and internal exposure. The primary modes of external exposure include immersion in a cloud of radioactive gaseous effluent, submersion in water containing radioactive effluent, and exposure from contaminated land surface. The primary modes of internal deposition include inhalation of air and ingestion of milk, fish, and shellfish. Dose via the ingestion pathway is limited by the following site related considerations. The vicinity represents a very limited milk shed. During the year, milk was analyzed by gamma spectrometry with a conservative de-

tection limit of 10 pCi/ℓ. In order to completely document this potential path, the 1974 program includes radiochemical analyses of milk samples for I-131 content with a sensitivity of 0.25 pCi/ℓ. The saline river is unusable for drinking purposes. Fish and shellfish consumption could become an important pathway in the future when sewage pollution (from cites upstream) is reduced.

The following shows the manner in which the elements of the Surry Surveillance Program fit together to monitor any radiological impact as a result of operations:

Relationship of Sampling and Measurements to Elements of the Radiation Dose Paths

Radiation Dose Path	Sample and Measurements (Supportive Data)
Air Immersion	Thermoluminescent Dosimetry (Air Sampling)
Inhalation	Air Sampling (Precipitation, Crop, Soil, and Milk Sampling)
Land Surface	Thermoluminescent Dosimetry, Crop and Soil Sampling (Air and Milk Sampling)
Ingestion	
Fish and Shellfish	Fish, Oysters, Clam and Crab Sampling (Water and Silt Sampling)
Water	Well, Surface Water, and Precipitation Sampling (River Water and Silt Sampling)
Milk	Milk Sampling (Air, Water, Soil and Crop Sampling)
Water Submersion	Water Sampling (Silt Sampling)

This report contains data resulting from the radioassay of various samples obtained from the environs of the station. Figure 1 indicates the land based sampling stations while Figure 2 indicates James River stations.

Vepco data, as well as that of Eberline Instrument Corporation

(EIC), a consulting service, is presented on a quarterly basis for the first and second quarters of the year.

The 1974 program when compared to that presented in the Technical Specifications is redundant in order to maintain the sampling and analytical requirements.

SURRY POWER STATION
ENVIRONMENTAL SAMPLING PROGRAM
1974

LAND BASED SAMPLING STATIONS
STATION NUMBER (See Figure 1)

Sample Medium	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Air Particulate	X	X	X	-	X	X	-	-	X	X	X	-	-	-	-	-	-
Radiogas	X	X	X	-	X	X	-	X	X	X	X	X	X	X	X	X	X
Precipitation	X	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
Milk	-	-	X(2)	-	-	X	-	-	X	-	-	X	-	-	-	-	-
Well Water	X	X	X	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Crop	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Surface Water	-	-	-	X	-	-	X	-	-	-	X	X	-	-	-	-	-
Fowl	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Soil	X	-	X	-	X	X	-	-	X	X	-	-	-	-	-	-	-

No. 1 - Surry Station
No 2 - Hog Island Reserve
No. 3 - Bacon's Castle
No. 4 - Chippokes Creek
No. 5 - Alliance
No. 6 - Colonial Parkway
No. 7 - Williamsburg
No. 8 - Jamestown
No. 9 - Dow
No. 10 - Fort Eustis
No. 11 - Newport News
No. 12 - Smithfield
No. 13 - Scotland Wharf
No. 14 - Lee Hall
No. 15 - Rt. 10 & 676
No. 16 - Kingsmill
No. 17 - Budweiser

JAMES RIVER SAMPLING STATIONS
STATION NUMBER (See Figure 2)

Sample Medium	1	2	3	4	5	6	7	8	9	10
James River Water	X	-	X	-	X	X	-	-	-	X
Silt	X	-	X	-	X	X	-	-	X	X
Oyster	-	-	-	-	-	-	-	X	X	X
Clam	X	X	-	X	X	-	X	-	-	-
Crab*	-	-	-	-	-	-	-	-	-	-
Fish*	-	-	-	-	-	-	-	-	-	-

No. 1 - Chickahominy
No. 2 - Cobham Bay
No. 3 - Station Discharge
No. 4 - Jamestown
No. 5 - Hog Island Point
No. 6 - Station Intake
No. 7 - Lawnes Creek
No. 8 - Deep Water Shoals
No. 9 - Point of Shoals
No. 10 - Newport News

* Sampled in vicinity of station - usually at intake canal.

SAMPLE TYPE	FREQUENCY	TYPE OF ANALYSIS
II. AIR		
A. Particulates	Bi-Weekly (Vepco)	Gross Beta
	Monthly (Vepco)	Gross Alpha
	Monthly (EIC)	Gross Beta (Gamma Isotopic if over 10pCi/m^3)
	Quarterly (EIC)***	Gamma Isotopic
Surry Station		
Hog Island Reserve		
Bacon's Castle		
Alliance		
Colonial Parkway		
Dow		
Fort Eustis		
Newport News		
B. Radiogas	Quarterly (EIC) TLD	mrem exposure
Surry Station		
Hog Island Reserve		
Bacon's Castle		
Alliance		
Colonial Parkway		
Dow		
Fort Eustis		
Newport News		
Smithfield		
Jamestown		
Scotland Wharf		
Lee Hall		
Rt. 10 & 676		
Kingsmill		
Budweiser		

*** Composites (by Eberline) of Bi-Weekly samples. Stations 1 and 2 analyzed as one sample. Stations 3, 5, 6, 9 and 10 analyzed as one sample. Station II analyzed as one sample.

SURRY POWER STATION
ENVIRONMENTAL SAMPLING PROGRAM

SAMPLE TYPE	FREQUENCY	TYPE OF ANALYSIS
1. WATERS		
A. James River	Bi-Monthly (Vepco) Bi-Monthly (Vepco) Tri-Annually (EIC) Semi-Annual	Gross Beta Tritium (Chickahominy & Newport News) Gamma Isotopic Enriched Tritium*
Chickahominy Hog Island Point Station Intake Newport News Station Discharge		
B. Wells	Semi-Annual (Vepco & EIC)	Gross Alpha, Gross Beta, & Tritium (Enriched Tritium by Eberline)
Surry Station (Deep) Hog Island Reserve (Deep) Bacon's Castle (Shallow) Jamestown (Shallow)		
C. Surface Water	Semi-Annual (Vepco & EIC)	Gross Alpha, Gross Beta, & Tritium
Chippokes Creek Williamsburg Reservoir Newport News Reservoir Smithfield		
D. Precipitation	Monthly (Vepco) Quarterly (EIC)**	Gross Beta & Tritium Gross Beta (Gamma Isotopic if over 15nCi/m^2) Enriched Tritium
Surry Station Newport News		

* Composites (by Eberline) of Bi-Monthly samples from Chickahominy & Newport News Stations.

** Composites (by Vepco) of monthly samples.

SAMPLE TYPE	FREQUENCY	TYPE OF ANALYSIS
III. BIOTA		
A. Crops	Annual (EIC) Corn, Peanuts and Soybean	Gamma Isotopic and Sr-89 & Sr-90
Bacon's Castle		
B. Fowl	Semi-Annual (EIC)	Gamma Isotopic
Hog Island Reserve		
C. Oyster	Bi-Monthly (EIC) Tissue	Gamma Isotopic
Deep Water Shoals Point of Shoals Newport News		
D. Clam	Bi-Monthly (EIC) Tissue	Gamma Isotopic
Chickahominy Hog Island Point Lawnes Creek Station Discharge Jamestown		
E. Crab	Three per season (EIC) Tissue (July, Aug. & Sept.)	Gamma Isotopic
In Vicinity of Station		
F. Fish (Catfish and White Perch or Eel)	Semi-Annual (EIC)	Gamma Isotopic
Vicinity of Station		

SAMPLE TYPE	FREQUENCY	TYPE OF ANALYSIS
IV. SILT	Semi-Annual (EIC)	Gamma Isotopic
Chickahominy Station Discharge Hog Island Point Station Intake Point of Shoals Newport News		
V. MILK	Monthly (EIC) Bi-Monthly (EIC)	Iodine 131 Gamma Scan (NaI) for Cs-137; Sr-89, Sr-90, and Calcium
Bacon's Castle (Epps) Bacon's Castle (Judkins) Lee Hall (Ross) Smithfield (Gwaltney) Colonial Parkway (Smith)		
VI. SOIL	Annual (EIC)	Gamma Isotopic
Alliance Bacon's Castle Colonial Parkway Dow Fort Eustis Surry Station		

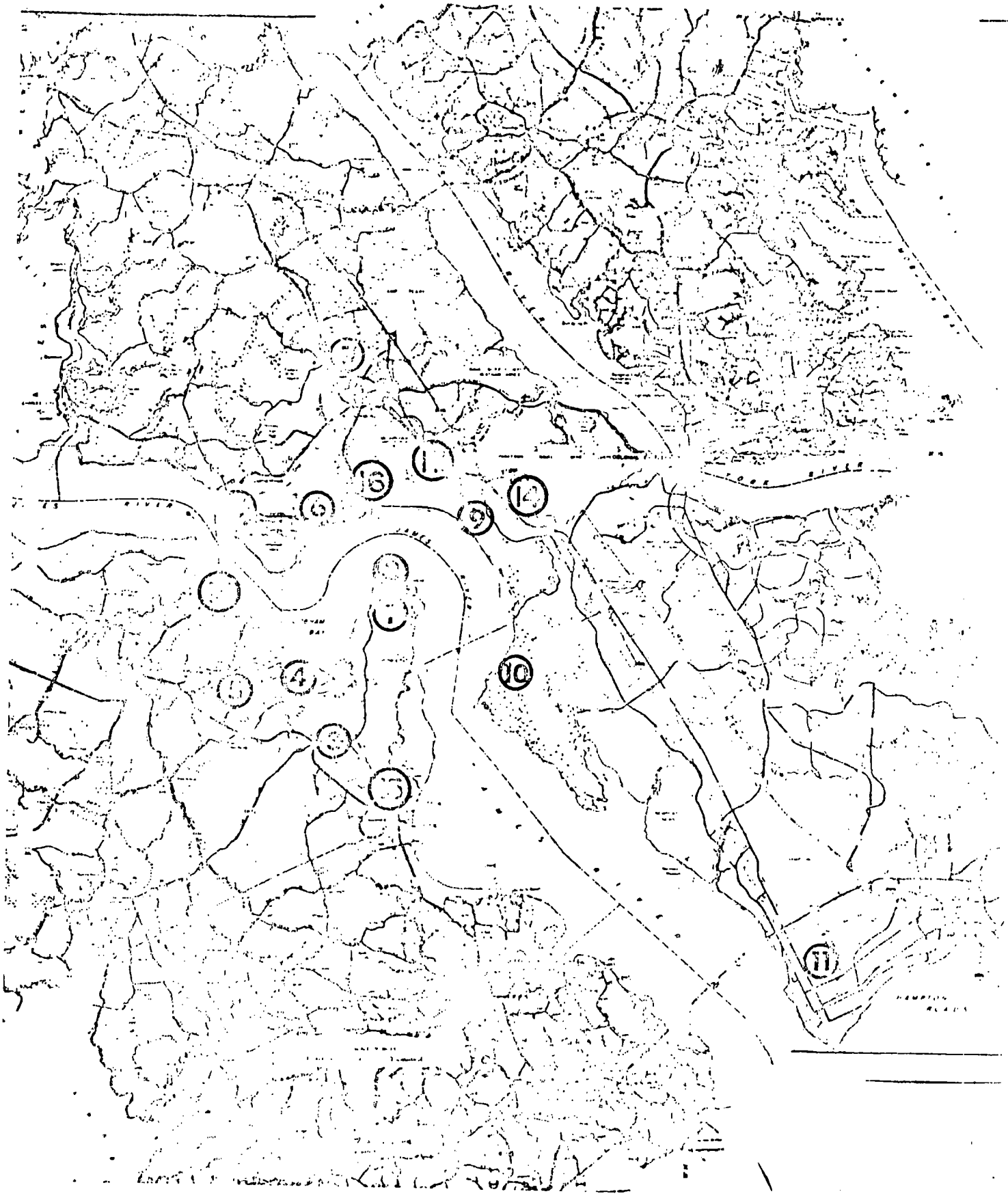


FIGURE 1

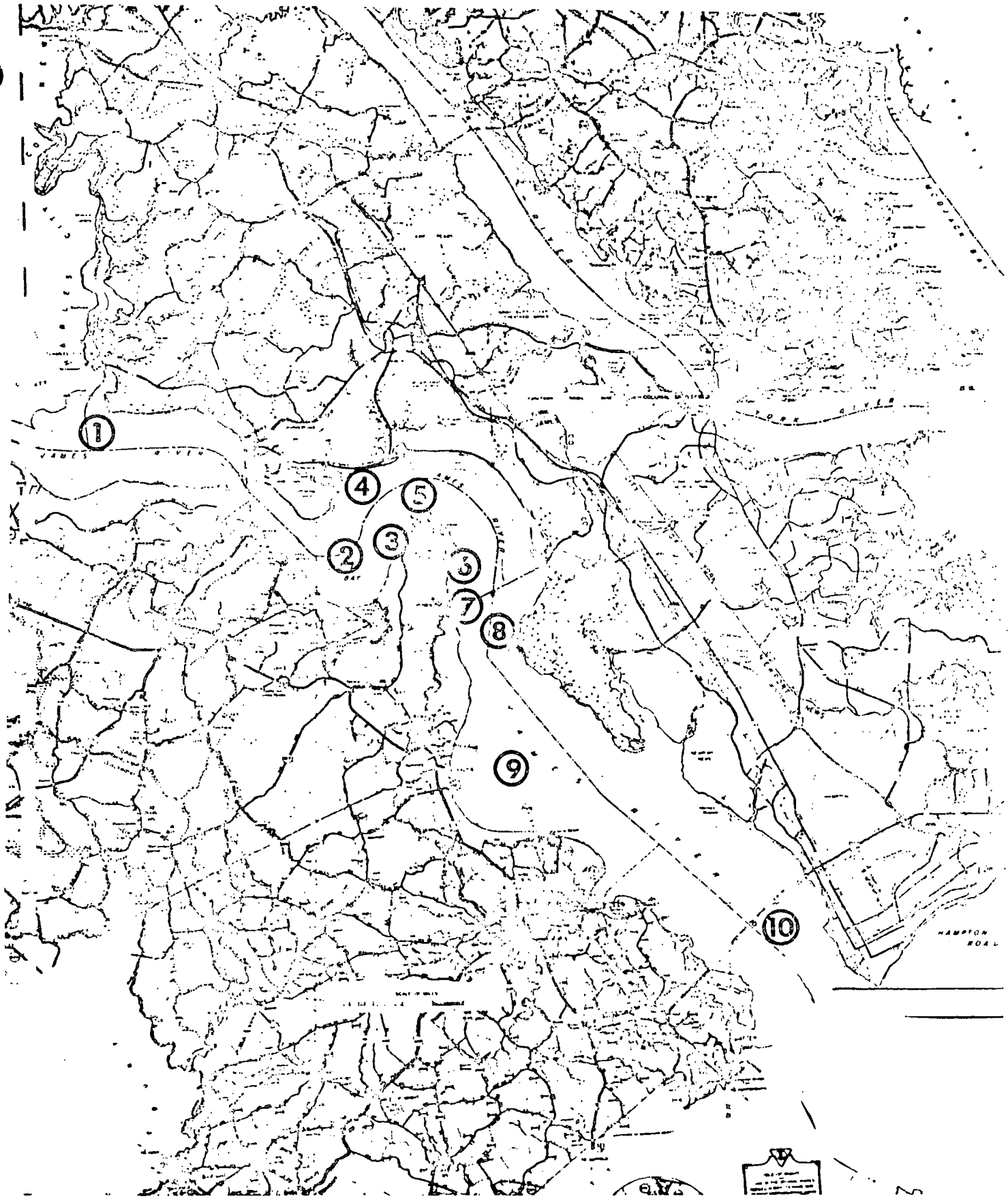


FIGURE 2

SUMMARY

Tables II and III summarize the collection and analytical schedules that comprise the Environmental Monitoring Program for Surry Power Station. The results demonstrate adherence to Surry Technical Specifications regarding public exposure. Specific aspects of the Program are detailed below. During the first six months of 1974, a feature of the monitoring results was the arrival of non-plant related fallout. The increased activity per sisted during the third quarter and tapered off during the fourth quarter. Another unusual occurrence that became evident during the third quarter, was the incidence of low levels of iodine-131 in milk samples. Ample data from Surry and other monitoring programs in the Southeastern United States show that any plant contribution is highly unlikely and that the presence of the isotope was due to the surface bomb test by the Peoples Republic of China on June 17, 1974.

Air Particulate Samples

The increases gross beta concentrations from the first half of 1974 were related to the typical Spring mixing, but with a changed upper atmosphere inventory due to the June, 1973 Chinese test. During 1973 the average of gross beta concentrations for the eight stations ranged from 2.6 to 4.8 E-02 picocuries per cubic meter. During 1974, averages for all stations began at 5.7 E-02 picocuries per cubic meter and gradually climbed to 3.6 E-01 picocuries per cubic meter in May and began to gradually recede. The average gross beta concentrations for all stations during the second half of 1974 was 1.1 E-01 picocuries per cubic meter. The average maximum was 1.9 E-01 picocuries per cubic meter and the average minimum 4.6 E-02

picocuries per cubic meter. There was a significant decrease in activity which can be illustrated by chronological listing of the averages for all stations:

Collection Date	Average (picocuries per cubic meter)
7-02-74	1.8 E-01
7-16-74	1.9 E-01
7-31-74	1.5 E-01
8-16-74	7.7 E-02
8-27/29-74	1.0 E-01
9-10-74	1.3 E-01
9-27-74	8.1 E-02
10-08-74	6.7 E-02
10-30-74	7.5 E-02
11-13-74	9.0 E-02
11-26-74	8.2 E-02
12-10-74	6.9 E-02
12-23-74	7.8 E-02

Alliance, as in all past sample analyses showed consistently higher concentrations of gross beta activity. This sampler was out of commission for the last July and two August samplings and the Dow Station showed the highest concentration for those three periods.

Gamma spectrometry results of the quarterly composites show the distribution of isotopes contributing to the beta activity of the airborne particulate samples.

Fission and activation product isotopes from the third quarter composite can be summarized (picocuries per cubic meter):

	Surry Station & Hog Island Point	Bacon's Castle, Alliance, Colonial Pkwy., Dow and Fort Eustis	Newport News
Cr-51	3.1 ± 1.6 E-02	9.9 ± 6.0 E-03	
Mn-54		7.9 ± 4.8 E-04	
Zr-95	5.3 ± 2.1 E-03	3.5 ± 1.7 E-03	7.0 ± 4.7 E-03
Nb-95	8.1 ± 2.8 E-03	5.1 ± 1.2 E-03	Less than 7.4 E-03
Cs-137	5.2 ± 2.4 E-03	1.9 ± 0.9 E-03	3.3 ± 3.1 E-03
Ce-141		2.3 ± 1.6 E-03	
Ce-144	3.6 ± 1.5 E-02	2.4 ± 0.5 E-02	2.9 ± 2.7 E-02

Although reduced in concentration, the results are very similar to the second quarter composite analysis. In both cases, cerium-144 was the dominant fission product along with zirconium and niobium-95. Chromium-51 was not previously observed and the second quarter composite also showed cobalts-58 and 60, ruthenium-103 and 106, and antimony-125. With the possible exception of chromium-51, all observed fission and activation products were uniformly distributed with no indication of the plant being a source. This fact, coupled with previous data, presume the same conclusion as the source.

The fourth quarter composite analysis yielded the following isotopes of interest (picocuries per cubic meter):

	Surry Station Hog Island Point	Bacon's Castle, Alliance, Colonial, Pkwy., Dow, and Fort Eustis	Newport News
Zr	Less than 3.5 E-02	2.7 ± 1.4 E-03	
Nb-95	5.2 ± 2.3 E-03	4.7 ± 1.8 E-03	
Ru-103			5.5 ± 3.4 E-03
Cs-137	4.0 ± 2.4 E-03	3.0 ± 1.2 E-03	
Ce-144	1.2 ± 1.1 E-02	1.4 ± 1.3 E-03	2.5 ± 2.2 E-03

The chromium-51, cerium-141, and maganese-54, observed in the third quarter, ceased to be measurable. The single indication of ruthenium-103 was new at Newport News. The zirconium and niobium-95 levels were somewhat less at all stations and was not detectable at Newport News. The cesium-137 levels were comparable to those of the first quarter. Cerium-144 appeared to be somewhat reduced and the distribution suggests Surry Station is not the source of this isotope. The isotopes observed during the last quarter appear to be a continuation of the activity which appeared during the Spring of 1974.

Ambient Thermoluminescent Dosimetry

The average for all stations was 1.4 and 1.8 mrem/wk for the third and fourth quarters respectively. The second quarter average was 1.4 mrem/wk. Surry Station exhibited the maximum dose rates during the first and second quarters with 2.3 mrem/wk. in the first and 3.2 mrem/wk. in the second. The Surry dosimetry station is closest to the source of airborne noble gases, however, the location could result in a measure of direct gamma "shine" not related to airborne effluent. The Lee Hall station showed 2.2 mrem/wk during the fourth quarter; this location has tended to have higher measurements in the past and the distribution of other dose measurements would deny this elevated measurement as an indication of any plant contribution.

Precipitation Samples

Quarterly composite analysis of precipitation samples can be summarized:

	nanocuries per cubic meter	
	Gross Beta	Tritium
Third Quarter		
Surry Station	5.0 ± 1.5	70 ± 26
Newport News	6.5 ± 2.1	23 ± 23
Fourth Quarter		
Surry Station	13 ± 2	37 ± 13
Newport News	2.8 ± 0.5	34 ± 10

The fourth quarter gross beta concentration at Surry Station is possibly slightly higher than the previous maximum at 11 ± 2 nanocuries per cubic meter. The tritium levels lie within the previously experienced range.

Milk Samples

Twenty three milk samples were analyzed from four locations during the second half of 1974. An unusual feature was the detection of positive levels of iodine-131 during August and September. A summary of the positive numbers yields:

Colonial Parkway	8-15-74	.36 ± .24 pCi/l
Lee Hall	8-15-74	.36 ± .30
Colonial Parkway	8-15-74	.62 ± .26
Epps Dairy	9-17-74	.63 ± .17

The following data, available through analysis of milk samples from a number of sites throughout the Southeastern United States show that iodine-131 was relatively wide spread. Between July 8 and September 17, 1974, 39 of 178 milk samples analyzed for low level iodine-131 showed detectable concentrations. The following one page table shows both the chronological sequence and the geographical distribution for samples analyzed by Eberline's Southeastern Facility. Other Eberline laboratories also quantitated similar concentrations for other parts of the United States. The activity is believed to be due to the gradual and somewhat extended arrival of iodine-131 from the June 17, 1974 weapons test by the Peoples Republic of China. It is highly unlikely that any of the observed activity was due to Surry operations. No radioiodine was detected in other environmental sample types which demonstrate the nature of the iodine path, through milk, to man.

Other analyses showed more routine data. No strontium-89 was detectable in milk samples and strontium-90 levels averaged 6.9 pCi/l with a range of from 1.6 to 15 pCi/l. High resolution gamma spectrometry showed the following fission

and activation products:

Cr-51	97 ± 90 pCi/l	7-02-74	Epps
Mn-54	11 ± 8 pCi/l	7-31-74	Epps
	16 ± 12	9-10-74	Lee Hall
Co-57	32 ± 29 pCi/l	8-15-74	Lee Hall
Co-60	35 ± 22 pCi/l	9-03-74	Epps
	50 ± 20	9-10-74	Lee Hall
	16 ± 13	9-17-74	Epps
Zr-95	20 ± 17 pCi/l	9-30-74	Colonial Pkwy.
Cs-137	22 ± 12 pCi/l	7-02-74	Judkins
	32 ± 16	7-31-74	Judkins
	12 ± 12	8-15-74	Colonial Pkwy.
	23 ± 14	9-16-74	Lee Hall
	14 ± 14	10-08-74	Judkins
	18 ± 10	12-23-74	Lee Hall
Hg-203	20 ± 19	12-23-74	Lee Hall

DATE COLLECTED 1974

CONCENTRATIONS OF I-131 IN MILK SAMPLES (pCi/Liter)*

	Alabama	Western South Carolina	Eastern South Carolina	North Carolina	Virginia
July 8	0.3(3)				
July 11				0.4(1)	
July 12				0.9(2)	
July 15	0.4(2)				
July 22	0.3(2)				
July 29	0.3(1)				
Aug. 6			0.2(1)		
Aug. 8				3.0(3)	
Aug. 15					0.5(2)
Aug. 19	0.3(4)		0.3(1)		
Aug. 20		0.2(2)			
Sept. 3	0.7(5)				
Sept. 5			0.7(3)		
Sept. 9	0.6(3)				
Sept. 10					0.6(1)
Sept. 16	0.6(2)				
Sept. 17					0.6(1)

*Data are averages of the number of samples indicated within parenthesis.

The strontium-90 levels are within expected concentrations for world wide fallout as are the cesium-137 levels. The balance of fission and activation products yielded concentrations very near detection limits and may or may not have been present; at the 99.7 confidence level, all except a single cobalt-60 concentration would be statistically improbable. Air sample analyses of composited filters did yield results for all those indicated with the exception of the two cobalt isotopes. These same isotopes were in evidence in other sample types collected and are discussed later in this section.

Well Water

Four samples were collected during October and analyzed for tritium and gross alpha and beta concentrations. All levels of tritium from samples collected during the first half of 1974 were below detection limits as were two of the four from this period. Bacon's Castle showed 200 $\pm$ 160 pCi/l and Jamestown 370 $\pm$ 160, which tend to indicate surface water intrusion to those wells. The April, 1974 sampling from Jamestown showed 380 $\pm$ 80 pCi/l. No plant contribution can be expected since the two stations are remote to the plant and the two close in stations showed no detectable activity. Gross alpha concentrations were below detection limits with the exception of 7.3 $\pm$ 3.8 pCi/l at Bacon's Castle. The 1973 - 74 experience is similar with one previous sample from Bacon's Castle showing 3.2 $\pm$ 1.3 pCi/l. Gross beta concentrations were at or near detection limits (approximately 5 pCi/l) with Bacon's Castle showing 17 $\pm$ 5 pCi/l. A high of 19 pCi/l was observed during the first half of 1973.

Surface Water

Four surface water samples were collected during October and also analyzed for tritium and gross alpha and beta concentrations. Tritium results were relatively low, averaging 150 pCi/l with a range of from 100 to 180 pCi/l. Concentrations of the samples collected during the first half of the year ranged from

140 to 360 pCi/l which are within expected background levels. Gross alpha concentrations were below detection limits; this is the 1973 - 74 experience. Gross beta concentrations at Chippokes Creek were below detection limits (3.8 pCi/l) and Williamsburg and Newport News were nearly the same at 8.1 ± 4.5 pCi/l and 6.9 ± 4.7 pCi/l respectively. Smithfield showed 12 ± 5 pCi/l, which is higher than previously measured concentrations, but well within the 2 to 31 pCi/l range shown by E.P.A. analyses from a 1970 sampling series at Kerr Dam in Virginia.

Soil Samples

The annual collection of soil samples was conducted on 8-25-74. Radiochemical analysis for strontium isotopes showed no detectable strontium-89, and a single positive value for strontium-90. The latter was .62 ± .60 pCi/g in the collection from Fort Eustis. That concentration is barely above detection limits, but is not unexpected due to world wide fallout distribution. The analysis is new for CY 1974.

High resolution gamma spectrometry yielded the following concentrations of fission and activation products:

Ru-106	4.4 ± 4.1 E-01 pCi/g	Surry Station
Sb-125	2.1 ± 2.0 E-01	Surry Station
	4.3 ± 3.5 E-01	Colonial Parkway
	5.6 ± 3.5 E-01	Fort Eustis
Cs-137	2.5 ± 0.9 E-01	Alliance
	2.7 ± 1.3 E-01	Dow
	1.6 ± 0.2 E+00	Colonial Parkway
	1.2 ± 0.2 E+00	Fort Eustis
	1.0 ± 0.2 E+00	Bacon's Castle
Hg-203	1.7 ± 1.4 E-01	Dow

The cesium-137 results are similar to those of the 1973 sample analysis. Last year, Bacon's Castle showed 2.5 pCi/g and Ft. Eustis had 1.7 pCi/g, for the two highest stations. Previously, cobalt-60, zirconium and niobium-95, antimony-125 were also observed. The ruthenium-106 and mercury-203 are new this year, however, the concentrations are very near detection limits.

Crop Samples

Peanuts and corn samples were collected during October; soybeans in November. They were analyzed by gamma spectrometry and by the radiochemical method for radiostrontium. Gamma spectrometry showed expected concentrations of naturally occurring isotopes with a possible trace of zirconium-95 (.14 ± .10 pCi/g) in the corn sample. Strontium-89 was calculated to be present in the soybean sample, .055 ± .036 pCi/g, with the strontium-90 concentration of .11 ± .03 pCi/g. The strontium-89 value is very near detection limits; a relatively small change in successive counts due to statistical variations can show the "presence" of strontium-89 as an artifact. This is due to the chemical separation of the parent and daughters. It is possible that no strontium-89 was present. Strontium was not detectable in the peanuts sample while the corn showed .043 ± 0.12 pCi/g of strontium-90. The 1972-74 experience for strontium-90 is summarized:

	1972	1973	1974
Corn	.072	.025	.043
Peanuts	.147	.011	Less than .009
Soybeans	.53	.20	.11

The data tend to indicate soybeans as the most sensitive sample and no plant contribution is indicated. Activity is due to the world-wide distribution of strontium-90 from early weapons tests.

Fowl Sample

The annual coot sample was collected on November 15, 1974. High resolution gamma spectrometry showed a trace of cobalt-57 at .25 ± .15 pCi/g (wet). The peak at cobalt-57 may have been a statistical artifact; background of the analytical system at that point is 0.08 counts per minute. Previously encountered chromium-51 and cerium-144 were not present in the current sample.

James River Water

The analysis of July samples showed no activity above detection limits with the exception of a single sample which exhibited natural potassium-40. There were trace indications of five other naturally occurring heavy isotopes and also cesium-137. The samples collected on September 12th and 13th showed potential traces of a greater array of fission and activation products, however only the Chickahominy sample showed activity above detection limits including:

Mn-54	1.8 ± 0.7 E+01 pCi/l
Co-60	2.0 ± 0.8 E+01
Cs-137	1.1 ± 0.6 E+01

The semi-annual composite sample analysis for tritium concentrations showed 230 ± pCi/l for both Chickahominy and Newport News.

The November sampling showed cesium-134 at Hog Island Point at 7.9 ± 5.5 pCi/l; all other samples collected this month showed no positive levels of fission or activation products.

Analysis of composite samples for the first six months of 1974 showed low concentrations of chromium-51 at Chickahominy while individual samples gave zinc-65 at Newport News, cesium-134 at the Station Intake, and a trace of cesium-137 at Hog Island Point.

Silt samples, collected on 9-13-74, yielded evidence of nine naturally occurring radionuclides and eleven fission and activation products. Positive concentrations of the latter can be summarized:

Mn-54	1.6 ± 1.2 E-01	Station Intake
Co-58	3.1 ± 1.1 E-01	Station Discharge
Co-60	4.0 ± 1.7 E-01	Station Discharge
Cs-134	2.4 ± 1.5 E-01	Station Discharge

Cs-137	1.1 ± 0.2 E+00	Station Discharge
	9.1 ± 2.1 E-01	Station Discharge
	9.2 ± 1.8 E-01	Hog Island Point
	3.3 ± 1.3 E-01	Point of Shoals
	2.4 ± 1.4 E-01	Newport News
	1.9 ± 1.4 E-01	Chickahominy
Ce-144	1.6 ± 1.4 E+00	Station Intake
Hg-203	1.9 ± 1.8 E-01	Station Discharge

The accumulation at Station Discharge is demonstrated and while the cesium-137 distribution would seem indicative of an overall accumulation, the data from September, 1973 showed that they do not permit such judgement. The 1973 data showed nearly the same average, but with the lowest concentration (.4 pCi/g) at the Station Discharge and the highest (1.1 pCi/g) at Chickahominy. The manganese-54 at Station Intake, and the other radionuclides quantitated at Station Discharge, were not observed in 1973.

Oyster Samples

Relatively low concentrations of both fission and activation products were obeserved in oyster samples collected during the second half of 1974. The data can be summarized by isotope:

	Cobalt-58	
Point of Shoals	7-02-74	3.0 ± 2.3 E-02 pCi/g (wet)
Newport News	7-02-74	2.5 ± 1.7 E-02
Deep Water Shoals	7-02-74	4.8 ± 3.0 E-02
Newport News	11-22-74	3.8 ± 2.1 E-02
	Cesium-137	
Point of Shoals	7-02-74	5.8 ± 2.1 E-02
Newport News	9-04-74	4.8 ± 2.4 E-02
Deep Water Sholas	9-13-74	4.1 ± 2.0 E-02
Point of Shoals	11-22-74	7.4 ± 4.6 E-02
Newport News	11-22-74	1.2 ± 0.3 E-01
Newport News	12-06-74	2.6 ± 2.1 E-02

	Ruthenium-106	
Newport News	11-22-74	1.9 ± 1.9 E-01
	Ruthenium-103	
Newport News	12-06-74	1.4 ± 1.3 E-02
	Cesium-134	
Newport News	11-22-74	4.3 ± 2.8 E-02

Gamma spectrometry data indicated the possibility of iodine-131 in the Point of Shoals and Deep Water Shoals sample collected during September. If this isotope was present, concentrations were too low to statistically quantitate or 7.0 E-02 pCi/g at time of analysis. The Novermber 22d samples collected at Newport News showed four fission and activation products including cobalt-58, ruthenium-106, cesium-134 and cesium-137. A subsequent sample collected on December 6th showed no measurable cobalt-58, cesium-134 or ruthenium-106. Ruthenium-103 appeared with a concentration near detection limits and the cesium-137 concentration was approximately one-fourth that of the sample collected 15 days earlier.

The levels observed at Newport News have some potential probability that Surry Station is not the sole source of the activity. The oyster bed is the farthest removed from the plant and there are several unique features. The Newport News samples were the only ones to show cesium-134, ruthenium-103 & 106, and all three samples showed cesium-137 with the 11-22-74 collection showing the highest concentration of any sample for this period. The presence of these isotopes is a continuation of data observed during the first half of 1974. During that time, cobalt-58 predominated however considerably more samples showed cesium-137 during the second half of the year. Though a relatively small number of samples, one can observe an apparent "shift" of activity to Newport News. The following section reviews the clam sample data and dose estimates for both shellfish samples.

Clam Samples

Clam samples also showed relatively low concentrations of fission and activation products during the second half of 1974. Positive concentrations of the isotopes of interest can be summarized:

	Cobalt-58	
Station Discharge	7-02-74	9.9 ± 4.7 E-02 pCi/g (wet)
Hog Island Pt.	7-02-74	1.2 ± 0.4 E-01
Station Discharge	9-13-74	4.8 ± 0.8 E-01
Hog Islang Point	9-13-74	6.2 ± 3.5 E-02
Jamestown	9-13-74	1.4 ± 1.4 E-02
Station Discharge	11-22-74	6.1 ± 3.8 E-02
Hog Island Point	11-22-74	4.4 ± 2.6 E-02
Lawnes Creek	11-22-74	3.3 ± 1.7 E-02
	Cesium-137	
Hog Island Point	7-02-74	6.0 ± 2.8 E-02
Jamestown	7-02-74	2.4 ± 2.4 E-02
Station Discharge	9-13-74	1.3 ± 0.4 E-01
Hog Island Point	9-13-74	7.0 ± 4.4 E-02
Chickahominy	9-13-74	5.4 ± 3.6 E-02
Lawnes Creek	9-13-74	2.6 ± 2.0 E-02
Station Discharge	11-22-74	6.8 ± 2.6 E-02
Hog Island Point	11-22-74	5.0 ± 2.8 E-02
Lawnes Creek	11-22-74	5.0 ± 2.4 E-02
Jamestown	11-22-74	3.8 ± 1.7 E-02
Chickahominy	11-25-74	4.8 ± 2.5 E-02
	Manganese-54	
Hog Island Point	7-02-74	5.6 ± 2.8 E-02
Station Discharge	9-13-74	8.6 ± 3.3 E-02
	Cobalt-60	
Station Discharge	7-02-74	1.3 ± 0.8 E-01
Station Discharge	9-13-74	2.4 ± 0.5 E-01
Hog Island Point	9-13-74	6.2 ± 3.5 E-02
	Cesium-134	
Station Discharge	9-13-74	6.1 ± 4.1 E-02
Jamestown	11-22-74	1.9 ± 1.7 E-02
	Ruthenium-106	
Lawnes Creek	9-13-74	1.9 ± 1.6 E-01

The most predominant isotopes appear to have peaked during September and dropped for the November sampling. Concentrations of cobalt-58, cesium-137, and 134, were still visible during November. The oyster data shows a trend toward more activity in the November sampling although cesium-137 was detectable in two oyster samples from September. There were more consistent concentrations in samples from the second six months of 1974 however many of the isotopes encountered are the same. The differences are that no chromium-51, iodine-131 or cerium-144 were seen in the last half year samples while cesium-134 and ruthenium-106 were observed in the latter half.

One can conservatively evaluate dose to man through oyster consumption by reviewing the data and creating the "maximum credible" shellfish dose path by using the highest concentration of each radionuclide and theorizing the effect through continuous consumption of that case.

Isotope	Maximum Concentration	Adjusted Fraction for Unrestricted Areas
Manganese-54	8.6 E-02 pCi/g (wet)	2×10^{-5}
Cobalt-58	4.8 E-01	1.3×10^{-4}
Cobalt-60	2.4 E-01	1.7×10^{-4}
Ruthenium-103	1.4 E-02	3.5×10^{-4}
Ruthenium-106	1.9 E-01	1.7×10^{-3}
Cesium-134	4.3 E-02	1.1×10^{-4}
Cesium-137	1.3 E-01	2.3×10^{-3}
	TOTAL	4.6×10^{-3}

The adjusted fraction for unrestricted areas is based upon the most restrictive case (soluble/insoluble) of the water limits of Appendix B, Table II of 10CRF20 normalized to shellfish intake at 18 kg/yr.

Fish Samples

A catfish and an eel were caught near the station intake on Aug. 30, 1974. Natural potassium-40 was quantified with potential traces of antimony-125 and cesium-137 indicated.

Crab Samples

Crabs were collected near the Station Intake on July 8 and on Aug. 25, 1974. The earlier sampling showed only potential traces of cobalt-58 and cesium-137. The August sampling showed low level concentrations of four plant related isotopes:

Co-57	4.7 ± 3.8 E-02 pCi/g
Co-58	3.2 ± 2.7 E-03
Cs-134	5.5 ± 2.8 E-02
Cs-137	4.8 ± 2.2 E-02

Constant consumption of crabs containing these concentrations would result in negligible radiation dose.

ANALYTICAL PROCEDURES

Air Particulate

Gross alpha and gross beta radioactivity measurements are made utilizing a Beckman Widebeta II low background (anti-coincidence proportional) counter. The minimum detectable levels (99.7% confidence) are approximately 0.24 pCi per sample for alpha particles and 0.80 pCi per sample for beta particles.

Air particle samples are mounted in two inch planchets and counted directly.

Gamma spectrum analysis utilizes a lithium-drifted germanium detector with a sensitive volume of 55 cm^3 and a thin aluminium window. The detector is housed in a graded lead shield with an internal volume of eight $ft.^3$, six inches of lead are at the bottom with four inches of lead on all sides and on top. The analyzer system is a Nuclear Data 4420 and ND812 computer housing a 20K memory for acquisition, storage, and manipulation of spectra and computer programs. The overall system has a resolution of 2.2 kev for the 1170 kev peak of cobalt-60 with a peak to compton ratio of 32:1.

Air particulate composites are fitted into a Petri dish and analyzed directly.

Ambient Radiation

Thermoluminescent dosimeters of lithium fluoride (TLD-100) are used to indicate ambient background radiation as well as noble gases such as xenon. The chips are preselected by laboratory irradiation and measurement with criterion of $\pm$ 4%. At low dose levels subsequent response can vary with $\pm$ 6% typical and with a range of less than $\pm$ 10%. A standard annealing cycle is used including one hour at 400%C and a subsequent 16 hours at 80%C. Calibration of the overall system includes use of ionization chambers as directly received from calibration by the National Bureau of Standards. Each annealing batch in-

cludes a packet for quality control comparison. The dose reported is that received between annealing and reading unless otherwise directed.

Well Water and Surface Water

These water samples are treated identically as the precipitation samples. The major factor influencing the data is the fraction of the total sample analyzed.

Fowl

The single coot sample analyzed semi-annually is analyzed by high resolution gamma spectrometry on the Ge-Li system. Following separation of the flesh from feathers, bone and other organs, the sample is ground and dried. The minimum detectable activities are essentially equal to those of other dried organic materials.

Soil and Silt Samples

Soil and silt samples are analyzed in an identical manner. Samples are dried and sieved through a number 11 U.S.A. Standard Testing Sieve to remove pebbles and other foreign matter. The samples are tumbled to provide uniform mixing and aliquots of approximately 100g are analyzed by high resolution gamma spectrometry. Representative sensitivities for various isotopes are:

Zr-95	0.1 pCi/g
Nb-95	0.1 pCi/g
Cs-137	0.1 pCi/g
Pb-214	1.0 pCi/g
Bi-214	1.0 pCi/g
Ra-226	9.0 pCi/g

James River Water

Samples from the James River are directly counted by Vepco for tritium.

Samples are analyzed by Eberline by high resolution gamma spectrometry and also by an enrichment procedure for tritium. The gamma spectrometry is performed by slowly drying a one liter aliquot and counting the residue. The tritium aliquot is electrolytically enriched before liquid scintillation counting and has a sensitivity of 90 pCi/L. This sensitivity is more than adequate to document equilibrium concentration due to world-wide environmental inventories.

Aquatic and Marine Organisms

Oysters and clams are analyzed by high resolution gamma spectrometry following grinding and drying. Only the edible portion of the mollusks are analyzed. Fish entrails are removed and the remainder submitted to pressurized steam to allow segregration of bone and flesh. The resultant sample weights are on the order of 10-20 grams. Typical resultant sensitivities are:

Zr-95	0.8 pCi/g
Nb-95	0.8 pCi/g
Sb-125	1.1 pCi/g
Cs-137	0.4 pCi/g
Ce-144	5.0 pCi/g
Ra-226	10.0 pCi/g

Precipitation

An aliquot of the composite is counted directly for tritium activity via liquid scintillation. The minimum detectable activity is 1.0 pCi/ml. Gross beta analysis is performed by drying an aliquot, in a planchet. The dried planchet is counted directly in the Widebeta II with a minimum detectable activity of 0.58 pCi per planchet.

The fractions of the samples analyzed are then related to the total precipitation collected and the area of the sample collector with units reported as nCi/M^2.

Milk Samples

Milk samples are analyzed for gamma emitters by sodium iodide spectrometry. Minimum detectable activities include 10 pCi/L for I-131 and 10 pCi/L for Cs-137. Samples are also analyzed for Sr-90 and calcium.

The strontium procedure includes separation by ion exchange with subsequent dried eluant counted on the Widebeta II system. An initial count with an additional count several days later, identified the Y-90 in-growth. The sensitivity for Sr-90 is approximately 2 pCi/L. Stable calcium is measured by a standard titration with a sensitivity of 1 mg/L. For dosimetric techniques, the ratio of pCi/L Sr-90 to gm/L Ca is also reported for each sample.

Milk samples are analyzed for low concentrations of I-131 through radiochemical analysis; sensitivity is approximately 0.25 pCi/L. Iodide carrier is added to the raw milk and ion exchange is used for the first step of purification. Sodium hypochlorite leached solution is treated with nitric acid and hydroxylamine. An organic extraction is effected and AgI is precipitated. The precipitate is washed, dried, and the tared filter is counted on a low background proportional beta particle counter. Recovery is based upon iodide carrier recovery.

EQUIPMENT

Gross alpha, gross beta, Sr-89, and Sr-90 measurements are made using a low background Beckman Widebeta II equipped with shielding and anti-coincidence electronic to obtain very low background counting rates. Automatic absorber measurements are also available.

Tritium enrichment analysis has a minimum detectable concentration of tritium in water on the order of 0.10 pCi/ml. Tritium is determined using a Beckman Model LS-200 liquid scintillation counter with 5 ml of water in Insta-Gel scintillator. The MDA for this system without enrichment is 0.6 pCi/ml based on a 100-minutes counting time, but the practical reporting level is 1 pCi/ml. When values below 1 pCi/ml are required, the sample is electrolytically enriched (HASL procedure) prior to liquid scintillation counting.

The gamma spectrometry system utilizes a high resolution detection with efficiency and resolution suitable for counting environmental samples. The analyzer system is a Nuclear Data 4420 with ND 812 Computer with 20 K memory for acquisition, storage, manipulation of spectra and programs. The Ge-Li detector is a right circular cylinder with a 40 mm diameter, drifted coaxially with an open end. The "P" core diameter is 6 mm and "N" layer thickness of 0.5 mm. An active area of 12.3 cm^2 faces the thin aluminum window which permits analysis of photon energies as low as 35 kev. The resolution is 2.2 kev for the 1170 kev peak of Co-60 and the peak-to-compton ratio is 32:1 for Co-60 gamma. The minimum detectable activities (MDA), based upon typical samples for the type indicated are listed in Table IV. The reporting level is a function of spectrum complexity, detector resolution, and peak-to-compton ratio. One reason this particular system was selected for environmental samples was the excellent resolution and peak-to-compton ratio. The detector resides in a graded shield with eight $ft.^3$ interior and with four inches of lead on top and sides and six inches on the bottom.

Several sodium-iodide gamma spectrometry systems are also employed to quantify gamma emitters. Table V shows typical minimum detectable activities based upon 99.7% confidence above background.

TABLE IV

TYPICAL MINIMUM DETECTABLE CONCENTRATIONS
GE-LI GAMMA SPECTROMETRY

Air Samples

Cs-134	1.6×10^{-2} pCi/M^3
Cs-137	1.6×10^{-2} pCi/M^3
Ba-140	5.2×10^{-2} pCi/M^3
La-140	3.2×10^{-2} pCi/M^3
Other Expected Gamma Emitters	1.2×10^{-2} to 1.2×10^{-1} pCi/M^3

Water Samples

Cr-51	80 pCi/l
Co-58	8 pCi/l
Co-60	8 pCi/l
Mn-54	8 pCi/l
Cs-134	9 pCi/l
Cs-137	9 pCi/l
Ba-140	30 pCi/l
La-140	20 pCi/l
Other Expected Gamma Emitters	8 to 80 pCi/l

Soil and Bottom Sediments

Cs-134	35 pCi/kg (dry)
Cs-137	35 pCi/kg (dry)
Cr-51	280 pCi/kg (dry)
Co-58	30 pCi/kg (dry)
Co-60	30 pCi/kg (dry)
Mn-54	30 pCi/kg (dry)
Other Expected Gamma Emitters	30 to 300 pCi/kg (dry)

Fish, Benthus, and Aquatic Vegetation

I-131	13 pCi/kg (wet)
Cs-134	14 pCi/kg (wet)
Cs-137	13 pCi/kg (wet)
Cr-51	110 pCi/kg (wet)
Co-58	12 pCi/kg (wet)
Co-60	13 pCi/kg (wet)
Mn-54	12 pCi/kg (wet)
Other Expected Gamma Emitters	1 to 120 pCi/kg (wet)

TABLE V

MINIMUM DETECTABLE ACTIVITY
IN SAMPLES ANALYZED BY
SODIUM IODIDE GAMMA SPECTROMETRY

Isotope	Peak Used To Quantity (KEV)	MDA for 4" x 4" (NaI(Tl) Detector (pCi/Sample)	
		Sm. Sample	2.5 Liters
Co-57	122	10	33
Ce-144	134	18	60
Hg-203	279	15	50
Cr-51	320	125	420
I-131	364	13	14
Ru-103	497	15	50
Na-22	511	8	26
Cs-134	605	11	37
Cs-137	662	12	40
Zr-Nb-95	724,756,765	6	20
Mn-54	835	13	43
Co-58	865	13	43
Zn-65	1115	21	70
Co-60	1173	11	75
K-40	1460	200	660
Ba-140	537	20	60
Ce-141	145	18	18

KEY INFORMATION FOR TABLES

1. Where data can range over several orders of magnitude, concentrations are expressed as powers of ten using E notation. For example E-03 is 10^{-3}.
2. Error terms are expressed as two standard deviations (95% confidence) for EIC data; zero values have three standard deviation error terms (99.7% confidence).
3. Where shown, averages are based upon measurable data, that is where two standard deviations are smaller than the calculated value. These averages should be used only as presented; averages among different sampling locations only present a basis for relative variability. The sequence in time is also an important factor.
4. The exact minimum detectable concentrations are variable dependent upon many factors such as complexity of a spectrum, quantity of the sample, etc. In order to maximize the value of the analysis, certain concentrations are reported as less than a given value. These data are reported through two methods.
   a. Frequently the analyses present information, such as a gamma spectrum peak, where the calculated error term at 95% confidence is larger than the calculated value. One can discern a very finite probability for the presence of that isotope. In these cases, the error term is increased to permit 99.7% confidence and the result is divided by sample size to yield concentration.
   b. One can expect certain isotopes to be present in a sample due to the nature of that sample. This is especially true when a member of a class of samples has definite data, but other members of the class do not exhibit the same information. Likewise, one can observe a small concentration of one member of a parent-daughter pair without observ-

ing the other member which is obviously present. In these cases (always represented by the lowest "less than" concentrations) the value reported is based upon three standard deviations (99.7% confidence) of the instrument background with a blank sample in the counting geometry.

CHRONOLOGICAL SUMMARY OF AIR SAMPLE DATA
GROSS BETA CONCENTRATIONS BY DATE COLLECTED
EBERLINE DATA
(picocuries per cubic meter)

Date Collected	July 2, 1974
Surry Station	1.8 ± 0.1 E-01
Hog Island Reserve	1.4 ± 0.1 E-01
Bacon's Castle	1.2 ± 0.1 E-01
Alliance	3.3 ± 0.1 E-01
Colonial Pkwy.	1.7 ± 0.1 E-01
Dow	2.0 ± 0.1 E-01
Fort Eustis	1.3 ± 0.1 E-01
Newport News	1.8 ± 0.1 E-01
Average	1.8 E-01
Maximum	3.3 ± 0.1 E-01
Minimum	1.2 ± 0.1 E-01

AIR PARTICULATE SAMPLES
(picocuries per cubic meter)

Date Collected	July 16, 1974	July 31, 1974
Surry Station	1.8 ± 0.1 E-01	1.4 ± 0.1 E-01
Hog Island Reserve	1.3 ± 0.1 E-01	1.5 ± 0.1 E-01
Alliance	3.2 ± 0.1 E-01	(mechanical failure)
Colonial Pkwy.	1.8 ± 0.1 E-01	1.7 ± 0.1 E-01
Dow	2.2 ± 0.1 E-01	2.1 ± 0.1 E-01
Fort Eustis	6.3 ± 0.6 E-02	1.2 ± 0.1 E-01
Newport News	2.3 ± 0.1 E-01	1.9 ± 0.1 E-01
Bacon's Castle	(mechanical failure)	8.9 ± 0.6 E-02
Average	1.9 E-01	1.5 E-01
Maximum	3.2 ± 0.1 E-01	2.1 ± 0.1 E-01
Minimum	6.3 ± 0.6 E-02	8.9 ± 0.6 E-02

AIR PARTICULATE SAMPLES
(picocuries per cubic meter)

Date Collected	August, 16, 1974	August 27/29, 1974
Surry Station	9.4 ± 0.6 E-02	3.2 ± 0.5 E-02
Hog Island Reserve	7.9 ± 0.6 E-02	8.6 ± 0.8 E-02
Bacon's Castle	5.1 ± 0.5 E-02	1.1 ± 0.1 E-01
Colonial Parkway	7.5 ± 0.6 E-02	1.2 ± 0.1 E-01
Dow	1.0 ± 0.1 E-01	1.5 ± 0.1 E-01
Fort Eustis	7.5 ± 0.5 E-02	1.1 ± 0.1 E-01
Newport News	6.4 ± 0.5 E-02	1.2 ± 0.1 E-01
Average	7.7 E-02	1.0 E-01
Maximum	1.0 ± 0.1 E-01	1.5 ± 0.1 E-01
Minimum	5.1 ± 0.5 E-02	3.2 ± 0.5 E-02

AIR PARTICULATE SAMPLES
(picocuries per cubic meter)

Date Collected	Sept. 10, 1974	Sept. 27, 1974
Surry Station	No sample collected	1.3 ± 0.1 E-01
Hog Island Reserve	9.5 ± 0.7 E-02	5.0 ± 0.5 E-02
Alliance	4.3 ± 0.1 E-01	1.4 ± 0.1 E-01
Colonial Pkwy.	2.4 ± 0.5 E-02	1.4 ± 0.4 E-02
Dow	9.9 ± 0.7 E-02	9.8 ± 0.6 E-02
Fort Eustis	7.4 ± 0.6 E-02	6.8 ± 0.5 E-02
Newport News	1.1 ± 0.1 E-01	8.6 ± 0.6 E-02
Bacon's Castle	8.2 ± 0.7 E-02	6.4 ± 0.5 E-02
Average	1.3 E-01	8.1 E-02
Maximum	4.3 ± 0.1 E-01	1.4 ± 0.1 E-01
Minimum	2.4 ± 0.5 E-02	1.4 ± 0.4 E-02

AIR PARTICULATE SAMPLES
(picocuries per cubic meter)

THIRD QUARTER, 1974 COMPOSITES

	Surry Station and Hog Island Reserve	Bacon's Castle, Alliance, Colonial Pkwy., Dow, Fort Eustis
Volume (M^3)	3156	8763
Gamma Spectrometry		
Be-7	5.0 ± 1.9 E-02	4.3 ± 0.9 E-02
K-40	Less than 3.4 E-02	Less than 1.2 E-02
Cr-51	3.1 ± 1.6 E-02	9.9 ± 6.0 E-03
Mn-54	Less than 2.2 E-03	7.9 ± 4.8 E-04
Co-60	Less than 3.6 E-03	Less than 1.3 E-03
Nb-95	8.1 ± 2.8 E-03	5.1 ± 1.2 E-03
Zr-95	5.3 ± 2.1 E-03	3.5 ± 1.7 E-03
Ru-103	Less than 2.6 E-03	Less than 9.2 E-04
Ru-106	Less than 2.8 E-02	Less than 1.0 E-02
Sb-125	Less than 1.0 E-02	Less than 3.7 E-03
Cs-137	5.2 ± 2.4 E-03	1.9 ± 0.9 E-03
Ce-141	Less than 6.4 E-03	2.3 ± 1.6 E-03
Ce-144	3.6 ± 1.5 E-02	2.4 ± 0.5 E-02
Tl-208	Less than 2.9 E-03	Less than 1.0 E-03
Pb-212	Less than 7.8 E-03	Less than 2.8 E-03
Ra-226	Less than 8.3 E-02	Less than 3.0 E-02
Ce-1		

AIR PARTICULATE SAMPLES
(picocuries per cubic meter)

THIRD QUARTER, 1974 COMPOSITES

Newport News

Volume (M^3)	1560

Gamma Spectrometry

Be-7	Less than 5.6 E-02
K-40	Less than 7.4 E-02
Cr-51	Less than 3.4 E-02
Mn-54	Less than 2.7 E-03
Co-60	Less than 7.2 E-03
Nb-95	Less than 7.4 E-03
Zr-95	7.0 ± 4.7 E-03
Ru-103	Less than 5.2 E-03
Ru-106	Less than 5.6 E-02
Sb-125	Less than 2.1 E-02
Cs-137	3.3 ± 3.1 E-03
Ce-141	Less than 1.3 E-02
Ce-144	2.9 ± 2.7 E-02
Tl-208	Less than 5.8 E-03
Pb-212	Less than 1.5 E-02
Ra-226	Less than 1.6 E-01

AIR PARTICULATE SAMPLES
GROSS BETA ANALYSIS
(picocuries per cubic meter)

Date Collected	October 8, 1974	October 30, 1974
Surry Station	9.7 ± 0.9 E-02	7.1 ± 0.5 E-02
Hog Island Reserve	5.1 ± 0.7 E-02	5.2 ± 0.4 E-02
Bacon's Castle	5.6 ± 0.7 E-02	5.6 ± 0.4 E-02
Alliance	1.0 ± 0.1 E-01	1.5 ± 0.1 E-01
Colonial Pkwy.	5.7 ± 0.6 E-02	5.1 ± 0.4 E-02
Dow	6.9 ± 0.7 E-02	9.0 ± 0.4 E-02
Fort Eustis	2.7 ± 0.5 E-02	2.7 ± 0.3 E-02
Newport News	7.5 ± 0.8 E-02	9.9 ± 0.6 E-02
Average	6.7 E-02	7.5 E-02
Maximum	1.0 ± 0.1 E-01	1.5 ± 0.1 E-01
Minimum	2.7 ± 0.5 E-02	2.7 ± 0.3 E-02

AIR PARTICULATE SAMPLES
GROSS BETA CONCENTRATIONS
(picocuries per cubic meter)

Station	November 13, 1974	November 26, 1974
Surry Station	6.3 ± 0.6 E-02	1.1 ± 0.1 E-01
Hog Island Reserve	6.7 ± 0.6 E-02	6.8 ± 0.5 E-02
Bacon's Castle	6.7 ± 0.6 E-02	3.7 ± 0.4 E-02
Alliance	1.3 ± 0.1 E-01	1.1 ± 0.1 E-01
Colonial Pkwy.	1.2 ± 0.1 E-01	1.2 ± 0.1 E-01
Dow	1.1 ± 0.1 E-01	1.1 ± 0.1 E-01
Fort Eustis	4.0 ± 0.5 E-02	3.5 ± 0.4 E-02
Newport News	1.2 ± 0.1 E-01	6.5 ± 0.5 E-02
Average	9.0 E-02	8.2 E-02
Maximum	1.3 ± 0.1 E-01	1.2 ± 0.1 E-01
Minimum	4.0 ± 0.5 E-02	3.5 ± 0.4 E-02

AIR PARTICULATE SAMPLES
GROSS BETA ANALYSIS
(picocuries per cubic meter)

Date Collected	December 10, 1974	December 23, 1974
Surry Station	9.2 ± 0.7 E-02	7.4 ± 0.7 E-02
Hog Island Reserve	5.8 ± 0.6 E-02	6.6 ± 0.5 E-02
Bacon's Castle	3.7 ± 0.5 E-02	7.5 ± 0.7 E-02
Alliance	1.1 ± 0.1 E-01	1.2 ± 0.1 E-01
Colonial Pkwy.	3.5 ± 0.5 E-02	No sample collected.
Dow	9.2 ± 0.7 E-02	8.9 ± 0.7 E-02
Fort Eustis	6.0 ± 0.6 E-02	4.7 ± 0.5 E-02
Newport News	7.1 ± 0.7 E-02	7.4 ± 0.7 E-02
Average	6.9 E-02	7.8 E-02
Maximum	1.1 ± 0.1 E-01	1.2 ± 0.1 E-01
Minimum	3.5 ± 0.5 E-02	4.7 ± 0.5 E-02

OVERALL AVERAGES
FOR SECOND HALF OF 1974

Average	1.1 E-01
Average Maximum	1.9 E-01
Average Minimum	4.6 E-02

AIR PARTICULATE SAMPLES
(picocuries per cubic meter)

FOURTH QUARTER, 1974 COMPOSITES

	Surry Station and Hog Island Reserve	Bacon's Castle, Alliance Colonial Parkway, Dow Fort Eustis
Volume (M^3)	3364	8490
Gamma Spectrometry		
Be-7	3.4 ± 1.7 E-02	6.0 ± 1.2 E-02
K-40	Less than 3.6 E-02	Less than 2.8 E-02
Zr-95	Less than 3.5 E-03	2.7 ± 1.4 E-03
Nb-95	5.2 ± 2.3 E-03	4.7 ± 1.8 E-03
Ru-103	Less than 1.8 E-03	Less than 7.0 E-04
Cs-137	4.0 ± 2.4 E-03	3.0 ± 1.2 E-03
Ce-144	1.2 ± 1.1 E-02	1.4 ± 1.3 E-02
Pb-212	Less than 7.0 E-03	Less than 5.8 E-03
Ra-226	Less than 1.3 E-01	Less than 6.6 E-02

AIR PARTICULATE SAMPLES
(picocuries per cubic meter)

FOURTH QUARTER, 1974 COMPOSITES

Newport News

Volume (M^3)	1499
<u>Gamma Spectrometry</u>	
Be-7	6.7 ± 2.9 E-02
K-40	Less than 9.3 E-02
Zr-95	Less than 6.0 E-03
Nb-95	Less than 6.5 E-03
Ru-103	5.5 ± 3.4 E-03
Cs-137	Less than 4.7 E-03
Ce-144	2.5 ± 2.2 E-02
Pb-212	Less than 1.5 E-02
Ra-226	Less than 1.6 E-01

AMBIENT THERMOLUMINESCENT DOSIMETRY

Date Annealed: June 22, 1974
Date Read: October 15, 1974

	NET MREM							
	1st	2nd	3rd	4th	5th	Average	± 2 Sigma	mrem/wk
Control	26	*	32	35	28	30.3	8.1	1.9
Surry Station	40	37	37	36	37.4	37.4	3.1	2.3
Hog Island Reserve	23	22	21	25	25	23.2	3.6	1.4
Bacon's Castle	17	19	18	15	18	17.4	3.0	1.1
Alliance	*	16	15	*	19	16.7	4.2	1.0
Colonial Pkwy.	19	19	21	19	22	20.0	2.8	1.2
Dow	22	20	24	20	18	20.8	4.6	1.3
Ft. Eustis	21	22	24	23	20	22.0	3.2	1.3
Newport News	27	*	21	27	*	25.0	6.9	1.5
Smithfield	24	28	27	28	26	26.6	3.3	1.6
Scotland Warf	*	20	20	17	18	18.8	3.0	1.2
Jamestown	20	20	18	19	19	19.2	1.7	1.2
Leehall	27	24	27	23	26	25.4	3.6	1.6
Routes 10-676	20	18	18	21	19	19.2	2.6	1.2
						Average		1.4

*Dosimeter damaged

AMBIENT THERMOLUMINESCENT DOSIMETRY

Date Annealed: Sept. 12, 1974
Date Read: Jan. 21, 1974

	NET MREM							
	1st	2nd	3rd	4th	5th	Average	± 2 Sigma	mrem/wk
Control	(not received will be entered upon receipt)							
Surry Station	62	59	61	62	57	60.2	4.4	3.2
Hog Island Reserve	33	33	30	31	32	31.8	2.6	1.7
Bacon's Castle	33	28	31	32	29	30.6	4.2	1.6
Alliance	31	27	30	29	28	29.0	3.2	1.6
Colonial Pkwy	28	27	29	30	28	28.4	2.2	1.5
Dow	30	31	27	27	29	28.8	3.6	1.5
Ft Eustis	35	33	37	35	32	34.4	3.8	1.8
Newport News	34	35	25	31	33	31.6	8.0	1.7
Smithfield	37	33	36	38	34	35.6	4.2	1.9
Scotland Warf	30	32	30	34	32	31.6	3.4	1.7
Jamestown	25	28	29	27	31	28.0	4.4	1.5
Lee Hall	44	44	38	37	41	40.8	6.6	2.2
Routes 10-676	26	29	27	26	29	27.4	3.0	1.5
					Average			1.8

PRECIPITATION COMPOSITES
(nanocuries per square meter)

THIRD QUARTER 1974

	Gross Beta	Tritium
Surry Station	5.0 ± 1.5 E+00	7.0 ± 2.6 E+01
Newport News	6.5 ± 2.1 E+00	2.3 ± 2.3 E+01

Surry Station Collector Area = 0.0729 square meter.

Newport News Collector Area = 0.0856 square meter.

PRECIPITATION SAMPLES
FOURTH QUARTER, 1974
(nanocuries per square meter)

	Gross Beta	Tritium*
Newport News	2.8 ± 0.5 E+00	3.4 ± 1.0 E+01
Surry Station	1.3 ± 0.2 E+01	3.7 ± 1.3 E+01

Newport News Collector Area = 0.0856 square meter

Surry Station Collector Area = 0.0729 square meter

*Enriched Tritium

MILK SAMPLES
(picocuries per liter)

	Epps	Judkins
Date Collected	7-2-74	7-2-74
Radiochemistry		
Sr-89	0.0 ± 3.0 E+00	0.0 ± 4.0 E+00
Sr-90	4.3 ± 1.8 E+00	1.5 ± 0.3 E+01
I-131	0.0 ± 8.9 E-02	0.0 ± 6.3 E-02
Ca (g/l)	1.38	1.30
Gamma Spectrometry		
Be-7	Less than 1.5 E+02	Less than 1.5 E+02
K-40	7.0 ± 2.4 E+02	1.1 ± 0.4 E+03
Cr-51	9.7 ± 9.0 E+01	Less than 1.4 E+02
Mn-54	Less than 1.2 E+02	Less than 1.2 E+02
Co-57	Less than 2.8 E+01	Less than 2.8 E+01
Co-60	Less than 2.0 E+01	Less than 2.0 E+01
Zr-95	Less than 2.6 E+01	Less than 2.6 E+01
Nb-95	Less than 2.0 E+01	Less than 2.0 E+02
Ru-106	Less than 1.9 E+02	Less than 2.0 E+02
Sb-125	Less than 8.0 E+01	Less than 8.0 E+01
Cs-137	Less than 1.0 E+01	2.2 ± 1.2 E+01
Tl-208	Less than 2.4 E+01	Less than 2.7 E+01
Pb-212	Less than 5.0 E+01	Less than 8.5 E+01
Bi-214	Less than 7.1 E+01	Less than 7.1 E+01
Pb-214	Less than 8.0 E+01	Less than 8.0 E+01
Ra-226	Less than 5.5 E+02	Less than 9.2 E+02
Ac-228	Less than 1.2 E+02	Less than 1.2 E+02

MILK SAMPLES
(picocuries per liter)

	Epps	Judkins
Date Collected	7-31-74	7-31-74
Radiochemistry		
Sr-89	0.0 ± 2.8 E+00	0.0 ± 3.5 E+00
Sr-90	7.1 ± 1.7 E+00	1.4 ± 0.2 E+01
I-131	0.0 ± 6.8 E-02	0.0 ± 6.6 E-02
Ca (g/l)	1.40	1.37
Gamma Spectrometry		
Be-7	Less than 1.5 E+02	Less than 1.5 E+02
K-40	1.7 ± 0.5 E+03	1.5 ± 0.6 E+03
Cr-51	Less than 1.4 E+02	Less than 1.4 E+02
Mn-54	1.1 ± 0.8 E+01	Less than 1.2 E+02
Co-57	Less than 2.8 E+01	Less than 2.8 E+01
Co-60	Less than 2.0 E+01	Less than 2.0 E+01
Zr-95	Less than 2.6 E+01	Less than 2.6 E+01
Nb-95	Less than 2.0 E+01	Less than 2.0 E+01
Ru-106	Less than 1.9 E+02	Less than 2.0 E+02
Sb-125	Less than 9.9 E+02	Less than 1.1 E+02
Cs-137	Less than 1.9 E+01	3.2 ± 1.6 E+01
Ce-141	Less than 7.8 E+01	Less than 7.8 E+01
Tl-208	Less than 2.7 E+01	Less than 7.8 E+01
Bi-212	Less than 8.4 E+01	Less than 8.4 E+01
Pb-212	Less than 9.0 E+01	Less than 9.6 E+01
Bi-214	Less than 7.1 E+01	Less than 7.1 E+01
Pb-214	Less than 8.0 E+01	Less than 8.0 E+01
Ra-226	Less than 9.9 E+02	Less than 1.1 E+03
Ac-228	Less than 1.2 E+02	Less than 1.2 E+02

MILK SAMPLES
(picocuries per liter)

	Colonial Parkway	Lee Hall
Date Collected	8-15-74	8-15-74
Radiochemistry		
Sr-89	0.0 ± 2.7 E+00	0.0 ± 2.4 E+00
Sr-90	6.3 ± 1.7 E+00	3.0 ± 1.5 E+00
I-131	3.6 ± 2.4 E-01	3.6 ± 3.0 E-01
Ca (g/L)	1.26	1.32
Gamma Spectrometry		
Be-7	Less than 1.5 E+02	1.8 ± 1.2 E+02
K-40	1.4 ± 0.4 E+03	1.6 ± 0.6 E+03
Cr-51	Less than 1.4 E+02	Less than 1.4 E+02
Mn-54	Less than 1.2 E+02	Less than 1.2 E+02
Co-57	Less than 2.8 E+01	3.2 ± 2.9 E+01
Co-60	Less than 2.0 E+01	Less than 2.0 E+01
Zr-95	Less than 2.6 E+01	Less than 2.6 E+01
Nb-95	Less than 2.0 E+01	Less than 2.0 E+01
Ru-106	Less than 2.0 E+01	Less than 2.0 E+01
Sb-125	Less than 8.0 E+01	Less than 8.0 E+01
Cs-137	1.2 ± 1.2 E+01	Less than 1.4 E+01
Ce-141	Less than 7.8 E+01	Less than 7.8 E+01
Tl-208	Less than 2.4 E+01	Less than 2.4 E+01
Bi-212	Less than 8.4 E+01	Less than 8.4 E+01
Pb-212	Less than 8.4 E+01	Less than 1.2 E+02
Bi-214	Less than 6.9 E+01	2.3 ± 1.8 E+02
Pb-214	Less than 8.1 E+01	Less than 1.2 E+02
Ra-226	Less than 5.5 E+02	Less than 5.5 E+02
Ac-228	Less than 1.2 E+02	Less than 1.2 E+02

MILK SAMPLES
(picocuries per liter)

	Epps	Judkins
Date Collected	9-3-74	9-3-74
Radiochemistry		
I-131	0.0 ± 8.7 E-02	0.0 ± 9.2 E-02
Ca (g/l)	1.48	1.32
Sr-89	0.0 ± 7.1 E+00	0.0 ± 4.5 E+00
Sr-90	8.6 ± 4.0 E+00	4.5 ± 4.5 E+00
Gamma Spectrometry		
Be-7	Less than 1.5 E+02	Less than 1.5 E+02
K-40	1.8 ± 0.5 E+03	1.7 ± 0.5 E+03
Cr-51	Less than 1.4 E+02	Less than 1.4 E+02
Mn-54	Less than 1.2 E+02	Less than 1.2 E+02
Co-57	Less than 2.8 E+01	Less than 2.8 E+01
Co-60	3.5 ± 2.2 E+01	Less than 1.6 E+01
Zr-95	Less than 2.6 E+01	Less than 2.6 E+01
Nb-95	Less than 2.0 E+01	Less than 2.0 E+01
Ru-106	Less than 2.0 E+01	Less than 2.0 E+01
Sb-125	Less than 8.0 E+01	Less than 8.0 E+01
Cs-137	Less than 2.5 E+01	Less than 1.9 E+01
Ce-141	Less than 7.8 E+01	Less than 8.1 E+01
Tl-208	Less than 3.1 E+01	Less than 2.4 E+01
Bi-212	Less than 8.4 E+01	1.8 ± 1.1 E+02
Pb-212	Less than 9.7 E+01	Less than 8.4 E+01
Bi-214	Less than 7.9 E+01	1.0 ± 0.8 E+02
Pb-214	Less than 8.0 E+01	Less than 8.0 E+01
Ra-226	Less than 5.5 E+02	Less than 8.9 E+02
Ac-228	Less than 1.2 E+02	Less than 1.2 E+02

MILK SAMPLES
(picocuries per liter)

	Colonial Parkway	Lee Hall
Date Collected	9-10-74	9-10-74
Radiochemistry		
I-131	6.2 ± 2.6 E-01	0.0 ± 9.5 E-02
Ca (g/l)	.82	.90
Sr-89	0.0 ± 2.7 E+00	0.0 ± 2.1 E+00
Sr-90	3.5 ± 1.8 E+00	1.6 ± 1.4 E+00
Gamma Spectrometry		
Be-7	Less than 1.5 E+02	Less than 1.5 E+02
K-40	9.7 ± 3.7 E+02	1.0 ± 0.4 E+03
Cr-51	Less than 1.4 E+02	Less than 1.4 E+02
Mn-54	Less than 1.2 E+02	1.6 ± 1.2 E+01
Co-57	Less than 2.8 E+01	Less than 2.8 E+01
Co-60	Less than 1.6 E+01	5.0 ± 2.0 E+01
Zr-95	Less than 2.6 E+01	Less than 2.6 E+01
Nb-95	Less than 2.0 E+01	Less than 2.0 E+02
Ru-106	Less than 2.0 E+01	Less than 2.0 E+02
Sb-125	Less than 8.0 E+01	Less than 8.0 E+01
Cs-137	Less than 1.8 E+01	2.3 ± 1.4 E+01
Ce-141	Less than 7.8 E+01	Less than 7.8 E+01
Tl-208	Less than 2.4 E+01	Less than 2.4 E+01
Bi-212	Less than 8.4 E+01	Less than 8.4 E+01
Pb-212	Less than 5.0 E+01	Less than 8.4 E+01
Bi-214	Less than 7.2 E+01	Less than 7.1 E+01
Pb-214	Less than 8.0 E+01	Less than 8.0 E+01
Ra-226	Less than 5.5 E+02	Less than 5.5 E+02
Ac-228	Less than 1.2 E+02	Less than 1.2 E+02

MILK SAMPLES
(picocuries per liter)

	Epps Dairy
Date Collected	9-17-74
Radiochemistry	
I-131	6.3 ± 1.7 E-01
Ca (g/l)	1.43
Sr-89	0.0 ± 3.1 E+00
Sr-90	4.5 ± 2.2 E+00
Gamma Spectrometry	
Be-7	Less than 1.5 E+02
K-40	1.1 ± 0.5 E+03
Cr-51	Less than 1.4 E+02
Mn-54	Less than 1.2 E+02
Co-57	Less than 2.8 E+01
Co-60	1.6 ± 1.3 E+01
Zr-95	Less than 2.6 E+01
Nb-95	Less than 2.0 E+01
Ru-106	Less than 2.0 E+01
Sb-125	Less than 8.0 E+01
Cs-137	Less than 1.0 E+01
Ce-141	Less than 7.8 E+01
Tl-208	Less than 2.4 E+01
Bi-212	Less than 8.4 E+01
Pb-212	Less than 8.4 E+01
Bi-214	Less than 7.5 E+01
Pb-214	Less than 8.0 E+01
Ra-226	Less than 5.5 E+02
Ac-228	Less than 1.2 E+02

MILK SAMPLES
(picocuries per liter)

	Epps	Judkins
Date Collected	9-27-74	9-27-74
Radiochemistry		
Sr-89	0.0 ± 2.8 E+00	0.0 ± 5.2 E+00
Sr-90	6.3 ± 2.0 E+00	1.1 ± 0.3 E+01
I-131	0.0 ± 1.2 E-01	0.0 ± 1.5 E-01
Ca (g/l)	1.40	1.37
Gamma Spectrometry		
Be-7	Less than 1.5 E+02	1.3 ± 1.0 E+02
K-40	1.4 ± 0.5 E+03	1.2 ± 0.4 E+03
Cr-51	Less than 1.4 E+02	Less than 1.4 E+02
Mn-54	Less than 1.2 E+02	Less than 1.2 E+02
Co-57	Less than 2.8 E+01	Less than 2.8 E+01
Co-60	Less than 1.6 E+01	Less than 1.6 E+01
Zr-95	Less than 2.6 E+01	Less than 2.6 E+01
Nb-95	Less than 2.0 E+01	Less than 2.0 E+01
Ru-106	Less than 2.0 E+01	Less than 2.0 E+01
Sb-125	Less than 8.0 E+01	Less than 8.1 E+01
Cs-137	Less than 1.8 E+01	Less than 2.3 E+01
Ce-141	Less than 7.8 E+01	Less than 7.8 E+01
Tl-208	Less than 2.4 E+01	Less than 2.4 E+01
Bi-212	Less than 8.4 E+01	Less than 8.4 E+01
Pb-212	Less than 8.4 E+01	Less than 8.0 E+01
Bi-214	Less than 6.9 E+01	Less than 7.1 E+01
Pb-214	Less than 8.0 E+01	Less than 8.6 E+01
Ra-226	Less than 5.5 E+02	Less than 5.5 E+02
Ac-228	Less than 1.2 E+02	Less than 1.2 E+02

MILK SAMPLES
(picocuries per liter)

	Lee Hall	Colonial Parkway
Date Collected	9-30-74	9-30-74
Radiochemistry		
I-131	0.0 ± 1.0 E-01	0.0 ± 1.9 E-01
Ca (g/l)	1.45	1.37
Sr-89	0.0 ± 3.3 E+00	0.0 ± 2.9 E+00
Sr-90	9.0 ± 2.2 E+00	5.2 ± 1.9 E+00
Gamma Spectrometry		
Be-7	Less than 1.5 E+02	Less than 1.5 E+02
K-40	1.5 ± 0.5 E+03	1.7 ± 0.5 E+03
Cr-51	Less than 1.4 E+02	Less than 1.4 E+02
Mn-54	Less than 1.2 E+02	Less than 1.2 E+02
Co-57	Less than 2.8 E+01	Less than 2.8 E+01
Co-60	Less than 1.6 E+01	Less than 1.6 E+01
Zr-95	Less than 2.6 E+01	2.0 ± 1.7 E+01
Nb-95	Less than 2.0 E+01	Less than 2.1 E+01
Ru-106	Less than 2.0 E+01	Less than 2.0 E+01
Sb-125	Less than 8.0 E+01	Less than 8.0 E-01
Cs-137	Less than 1.7 E+01	Less than 1.7 E+01
Ce-141	Less than 7.8 E+01	Less than 7.8 E+01
Tl-208	Less than 2.7 E+01	Less than 2.7 E+01
Bi-212	Less than 8.4 E+01	Less than 2.9 E+02
Pb-212	Less than 5.0 E+01	Less than 5.0 E+01
Bi-214	Less than 7.1 E+01	Less than 7.1 E+01
Pb-214	Less than 8.0 E+01	Less than 8.0 E+01
Ra-226	Less than 5.5 E+02	Less than 5.5 E+02
Ac-228	Less than 1.2 E+02	Less than 1.2 E+02

MILK SAMPLES
(picocuries per liter)

	Bacon's Castle Epp's	Bacon's Castle Judkins
Date Collected	10-8-74	10-8-74
Radiochemistry		
I-131	0.0 ± 9.5 E-02	0.0 ± 8.2 E-02
Ca (g/1)	1.35	1.43
Sr-89	0.0 ± 2.6 E+00	0.0 ± 3.2 E+00
Sr-90	7.6 ± 1.8 E+00	1.3 ± 0.2 E+01
Gamma Spectrometry		
Be-7	Less than 1.0 E+02	Less than 1.0 E+02
K-40	1.4 ± 0.4 E+03	1.5 ± 0.4 E+03
Sb-125	Less than 8.0 E+01	Less than 8.3 E+01
Cs-137	Less than 2.1 E+01	1.4 ± 1.4 E+01
Ce-141	Less than 7.5 E+01	Less than 7.5 E+01
Hg-203	Less than 1.5 E+01	Less than 1.5 E+01
Tl-208	Less than 2.0 E+01	Less than 2.0 E+01
Bi-212	Less than 1.0 E+02	Less than 1.0 E+02
Pb-212	Less than 8.1 E+01	Less than 8.4 E+01
Pb-214	Less than 7.8 E+01	Less than 7.5 E+01
Bi-214	8.5 ± 7.6 E+01	Less than 6.3 E+01
Ra-226	Less than 9.0 E+02	Less than 9.0 E+02

MILK
(picocuries per liter)

	Epps	Judkins
Date Collected	10-30-74	10-30-74
Radiochemistry		
Sr-89	0.0 ± 5.5 E+00	0.0 ± 6.6 E+00
Sr-90	7.9 ± 4.6 E+00	7.0 ± 3.9 E+00
I-131	0.0 ± 8.2 E-02	0.0 ± 8.0 E-02
Ca (g/l)	1.47	1.34
Gamma Spectrometry		
Be-7	Less than 1.5 E+02	Less than 1.0 E+02
K-40	1.8 ± 0.5 E+03	1.6 ± 0.5 E+03
Sb-125	Less than 8.0 E+01	Less than 8.1 E+01
Cs-137	Less than 2.6 E+01	Less than 2.3 E+01
Ce-141	Less than 7.5 E+01	Less than 7.5 E+01
Hg-203	Less than 1.5 E+01	Less than 1.5 E+01
Tl-208	Less than 2.0 E+01	Less than 2.0 E+01
Bi-212	1.8 ± 1.3 E+02	Less than 1.0 E+02
Pb-212	Less than 8.6 E+01	Less than 8.1 E+01
Pb-214	Less than 9.9 E+01	Less than 9.0 E+01
Bi-214	Less than 8.1 E+01	Less than 7.4 E+01
Ra-226	Less than 9.2 E+02	Less than 9.0 E+02

MILK SAMPLES
(picocuries per liter)

	Colonial Parkway
Date Collected	11-26-74
Radiochemistry	
Sr-89	0.0 ± 5.0 E+00
Sr-90	5.4 ± 3.2 E+00
I-131	0.0 ± 7.5 E-02
Ca (g/L)	1.37
Gamma Spectrometry	
Be-7	1.2 ± 1.2 E+02
K-40	1.3 ± 0.4 E+03
Sb-125	Less than 8.0 E+01
Cs-137	Less than 1.6 E+01
Ce-141	Less than 8.0 E+01
Hg-203	Less than 1.5 E+01
Tl-208	Less than 2.6 E+01
Bi-212	Less than 1.0 E+02
Pb-212	Less than 8.2 E+01
Pb-214	Less than 8.1 E+01
Bi-214	Less than 6.0 E+01
Ra-226	Less than 9.0 E+02

MILK SAMPLES
(picocuries per liter)

	Epps	Judkins
Date Collected	12-2-74	12-2-74
Radiochemistry		
Sr-89	0.0 ± 4.1 E+00	0.0 ± 2.8 E+00
Sr-90	7.0 ± 2.4 E+00	4.0 ± 1.5 E+00
I-131	0.0 ± 7.4 E-02	0.0 ± 7.8 E-02
Ca (g/l)	1.57	1.34
Gamma Spectrometry		
Be-7	Less than 1.0 E+02	Less than 1.0 E+02
K-40	8.8 ± 4.5 E+02	1.9 ± 0.5 E+03
Sb-125	Less than 8.0 E+01	Less than 8.0 E+01
Cs-137	Less than 2.1 E+01	Less than 2.4 E+01
Ce-141	Less than 7.5 E+01	Less than 7.6 E+01
Hg-203	Less than 1.5 E+01	Less than 1.5 E+01
Tl-208	Less than 2.0 E+01	Less than 2.0 E+01
Bi-212	Less than 1.0 E+02	Less than 1.0 E+02
Pb-212	Less than 8.1 E+01	Less than 8.4 E+01
Pb-214	Less than 7.5 E+01	Less than 7.5 E+01
Bi-214	Less than 6.6 E+01	Less than 6.0 E+01
Ra-226	Less than 9.2 E+02	Less than 9.0 E+02

MILK SAMPLES
(picocuries per liter)

	Lee Hall
Date Collected	12-23-74
Radiochemistry	
Sr-89	0.0 ± 2.2 E+00
Sr-90	1.9 ± 1.5 E+00
I-131	0.0 ± 6.5 E-02
Ca (g/l)	1.47
Gamma Spectrometry	
Be-7	Less than 1.0 E+02
K-40	2.1 ± 0.5 E+03
Sb-125	Less than 8.6 E+01
Cs-137	1.8 ± 1.0 E+01
Ce-141	Less than 7.5 E+01
Hg-203	2.0 ± 1.9 E+01
Tl-208	Less than 2.6 E+01
Bi-212	Less than 1.0 E+02
Pb-212	Less than 8.0 E+01
Pb-214	Less than 8.3 E+01
Bi-214	Less than 6.0 E+01
Ra-226	Less than 9.4 E+02

WELL WATER SAMPLES
(picocuries per liter)

Samples collected October 30, 1974

Location	Tritium	Gross Alpha	Gross Beta
Surry Station	Less than 1.6 E+02	0.0 ± 2.5 E+00	5.2 ± 4.5 E+00
Bacon's Castle	2.0 ± 1.6 E+02	7.1 ± 3.8 E+00	1.7 ± 0.5 E+01
Hog Island Reserve	Less than 1.6 E+02	0.0 ± 2.6 E+00	5.3 ± 4.4 E+00
Jamestown	3.7 ± 1.6 E+02	0.0 ± 2.6 E+00	0.0 ± 4.5 E+00

SURFACE WATER SAMPLES
GROSS ALPHA AND BETA CONCENTRATIONS
(picocuries per liter)

Date Collected - October 30, 1974

Location	L. S. Tritium	Gross Alpha	Gross Beta
Williamsburg	1.8 ± 0.8 E+02	0.0 ± 2.2 E+00	8.1 ± 4.5 E+00
Newport News	1.0 ± 0.8 E+02	0.0 ± 1.7 E+00	6.9 ± 4.7 E+00
Chippokes Creek	1.8 ± 0.8 E+02	0.0 ± 1.3 E+00	0.0 ± 3.8 E+00
Smithfield	1.5 ± 0.8 E+02	0.0 ± 1.9 E+00	1.2 ± 0.5 E+01

SOIL SAMPLES
(picocuries per gram dry)

	Fort Eustis	Bacon's Castle
Date Collected	8-25-74	8-25-74
Sample Weight Dry	113.5 g	111.5 g
<u>Radiochemistry</u>		
Sr-89	0.0 ± 6.4 E-01	0.0 ± 6.3 E-01
Sr-90	6.2 ± 6.0 E-01	0.0 ± 8.7 E-01
<u>Gamma Spectrometry</u>		
K-40	1.1 ± 0.2 E+01	4.9 ± 2.3 E+00
Cr-51	Less than 1.9 E+00	Less than 2.0 E+00
Co-57	Less than 1.9 E-01	Less than 1.9 E-01
Nb-95	Less than 1.7 E-01	Less than 1.7 E-01
Ru-106	Less than 6.2 E-01	Less than 6.3 E-01
Sb-125	5.6 ± 3.5 E-01	Less than 3.2 E-01
Cs-137	1.2 ± 0.2 E+00	1.0 ± 0.2 E+00
La-140	Less than 2.8 E-01	Less than 2.8 E-01
Ce-141	Less than 3.9 E-01	Less than 3.9 E-01
Hg-203	Less than 1.5 E-01	Less than 1.5 E-01
Tl-208	2.1 ± 1.5 E-01	1.7 ± 1.5 E-01
Bi-212	Less than 1.1 E+00	Less than 1.1 E+00
Pb-212	1.0 ± 0.4 E+00	1.2 ± 0.3 E+00
Pb-214	8.4 ± 3.9 E-01	1.2 ± 0.3 E+00
Bi-214	7.1 ± 3.9 E-01	8.2 ± 3.6 E-01
Ra-226	4.5 ± 3.7 E+00	Less than 5.3 E+00
Ac-228	7.3 ± 7.1 E-01	Less than 4.0 E-01

SOIL SAMPLES
(picocuries per gram dry)

	Dow	Colonial Parkway
Date Collected	8-25-74	8-25-74
Sample Weight Dry	123.0 g	127.0 g
Radiochemistry		
Sr-89	0.0 ± 5.0 E-01	0.0 ± 8.1 E-01
Sr-90	0.0 ± 6.7 E-01	0.0 ± 1.1 E+00
Gamma Spectrometry		
K-40	8.7 ± 2.3 E+00	4.1 ± 1.5 E+00
Cr-51	Less than 1.8 E+00	Less than 1.8 E+00
Co-57	Less than 1.4 E-01	Less than 1.4 E-01
Nb-95	Less than 1.4 E-01	Less than 1.4 E-01
Ru-106	Less than 5.7 E-01	Less than 5.6 E-01
Sb-125	Less than 2.9 E-01	4.3 ± 3.5 E-01
Cs-137	2.7 ± 1.2 E-01	1.6 ± 0.2 E+00
La-140	Less than 2.6 E-01	Less than 2.7 E-01
Ce-141	Less than 4.0 E-01	Less than 3.6 E-01
Hg-203	1.7 ± 1.4 E-01	Less than 1.4 E-01
Tl-208	4.4 ± 1.5 E-01	1.6 ± 1.4 E-01
Bi-212	1.9 ± 1.0 E+00	Less than 9.7 E-01
Pb-212	1.6 ± 0.4 E+00	8.3 ± 2.9 E-01
Pb-214	1.4 ± 0.4 E+00	3.8 ± 3.4 E-01
Bi-214	8.2 ± 4.0 E-01	4.2 ± 2.9 E-01
Ra-226	Less than 5.4 E+00	Less than 4.8 E+00
Ac-228	1.4 ± 0.7 E+00	Less than 5.0 E-01

SOIL SAMPLES
(picocuries per gram dry)

	Alliance	Surry Station
Date Collected	8-25-74	8-25-74
Sample Weight Dry	155.5 g	176.5 g
Radiochemistry		
Sr-89	0.0 ± 6.7 E-01	0.0 ± 1.1 E+00
Sr-90	0.0 ± 9.5 E-01	0.0 ± 1.5 E+00
Gamma Spectrometry		
K-40	1.4 ± 1.3 E+00	1.2 ± 0.2 E+01
Cr-51	Less than 1.7 E+00	Less than 1.6 E+00
Co-57	Less than 1.3 E-01	Less than 1.2 E-01
Nb-95	Less than 1.1 E-01	Less than 1.0 E-01
Ru-106	Less than 4.5 E-01	4.4 ± 4.1 E-01
Sb-125	Less than 2.3 E-01	2.1 ± 2.0 E-01
Cs-137	2.5 ± 0.9 E-01	Less than 1.1 E-01
La-140	Less than 2.0 E-01	Less than 1.8 E-01
Ce-141	Less than 2.9 E-01	Less than 2.5 E-01
Hg-203	Less than 1.1 E-01	Less than 9.7 E-02
Tl-208	Less than 1.6 E-01	1.3 ± 1.0 E-01
Bi-212	Less than 7.9 E-01	Less than 6.9 E-01
Pb-212	4.8 ± 2.3 E-01	5.0 ± 2.2 E-01
Pb-214	4.7 ± 2.5 E-01	3.4 ± 2.2 E-01
Bi-214	4.1 ± 2.0 E-01	5.2 ± 2.7 E-01
Ra-226	Less than 3.8 E+00	Less than 3.6 E+00
Ac-228	6.1 ± 4.7 E-01	6.5 ± 4.2 E-01

CROP VEGETATION
(picocuries per gram wet)

	Peanuts	Corn
Date Collected	10-30-74	10-30-74
Sample Weight Dry/Wet	62.0/68.5 g	79.5/91.0 g
Radiochemistry		
Sr-89	0.0 ± 1.3 E-02	0.0 ± 2.3 E-02
Sr-90	0.0 ± 9.4 E-03	4.3 ± 1.2 E-02
Gamma Spectrometry		
K-40	5.7 ± 2.8 E+00	Less than 2.8 E+00
Co-60	Less than 1.5 E-01	Less than 1.2 E-01
Zr-95	Less than 1.3 E-01	1.4 ± 1.0 E-01
Cs-137	Less than 1.8 E-01	Less than 1.4 E-01
Tl-208	Less than 2.1 E-01	Less than 1.8 E-01
Pb-212	Less than 7.0 E-01	Less than 5.6 E-01
Pb-214	Less than 7.4 E-01	Less than 5.8 E-01
Bi-214	7.4 ± 6.6 E-01	4.6 ± 3.6 E-01
Ra-226	Less than 7.8 E+00	Less than 5.7 E+00

CROP SAMPLES
(picocuries per gram dry)

	Soybeans
Date Collected	11-22-74
Sample Weight Dry/Wet	79.0/79.0 g
Radiochemistry	
Sr-89	5.5 ± 3.6 E-02
Sr-90	1.1 ± 0.3 E-01
Gamma Spectrometry	
K-40	1.2 ± 0.4 E+01
Co-60	Less than 1.2 E-01
Zr-95	Less than 1.0 E-01
Cs-137	Less than 1.4 E-01
Tl-208	Less than 1.8 E-01
Pb-212	Less than 6.0 E-01
Pb-214	Less than 5.8 E-01
Bi-214	Less than 4.0 E-01
Ra-226	Less than 5.5 E+00

FOWL SAMPLE
(picocuries per liter)

	Coot
Date Collected	11-15-74
<u>Gamma Spectrometry</u>	
Co-57	2.5 ± 1.5 E-01
Cs-137	Less than 1.8 E-01
Pb-212	Less than 6.9 E-01
Pb-214	Less than 7.9 E-01
Bi-214	Less than 6.4 E-01
Ra-226	Less than 7.7 E+00

JAMES RIVER WATER
(picocuries per liter)

	Hog Island Point	Chickahominy
Date Collected	7-2-74	7-2-74
Gamma Spectrometry		
K-40	Less than 1.3 E+01	Less than 1.0 E+01
Cs-137	Less than 6.0 E+00	Less than 5.4 E+00
Tl-208	Less than 8.0 E+00	Less than 9.8 E+00
Pb-212	Less than 2.2 E+01	Less than 2.2 E+01
Pb-214	Less than 2.7 E+01	Less than 2.5 E+01
Bi-214	Less than 2.5 E+01	Less than 2.5 E+01
Ra-226	Less than 2.4 E+02	Less than 2.4 E+02

JAMES RIVER WATER
(picocuries per liter)

	Newport News
Date Collected	7-2-74
<u>Gamma Spectrometry</u>	
K-40	2.0 ± 1.4 E+02
Cs-137	Less than 1.4 E+01
Tl-208	Less than 1.5 E+01
Pb-212	Less than 4.9 E+01
Pb-214	Less than 2.5 E+01
Bi-214	Less than 3.8 E+01
Ra-226	Less than 5.4 E+02

JAMES RIVER WATER
(picocuries per liter)

	Station Intake	Station Discharge
Date Collected	7-3-74	7-15-74
Gamma Spectrometry		
K-40	Less than 1.0 E+02	Less than 1.3 E+02
Cs-137	Less than 7.3 E+00	Less than 6.6 E+00
Tl-208	Less than 8.0 E+00	Less than 8.9 E+00
Pb-212	Less than 2.2 E+01	Less than 2.4 E+01
Pb-214	Less than 2.5 E+01	Less than 2.7 E+01
Bi-214	Less than 2.6 E+01	Less than 2.6 E+01
Ra-226	Less than 2.4 E+02	Less than 2.4 E+02

JAMES RIVER WATER
(picocuries per liter)

	Chickahominy	Station Discharge
Date Collected	9-12-74	9-12-74
Gamma Spectrometry		
K-40	Less than 1.0 E+02	Less than 9.5 E+01
Mn-54	1.8 ± 0.7 E+01	Less than 8.0 E+00
Co-60	2.0 ± 0.8 E+01	Less than 7.0 E+00
Ru-106	Less than 5.0 E+01	Less than 5.0 E+01
Sb-125	Less than 3.2 E+01	Less than 2.5 E+01
Cs-137	1.1 ± 0.6 E+01	Less than 8.1 E+00
Ce-144	Less than 4.0 E+01	Less than 4.0 E+01
Tl-208	Less than 7.5 E+00	Less than 7.5 E+00
Pb-212	Less than 2.2 E+01	Less than 2.3 E+01
Pb-214	Less than 3.2 E+01	Less than 2.5 E+01
Bi-214	Less than 3.0 E+01	Less than 2.4 E+01
Ra-226	Less than 2.4 E+02	Less than 2.4 E+02

JAMES RIVER WATER
(picocuries per liter)

	Station Intake	Newport News
Date Collected	9-13-74	9-13-74
<u>Gamma Spectrometry</u>		
K-40	Less than 1.2 E+02	1.7 ± 0.9 E+02
Mn-54	Less than 8.0 E+00	Less than 8.0 E+00
Co-60	Less than 7.0 E+00	Less than 7.0 E+00
Ru-106	Less than 6.4 E+01	Less than 5.0 E+01
Sb-125	Less than 2.5 E+01	Less than 3.0 E+01
Cs-137	Less than 5.1 E+00	Less than 7.5 E+00
Ce-144	Less than 4.8 E+01	Less than 4.0 E+01
Tl-208	Less than 8.7 E+00	Less than 9.0 E+00
Pb-212	Less than 2.2 E+01	Less than 2.4 E+01
Pb-214	Less than 2.5 E+01	Less than 2.5 E+01
Bi-214	Less than 2.5 E+01	Less than 2.5 E+01
Ra-226	Less than 2.4 E+02	Less than 2.4 E+02

JAMES RIVER WATER
(picocuries per liter)

	Hog Island Reserve
Date Collected	9-12-74
Gamma Spectrometry	
K-40	Less than 9.5 E+01
Mn-54	Less than 8.0 E+00
Co-60	Less than 7.0 E+00
Ru-106	Less than 5.0 E+01
Sb-125	Less than 2.5 E+01
Cs-137	Less than 7.2 E+00
Ce-144	Less than 4.0 E+01
Tl-208	Less than 7.5 E+00
Pb-212	Less than 2.3 E+01
Pb-214	Less than 2.5 E+01
Bi-214	Less than 7.2 E+01
Ra-226	Less than 2.4 E+02

JAMES RIVER WATER
(picocuries per liter)

	Newport News	Hog Island Point
Date Collected	11-22-74	11-22-74
<u>Gamma Spectrometry</u>		
Be-7	Less than 2.5 E+01	Less than 2.5 E+01
K-40	2.0 ± 1.8 E+02	Less than 1.5 E+02
Sb-125	Less than 2.5 E+01	Less than 3.6 E+01
Cs-134	Less than 5.0 E+00	7.9 ± 5.5 E+00
Cs-137	Less than 1.2 E+01	Less than 9.6 E+00
Tl-208	Less than 1.5 E+01	Less than 1.0 E+01
Bi-212	Less than 1.0 E+02	1.0 ± 0.8 E+02
Pb-212	Less than 4.0 E+01	Less than 2.8 E+01
Pb-214	Less than 2.5 E+01	Less than 2.5 E+01
Bi-214	3.6 ± 2.7 E+01	Less than 2.0 E+01
Ra-226	Less than 2.5 E+02	Less than 2.8 E+02
Ac-228	Less than 5.0 E+01	Less than 6.9 E+01

JAMES RIVER WATER
(picocuries per liter)

	Station Intake	Station Discharge
Date Collected	11-22-74	11-22-74
Gamma Spectrometry		
Be-7	Less than 2.5 E+01	Less than 2.5 E+01
K-40	Less than 1.5 E+02	Less than 1.5 E+02
Sb-125	Less than 2.5 E+01	Less than 2.5 E+01
Cs-134	Less than 5.0 E+00	Less than 5.0 E+00
Cs-137	Less than 6.6 E+00	Less than 1.0 E+01
Tl-208	Less than 1.0 E+01	Less than 1.1 E+01
Bi-212	Less than 1.0 E+02	Less than 1.0 E+02
Pb-212	Less than 2.4 E+01	Less than 2.0 E+01
Pb-214	Less than 2.5 E+01	Less than 3.0 E+01
Bi-214	Less than 2.0 E+01	Less than 2.8 E+01
Ra-226	Less than 2.5 E+02	Less than 2.6 E+02
Ac-228	Less than 6.6 E+00	Less than 5.0 E+01

JAMES RIVER WATER SAMPLES
(picocuries per liter)

	Chickahominy
Date Collected	11-25-74
<u>Gamma Spectrometry</u>	
Be-7	4.0 ± 2.6 E+01
K-40	8.2 ± 7.9 E+01
Sb-125	Less than 3.0 E+01
Cs-134	Less than 5.0 E+00
Cs-137	Less than 8.7 E+00
Tl-208	Less than 1.0 E+01
Bi-212	Less than 1.0 E+02
Pb-212	Less than 2.6 E+01
Pb-214	Less than 3.0 E+01
Bi-214	2.0 ± 1.9 E+01
Ra-226	Less than 2.7 E+02
Ac-228	Less than 5.0 E+01

JAMES RIVER WATER
SEMI-ANNUAL COMPOSITE
(picocuries per liter)

Enriched Tritium	Chickahominy	Newport News
	230 ± 100	230 ± 100

SILT SAMPLES
(picocuries per gram dry)

	Point of Shoals	Newport News
Date Collected	9-13-74	9-13-74
<u>Gamma Spectrometry</u>		
Be-7	1.4 ± 1.0 E+00	Less than 1.4 E+00
K-40	1.6 ± 0.3 E+01	1.3 ± 0.3 E+01
Cr-51	Less than 2.0 E+00	Less than 2.1 E+00
Mn-54	Less than 1.0 E-01	Less than 1.0 E-01
Co-58	Less than 1.5 E-01	Less than 1.5 E-01
Co-60	Less than 1.8 E-01	Less than 1.5 E-01
Nb-95	Less than 2.0 E-01	Less than 2.0 E-01
Sb-125	Less than 5.6 E-01	Less than 5.0 E-01
Cs-134	Less than 1.0 E-01	Less than 1.0 E-01
Cs-137	3.3 ± 1.3 E-01	2.4 ± 1.4 E-01
Ce-141	Less than 4.0 E-01	Less than 4.0 E-01
Ce-144	Less than 1.5 E+00	Less than 1.5 E+00
Hg-203	Less than 1.5 E-01	Less than 1.5 E-01
Tl-208	4.6 ± 1.6 E-01	4.0 ± 1.5 E-01
Bi-212	Less than 1.5 E+00	Less than 1.8 E+00
Pb-212	1.2 ± 0.4 E+00	1.3 ± 0.4 E+00
Pb-214	1.4 ± 0.4 E+00	9.0 ± 3.6 E-01
Bi-214	1.1 ± 0.4 E+00	7.1 ± 3.0 E-01
Ra-226	Less than 5.8 E+00	Less than 5.6 E+00
Ac-228	Less than 1.0 E+00	7.5 ± 7.4 E-01

SILT SAMPLES
(picocuries per gram dry)

	Chickahominy	Hog Island Point
Date Collected	9-13-74	9-13-74
Gamma Spectrometry		
Be-7	Less than 1.4 E+00	Less than 1.6 E+00
K-40	1.4 ± 0.3 E+01	1.3 ± 0.3 E+01
Cr-51	Less than 2.0 E+00	Less than 2.0 E+00
Mn-54	Less than 1.0 E-01	Less than 1.0 E-01
Co-58	Less than 1.5 E-01	Less than 1.5 E-01
Co-60	Less than 1.5 E-01	Less than 1.5 E-01
Nb-95	Less than 2.0 E-01	Less than 2.0 E-01
Sb-125	Less than 5.0 E-01	Less than 5.4 E-01
Cs-134	Less than 1.0 E-01	Less than 1.0 E-01
Cs-137	1.9 ± 1.4 E-01	8.2 ± 1.8 E-01
Ce-141	Less than 4.6 E-01	Less than 4.4 E-01
Ce-144	Less than 1.5 E+00	Less than 1.5 E+00
Hg-203	Less than 2.5 E-01	Less than 1.5 E-01
Tl-208	4.1 ± 1.9 E-01	4.9 ± 1.6 E-01
Bi-212	Less than 1.5 E+00	1.7 ± 1.3 E+00
Pb-212	1.8 ± 0.5 E+00	1.4 ± 0.4 E+00
Pb-214	1.5 ± 0.4 E+00	1.2 ± 0.4 E+00
Bi-214	1.1 ± 0.3 E+00	9.8 ± 3.8 E-01
Ra-226	Less than 6.4 E+00	Less than 5.8 E+00
Ac-228	2.1 ± 0.8 E+00	1.3 ± 0.7 E+00

SILT SAMPLES
(picocuries per gram dry)

	Station Intake	Station Discharge
Date Collected	9-13-74	9-13-74
<u>Gamma Spectrometry</u>		
Be-7	1.7 ± 1.3 E+00	1.6 ± 1.2 E+00
K-40	1.7 ± 0.5 E+01	1.1 ± 0.3 E+01
Cr-51	Less than 2.0 E+00	Less than 2.0 E+00
Mn-54	1.6 ± 1.2 E-01	Less than 1.0 E-01
Co-58	Less than 1.5 E-01	3.1 ± 1.1 E-01
Co-60	Less than 1.5 E-01	4.0 ± 1.7 E-01
Nb-95	Less than 2.2 E-01	Less than 2.0 E-01
Sb-125	Less than 7.2 E-01	Less than 5.6 E-01
Cs-134	Less than 1.0 E-01	2.4 ± 1.5 E-01
Cs-137	9.1 ± 2.1 E-01	1.1 ± 0.2 E+00
Ce-141	Less than 4.0 E-01	Less than 4.0 E-01
Ce-144	1.6 ± 1.4 E+00	Less than 1.5 E+00
Hg-203	Less than 1.5 E-01	1.9 ± 1.8 E-01
Tl-208	3.4 ± 2.3 E-01	3.0 ± 1.9 E-01
Bi-212	Less than 1.5 E+00	3.5 ± 1.5 E+00
Pb-212	1.7 ± 0.5 E+00	1.8 ± 0.4 E+00
Pb-214	9.7 ± 4.9 E-01	1.2 ± 0.4 E+00
Bi-214	9.4 ± 4.2 E-01	9.7 ± 3.2 E-01
Ra-226	Less than 7.4 E+00	Less than 7.4 E+00
Ac-228	1.2 ± 1.0 E+00	2.2 ± 0.8 E+00

OYSTER SAMPLES
(picocuries per gram wet)

	Point of Shoals
Date Collected	7-2-74
<u>Gamma Spectrometry</u>	
K-40	1.2 ± 0.6 E+00
Co-58	3.0 ± 2.3 E-02
Nb-95	Less than 3.5 E-02
Sb-125	Less than 1.0 E-01
Cs-137	5.8 ± 2.1 E-02
Tl-208	Less than 4.4 E-02
Pb-212	Less than 1.5 E-01
Pb-214	Less than 1.5 E-01
Ra-226	Less than 1.3 E+00

OYSTER SAMPLES
(picocuries per gram wet)

	Newport News	Deep Water Shoals
Date Collected	7-2-74	7-2-74
Gamma Spectrometry		
K-40	1.3 ± 0.6 E+00	Less than 8.2 E-01
Co-58	2.5 ± 1.7 E-02	4.8 ± 3.0 E-02
Nb-95	Less than 3.0 E-02	Less than 3.0 E-02
Sb-125	Less than 1.4 E-01	Less than 1.0 E-01
Cs-137	Less than 3.1 E-02	Less than 4.0 E-02
Tl-208	Less than 4.2 E-02	Less than 4.7 E-02
Pb-212	Less than 1.4 E-01	Less than 1.5 E-01
Pb-214	Less than 1.5 E-01	Less than 1.5 E-01
Ra-226	Less than 1.5 E+00	Less than 1.7 E+00

OYSTER SAMPLES
(picocuries per gram wet)

	Point of Shoals	Deep Water Shoals
Date Collected	9-13-74	9-13-74
<u>Gamma Spectrometry</u>		
K-40	6.6 ± 4.2 E-01	9.0 ± 6.0 E-01
Co-60	Less than 2.5 E-02	Less than 2.5 E-02
Nb-95	Less than 5.0 E-02	Less than 5.1 E-02
I-131	Less than 5.6 E-02	Less than 6.9 E-02
Cs-137	Less than 4.2 E-02	4.1 ± 2.0 E-02
Tl-208	Less than 4.8 E-02	Less than 3.5 E-02
Pb-212	Less than 1.3 E-01	Less than 1.3 E-01
Pb-214	Less than 1.5 E-01	Less than 1.8 E-01
Ra-226	Less than 1.2 E+00	Less than 1.0 E+00

OYSTER SAMPLES
(picocuries per gram wet)

	Newport News
Date Collected	9-4-74
<u>Gamma Spectrometry</u>	
K-40	1.4 ± 0.6 E+00
Co-60	Less than 3.9 E-02
Nb-95	Less than 5.0 E-02
I-131	Less than 5.0 E-02
Cs-137	4.8 ± 2.4 E-02
Tl-208	Less than 3.5 E-02
Pb-212	Less than 1.4 E-01
Pb-214	Less than 1.5 E-01
Ra-226	Less than 1.0 E+00

OYSTER SAMPLES
(picocuries per gram wet)

	Newport News	Deep Water Shoals
Date Collected	11-22-74	11-22-74
Sample Weight (Dry/Wet)	16.0/251.0 g	16.0/212.0 g
<u>Gamma Spectrometry</u>		
K-40	6.9 ± 4.1 E-01	7.1 ± 4.7 E-01
Co-58	3.8 ± 2.1 E-02	Less than 2.0 E-02
Co-60	Less than 3.3 E-02	Less than 3.0 E-02
Ru-103	Less than 1.0 E-02	Less than 1.0 E-02
Ru-106	1.9 ± 1.8 E-01	Less than 1.5 E-01
Cs-134	4.3 ± 2.8 E-02	Less than 3.0 E-02
Cs-137	1.2 ± 0.3 E-01	Less than 4.5 E-02
Ce-144	Less than 1.9 E-01	Less than 1.5 E-01
Pb-212	Less than 9.5 E-02	Less than 1.2 E-01
Pb-214	Less than 1.2 E-01	Less than 1.5 E-01
Bi-214	Less than 1.0 E-01	Less than 1.3 E-01
Ra-226	Less than 1.0 E+00	Less than 1.1 E+00

OYSTER SAMPLES
(picocuries per gram wet)

	Point of Shoals
Date Collected	11-22-74
Sample Weight Dry/Wet	15.0/202.0 g
<u>Gamma Spectrometry</u>	
K-40	1.3 ± 1.0 E+00
Co-58	Less than 2.0 E-02
Co-60	Less than 3.0 E-02
Ru-103	Less than 1.0 E-02
Ru-106	Less than 1.5 E-01
Cs-134	Less than 3.0 E-02
Cs-137	7.4 ± 4.6 E-02
Ce-144	Less than 1.5 E-01
Pb-212	Less than 2.6 E-01
Pb-214	Less than 1.0 E-01
Bi-214	Less than 2.1 E-01
Ra-226	Less than 1.0 E+00

OYSTER SAMPLES
(picocuries per gram wet)

	Newport News
Date Collected	12-6-74
Sample Weight Dry/Wet	24.5/301.5 g
Gamma Spectrometry	
K-40	9.0 ± 4.2 E-01
Co-58	Less than 2.0 E-02
Co-60	Less than 3.0 E-02
Ru-103	1.4 ± 1.3 E-02
Ru-106	Less than 1.5 E-01
Cs-134	Less than 3.0 E-02
Cs-137	2.6 ± 2.1 E-02
Ce-144	Less than 1.5 E-01
Pb-212	Less than 7.5 E-02
Pb-214	Less than 1.0 E-01
Bi-214	Less than 1.0 E-01
Ra-226	Less than 1.0 E+00

CLAM SAMPLES
(picocuries per gram wet)

	Hog Island Point	Station Discharge
Date Collected	7-2-74	7-2-74
Sample Weight Wet/Dry	226.5/19.9 g	79.6/7.2 g
<u>Gamma Spectrometry</u>		
K-40	4.9 ± 4.1 E-01	Less than 1.4 E+00
Mn-54	5.6 ± 2.8 E-02	Less than 6.9 E-02
Co-57	Less than 2.8 E-02	Less than 7.8 E-02
Co-58	1.2 ± 0.4 E-01	9.9 ± 4.7 E-02
Co-60	Less than 4.5 E-02	1.3 ± 0.8 E-01
Nb-95	Less than 3.7 E-02	Less than 1.0 E-01
Zr-95	Less than 3.6 E-02	Less than 1.0 E-01
Sb-125	Less than 1.3 E-01	Less than 3.6 E-01
I-131	Less than 4.7 E-02	Less than 1.3 E-01
Cs-137	6.0 ± 2.8 E-02	Less than 8.5 E-02
Tl-208	Less than 4.6 E-02	Less than 1.3 E-01
Bi-212	Less than 2.6 E-01	Less than 7.2 E-01
Pb-212	Less than 1.0 E-01	Less than 3.0 E-01
Ra-226	Less than 1.1 E+00	Less than 3.0 E+00
Ac-228	Less than 2.9 E-01	Less than 8.0 E-01

CLAM SAMPLES
(picocuries per gram wet)

	Chickahominy	Lawnes Creek
Date Collected	7-2-74	7-2-74
Sample Weight Wet/Dry	126.5/11.5 g	189.2/18.5 g
<u>Gamma Spectrometry</u>		
K-40	5.9 ± 5.7 E-01	6.9 ± 4.4 E-01
Mn-54	Less than 4.3 E-02	Less than 2.7 E-02
Co-57	Less than 4.9 E-02	Less than 3.0 E-02
Co-58	Less than 3.1 E-02	Less than 1.9 E-02
Co-60	Less than 6.5 E-02	Less than 4.8 E-02
Nb-95	Less than 6.4 E-02	Less than 4.0 E-02
Zr-95	Less than 6.3 E-02	Less than 3.9 E-02
Sb-125	Less than 2.2 E-01	Less than 1.4 E-01
I-131	Less than 8.2 E-02	Less than 5.1 E-02
Cs-137	Less than 6.0 E-02	Less than 4.8 E-02
Tl-208	Less than 8.0 E-02	Less than 4.9 E-02
Bi-212	Less than 4.5 E-01	4.2 ± 2.8 E-01
Pb-212	Less than 2.0 E-01	Less than 1.2 E-01
Ra-226	Less than 1.9 E+00	Less than 1.3 E+00
Ac-228	Less than 5.0 E-01	Less than 3.1 E-01

CLAM SAMPLES
(picocuries per gram wet)

	Jamestown
Date Collected	7-2-74
Sample Weight Wet/Dry	184.9/16.0 g

Gamma Spectrometry

K-40	Less than 7.7 E-01
Mn-54	Less than 3.1 E-02
Co-57	Less than 3.5 E-02
Co-58	Less than 2.3 E-02
Co-60	Less than 6.2 E-02
Nb-95	Less than 4.6 E-02
Zr-95	Less than 4.5 E-02
Sb-125	Less than 1.6 E-01
I-131	Less than 5.9 E-02
Cs-137	2.4 ± 2.4 E-02
Tl-208	Less than 4.9 E-02
Bi-212	Less than 3.2 E-01
Pb-212	Less than 1.2 E-01
Ra-226	Less than 1.4 E+00
Ac-228	Less than 3.3 E-01

CLAM SAMPLES
(picocuries per gram wet)

	Hog Island Point	Chickahominy
Date Collected	9-13-74	9-13-74
Sample Weight (Wet/Dry)	185.0/13.0 g	202.0/13.0 g
<u>Gamma Spectrometry</u>		
K-40	4.9 ± 4.1 E-01	Less than 7.2 E-01
Mn-54	Less than 3.6 E-02	Less than 3.6 E-02
Co-58	1.2 ± 0.4 E-01	Less than 1.7 E-02
Co-60	6.2 ± 3.5 E-02	Less than 3.9 E-02
Ru-106	Less than 2.0 E-01	Less than 2.0 E-01
Sb-125	Less than 1.7 E-01	Less than 1.7 E-01
Cs-134	Less than 8.4 E-02	Less than 5.4 E-02
Cs-137	7.0 ± 4.4 E-02	5.4 ± 3.6 E-02
Ce-144	Less than 1.0 E-01	Less than 1.0 E-01
Tl-208	Less than 5.5 E-02	Less than 4.8 E-02
Pb-212	Less than 1.4 E-01	Less than 1.2 E-01
Pb-214	1.2 ± 1.0 E-01	Less than 1.5 E-01
Bi-214	Less than 1.6 E-01	Less than 2.3 E-01
Ra-226	Less than 1.2 E+00	Less than 1.2 E+00

CLAM SAMPLES
(picocuries per gram wet)

	Lawnes Creek
Date Collected	9-13-74
Sample Weight (Wet/Dry)	260.0/17.0 g
<u>Gamma Spectrometry</u>	
K-40	5.8 ± 3.8 E-01
Mn-54	Less than 2.7 E-02
Co-58	Less than 1.3 E-02
Co-60	Less than 3.2 E-02
Ru-106	1.9 ± 1.6 E-01
Sb-125	Less than 1.7 E-01
Cs-134	Less than 4.1 E-02
Cs-137	2.6 ± 2.0 E-02
Ce-144	Less than 7.6 E-02
Tl-208	Less than 3.7 E-02
Pb-212	Less than 1.1 E-01
Pb-214	Less than 1.1 E-01
Bi-214	Less than 2.3 E-01
Ra-226	Less than 8.2 E-01

CLAM SAMPLES
(picocuries per gram wet)

	Jamestown	Station Discharge
Date Collected	9-13-74	9-13-74
Sample Weight (Wet/Dry)	235.0/16.0 g	193.0/14.0 g
<u>Gamma Spectrometry</u>		
K-40	4.0 ± 3.8 E-01	Less than 4.8 E-01
Mn-54	Less than 2.9 E-02	8.6 ± 3.3 E-02
Co-58	1.4 ± 1.4 E-02	4.8 ± 0.8 E-01
Co-60	Less than 3.2 E-02	2.4 ± 0.5 E-01
Ru-106	Less than 1.6 E-01	Less than 1.8 E-01
Sb-125	Less than 1.7 E-01	Less than 1.6 E-01
Cs-134	Less than 4.4 E-02	6.1 ± 4.1 E-02
Cs-137	Less than 4.4 E-02	1.3 ± 0.4 E-01
Ce-144	Less than 8.1 E-02	Less than 9.3 E-02
Tl-208	Less than 3.9 E-02	Less than 4.5 E-02
Pb-212	Less than 1.2 E-01	Less than 1.3 E+00
Pb-214	Less than 1.2 E-01	1.6 ± 1.2 E-01
Bi-214	8.6 ± 6.5 E-02	3.0 ± 2.3 E-01
Ra-226	Less than 9.8 E-01	Less than 1.1 E+00

CLAM SAMPLES
(picocuries per gram wet)

	Jamestown	Station Discharge
Date Collected	11-22-74	11-22-74
Sample Weight Wet/Dry	279.0/13.0 g	164.0/8.0 g
<u>Gamma Spectrometry</u>		
K-40	4.1 ± 2.9 E-01	Less than 6.5 E-01
Co-58	Less than 4.6 E-02	6.1 ± 3.8 E-02
Co-60	Less than 4.9 E-02	Less than 5.8 E-02
Cs-134	1.9 ± 1.7 E-02	Less than 2.4 E-02
Cs-137	3.8 ± 1.7 E-02	6.8 ± 2.6 E-02
Ce-141	Less than 6.8 E-02	Less than 9.8 E-02
Tl-208	Less than 4.1 E-02	Less than 6.0 E-02
Bi-212	Less than 2.3 E-01	Less than 3.8 E-01
Pb-212	Less than 8.5 E-02	Less than 1.4 E-01
Pb-214	Less than 1.4 E-01	Less than 2.3 E-01
Bi-214	Less than 1.1 E-01	Less than 3.9 E-01
Ra-226	Less than 9.0 E-01	Less than 1.5 E+00
Ac-228	Less than 2.0 E-01	Less than 3.3 E-01

CLAM SAMPLES
(picocuries per gram wet)

	Hog Island Point	Lawnes Creek
Date Collected	11-22-74	11-22-74
Sample Weight Wet/Dry	216.0/12.0 g	271.0/20.0 g
<u>Gamma Spectrometry</u>		
K-40	7.8 ± 4.2 E-01	6.5 ± 3.4 E-01
Co-58	4.4 ± 2.6 E-02	3.3 ± 1.7 E-02
Co-60	Less than 4.3 E-02	Less than 3.2 E-02
Cs-134	Less than 1.6 E-02	Less than 9.8 E-03
Cs-137	5.0 ± 2.8 E-02	5.0 ± 2.4 E-02
Ce-141	Less than 6.5 E-02	Less than 3.9 E-02
Tl-208	Less than 4.5 E-02	Less than 2.7 E-02
Bi-212	Less than 2.5 E-01	Less than 1.5 E-01
Pb-212	Less than 1.1 E-01	Less than 8.7 E-02
Pb-214	Less than 1.5 E-01	Less than 9.0 E-02
Bi-214	Less than 1.2 E-01	Less than 7.2 E-02
Ra-226	Less than 9.8 E-01	Less than 5.9 E-01
Ac-228	Less than 2.2 E-01	Less than 1.3 E-01

CLAM SAMPLES
(picocuries per gram wet)

	Chickahominy
Date Collected	11-25-74
Sample Weight Wet/Dry	175.0/12.0 g

Gamma Spectrometry

K-40	Less than 5.7 E-01
Co-58	Less than 5.0 E-02
Co-60	Less than 3.8 E-02
Cs-134	Less than 1.6 E-02
Cs-137	4.8 ± 2.5 E-02
Ce-141	Less than 6.5 E-02
Tl-208	Less than 4.5 E-02
Bi-212	2.9 ± 2.7 E-01
Pb-212	Less than 1.4 E-01
Pb-214	Less than 1.5 E-01
Bi-214	Less than 1.4 E-01
Ra-226	Less than 1.3 E+00
Ac-228	2.2 ± 2.2 E-01

EEL SAMPLES
(picocuries per gram wet)

	Station Intake
Date Collected	8-30-74
Sample Weight Dry/Wet	14.0/30.0 g
Gamma Spectrometry	
K-40	6.2 ± 4.6 E+00
Sb-125	Less than 1.6 E+00
Cs-137	Less than 3.3 E-01
Pb-212	Less than 1.6 E+00

FISH SAMPLE
(picocuries per gram wet)

	Catfish from Station Intake
Date Collected	8-30-74
Sample Weight Dry/Wet	18.5/37.5 g
Gamma Spectrometry	
K-40	4.4 ± 4.0 E-01
Cs-137	Less than 2.8 E-01
Pb-212	Less than 1.3 E+00
Ra-226	Less than 1.5 E+01

CRAB SAMPLE
(picocuries per gram wet)

	Station Intake
Date Collected	7-8-74
<u>Gamma Isotopic Analysis</u>	
K-40	Less than 1.2 E+00
Co-58	Less than 5.1 E-02
Cs-137	Less than 4.6 E-02
Tl-208	Less than 4.4 E-02
Pb-212	1.0 ± 0.8 E-01
Ra-226	2.0 ± 0.9 E+00

CRAB SAMPLE
(picocuries per gram wet)

	Station Intake
Date Collected	8-25-74
Sample Weight Dry/Wet	32.5/254.1 g
Gamma Spectrometry	
K-40	1.3 ± 0.7 E+00
Co-57	4.7 ± 3.8 E-02
Co-58	3.2 ± 2.7 E-02
Cs-134	5.5 ± 2.8 E-02
Cs-137	4.8 ± 2.2 E-02
Pb-212	Less than 1.8 E-01

CONCLUSION

The results of the Environmental Monitoring Program for Surry Power Station show conformance with Technical Specifications regarding public exposure. The data also demonstrate the ability to reveal low level concentrations of a number of radioactive materials released through plant effluent.

The presence of specific radionuclides can be related to the effluent path from the Power Station. The airborne effluent is demonstrated through thermoluminescent dosimetry, air samples, precipitation samples, crop samples, soil samples, and milk samples. Liquid effluent is exhibited through analysis of water, silt, fish, oyster, clam, and crab samples.

Environmental dosimeters suggested an increase above background however the balance of dosimetry data could not demonstrate definitive additional population exposure above background levels. Airborne activity was quite apparent however a number of conditions permit exclusion of cerium-144, zirconium and niobium-95, and probably cesium-137 as plant related. The first three isotopes predominated during the last three quarters of 1974. Airborne chromium-51 levels were very low, but may be plant related; concentrations of manganese-54 and cerium-141 were also observed. The precipitation composites appear to relate to gross beta air sample data. Soil samples showed levels of cesium-137 and antimony-125 that are typical of previous data and are probably related to world wide fallout.

Milk samples showed iodine-131 that is not plant related. The strontium-90 and cesium-137 levels showed typical milk concentrations for world wide fallout. The gamma emmitting isotopes observed in milk generally did not relate to air particulate sample activity however one can look at the third quarter samples only and possibly observe some relationship.

Isotope	Airborne Concentration (Five station composite)	Milk Concentration
Cr-51	9.9 ± 6.0 E-03 pCi/M^3	97 ± 90 pCi/1 (Epps)
Mn-54	7.9 ± 4.8 E-04	11 ± 8 (Epps) 16 ± 12 (Lee Hall)
Zr-95	3.5 ± 1.7 E-03	20 ± 17 (Colonial Pkwy)
Cs-137	1.9 ± 0.9 E-03	22 ± 12 (Judkins) 32 ± 16 (Judkins) 12 ± 12 (Colonial Pkwy) 23 ± 14

None of the airborne cerium-144 was observed in milk, and the cobalt isotopes potentially in milk were not seen in air sample data.

The liquid effluent path documentation begins with James River samples. Because of the great dilution and lack of accumulation, these samples are probably the leas sensitive. Only one Chickahominy samply showed appreciable activity including manganese-54, cobalt-60, and cesium-137. A single November sample collected at Hog Island Point showed cesium-134. Some relationship can be shown between concurrent sampling locations for silt, clams, oysters, and crabs:

Station Discharge

Isotope	Silt (pCi/g)	Clams (pCi/g)	
Mn-54	1.6 ± 1.2 E-01	8.6 ± 3.3 E-02	(September)
Co-58	3.1 ± 1.1 E-01	9.9 ± 4.7 E-02	(July)
		4.8 ± 0.8 E-01	(September)
		6.1 ± 3.8 E-02	(November)
Co-60	4.0 ± 1.7 E-01	1.3 ± 0.8 E-01	(July)
		2.4 ± 0.5 E-01	(September)
Cs-134	2.4 ± 1.5 E-01	6.1 ± 4.1 E-02	(September)
Cs-137	1.1 ± 0.2 E+00	1.3 ± 0.4 E-01	(September)
		6.8 ± 2.6 E-02	(November)

Station Intake

Isotope	Silt	Crab (all samples Aug., 1974)
Mn-54	1.6 ± 1.2 E-01	(Not observed)
Co-57	(Not observed)	4.7 ± 3.8 E-02
C -58	(Not observed)	3.2 ± 2.7 E-02

Station Intake (con't)

Isotope	Silt	Crab (all samples Aug., 1974)
Cs-134	(Not observed)	5.5 ± 2.8 E-02
Cs-137	9.1 ± 2.1 E-01	4.8 ± 2.2 E-02

Newport News

Isotope	Silt	Oyster	
Co-58	(Not observed)	2.5 ± 1.7 E-02	(July)
Cs-134	(Not observed)	4.3 ± 2.8 E-02	(November)
Cs-137	2.4 ± 1.4 E-01	4.8 ± 2.4 E-02	(September)
		1.2 ± 0.3 E-01	(November)
		2.6 ± 2.1 E-02	(December)

Relationships are suggested however validity of concentration factors will require analyses of many future samples for any statistical conclusion. Dose to the potential consumer of clams, crabs, and oysters remains extremely low.

5.0 STATION RADIOACTIVE EFFLUENT RELEASES AND SOLID RADIOACTIVE WASTE

Data on radioactive effluents for the second six (6) months of 1974 are herewith reported in the form given in Appendix A of U.S.A.E.C. Safety Guide 21, dated December 29, 1971.

Liquid concentrations were measured at their source prior to discharge to determine total activities released. Percent of technical specification limit for activity released is based on the limits specified in 10CFR20, Appendix B, for unrestricted areas and takes into account the nuclides present, excluding tritium, and are calculated using data averaged over the actual time of discharges only and hence do not take credit for dilution water flow available at those time when releases were not being made.

Halogen and particulate concentrations were measured by continuous samples of all discharges near their points of release. Gaseous concentrations were measured at the source prior to discharge to determine total activities released.

Percent of applicable limit for airborne releases are based on the limits specified in 10CRF20, Appendix B.

REPORT OF RADIOACTIVE EFFLUENTS
TECH. SPEC. 6.6.A.6 & 7

Facility: Surry Power Station Docket: 50-280 and 50-281 Year: 1974

I. LIQUID RELEASES	UNITS	MONTHS JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.	TOTAL	± ERROR
1. Gross Radioactivity (B.Y.)									
a) Total release	Curies	5.44E-1	1.32E-0	ISOTOPIC ANALYSIS			-		
b) Average concentration released	µCi/ml	2.76E-9	6.87E-9	-	-	-	-		
c) Maximum concentration released	µCi/ml	6.76E-9	1.00E-8	-	-	-	-		
2. Tritium									
a) Total released	Curies	6.19E+0	1.65E+1	2.87E+1	1.32E+1	9.46E+0	8.72E+0	8.28E+1	7.04E+0
b) Average concentration released	µCi/ml	3.14E-8	8.59E-8	1.42E-7	1.44E-7	1.34E-7	8.47E-8		
3. Dissolved Noble Gases									
a) Total release	Curies	3.37E-1	6.31E-1	1.90E+0	3.63E+0	1.31E-1		6.63E+0	5.64E-1
b) Average concentration released	µCi/ml	7.08E-9	3.45E-8	5.78E-9	3.88E-8	1.85E-9			
4. Gross Alpha Radioactivity									
a) Total release	Curies	-0-	-0-	-0-	4.70E-6	2.27E-6	1.25E-6	8.22E-6	8.22E-6
b) Average Concentration released	µCi/ml	-0-	-0-	-0-	5.02E-14	3.21E-14	1.22E-14		
5. Volume Of Liquid To Discharge Canal	Liters	9.89E+6	1.06E+7	1.91E+7	1.46E+7	1.27E+6	3.03E+6	5.84E+7	2.05E+6
6. Volume of Dilution Water	Liters	1.97E+11	1.92E+11	2.01E+11	9.36E+10	7.08E+10	1.03E+11	8.57E+11	3.00E+10
7. Isotopes Released MPC µCi/ml	Curies								
Ba + La - 140 2×10^{-5}									
Sr-89 3×10^{-6}		7.63E-3	1.97E-3	3.28E-3	2.43E-3	1.36E-3	3.06E-3	1.97E-2	
I-131 3×10^{-7}		1.70E-1	5.24E-1	7.38E+0	2.22E+0	5.32E-1	3.48E-3	1.08E+1	9.18E-1
Xe-133 3×10^{-7}		3.37E-1	6.31E-1	1.79E+0	3.63E+0	1.31E-1		6.52E+0	5.54E-1
Xe-135 1×10^{-7}				1.11E-1				1.11E-1	9.44E-3
Cs-137 2×10^{-5}		1.90E-1	8.47E-1	1.98E+0	1.13E+0	1.88E+0	6.18E-1	6.65E+0	5.65E-1
Cs-134 9×10^{-6}		7.17E-2	4.16E-1	1.12E+0	6.25E-1	1.12E+0	3.17E-1	3.67E+0	3.12E-1
Co-60 3×10^{-5}		2.27E-2	1.74E-2	3.74E-1	1.11E-1	2.27E-1	1.15E-1	8.67E-1	7.37E-2
Co-58 9×10^{-5}		5.15E-2	1.23E-2	8.16E-1	2.91E-1	4.06E-1	1.07E-1	1.68E+0	1.43E-1
I-133 1×10^{-6}				4.63E+0	4.26E-2			4.67E+0	3.97E-1
Mn-54 1×10^{-4}		1.43E-4	2.07E-3	9.75E-2	6.32E-2	1.51E-1	3.39E-2	3.48E-1	2.96E-2
Zn-65 1×10^{-4}									
Sr-90 3×10^{-7}		2.25E-4	1.08E-4	1.92E-4	1.63E-4	1.09E-4	2.42E-4	1.04E-3	
C-14 8×10^{-4}		4.36E-4	1.46E-4	5.50E-4	8.38E-5	5.07E-5	1.54E-4	1.42E-3	
8. Percent Of Technical Specification Limit For Activity Released (10CFR20)	%	2.98E-1	9.57E-1	1.47E+1	8.10E+0	2.83E+0	8.24E-2		

REPORT OF RADIOACTIVE EFFLUENTS

Facility: Surry Power Station Docket: 50-280 and 50-281 Year: 1974

II. AIRBORN RELEASES

	UNITS	MONTHS JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.	TOTAL	± ERROR
1. Total Noble Gases	Curies	1.37E+2	1.22E+4	3.74E+4	4.70E+3	5.13E+0	2.86E-2	5.44E+4	4.63E+3
2. Total Halogens	Curies	5.58E-3	6.17E-3	3.48E-2	2.00E-2	3.65E-3	5.65E-4	7.08E-2	6.02E-3
3. Total Particulate Gross Radioactivity (B.Y.)	Curies	2.31E-3	1.59E-3	2.78E-3	1.23E-3	8.46E-4	4.74E-4	9.23E-3	7.85E-4
4. Total Tritium	Curies	2.75E+1	3.04E+0	2.56E+0	1.26E+0	-	1.23E+0	3.56E+1	3.03E+0
5. Total Particulate Gross Alpha Radioactivity	Curies	5.35E-5	3.27E-2	6.88E-5	1.06E-4	4.82E-5	3.55E-5	3.30E-2	2.81E-3
6. Maximum Noble Gas Release Rate	µCi/sec	1.75E+4	9.46E+4	1.56E+4	9.88E+3	5.71E+3	5.18E-1		
7. Percent of Applicable Limit For 10CRF20:									
a) Noble gases	%	8.21E-2	7.52E+0	2.41E+1	2.93E+0	3.30E-3	1.78E-5		
b) Halogens	%	1.04E-2	1.15E-2	6.72E-2	3.73E-2	7.04E-3	1.06E-3		
c) Particulates	%	1.44E-3	9.89E-4	1.79E-3	1.15E+1	8.16E-5	6.84E-4		
8. Isotope Released:	Curies								
a) Particulates									
Co-58	Curies	9.28E-5	4.54E-4	8.34E-5	-	3.04E-5	5.03E-4	1.16E-3	9.89E-5
Ba-LA-140									
Sr-90		5.00E-12	1.30E-12	1.20E-12	-	1.80E-12	1.30E-12	1.06E-11	
Co-60	Curies	1.22E-4	8.12E-4	2.74E-7	-	5.77E-8	2.28E-4	1.16E-3	9.88E-5
Sr-89									
Mn-54	Curies		3.74E-2					3.74E-2	3.18E-3
b) Halogens									
I-131	Curies	5.04E-3	4.30E-3	1.90E-2	1.98E-2	3.65E-3	5.65E-4	5.24E-2	4.45E-3
I-133	Curies	4.22E-4	1.19E-3	1.11E-2	2.23E-4	-		1.29E-2	1.10E-3
I-135	Curies	6.15E-5	4.64E-4	3.41E-3				3.94E-3	3.35E-4
I-132	Curies	1.37E-5	1.93E-4	1.23E-3				1.44E-3	1.22E-4
c) Gases									
Kr-85	Curies		8.12E+0					8.12E+0	6.90E-1
Xe-133	Curies	1.34E+2	1.20E+4	3.72E+4	4.69E+3	5.13E+0	2.86E-2	5.40E+4	4.59E+3
Kr-88	Curies	2.80E-1	4.46E+0	1.46E+1				1.93E+1	1.64E+0
Kr-87	Curies	8.64E-2	7.44E+0	7.41E+0				1.49E+1	1.27E+0
Kr-85m	Curies	8.04E-2	4.22E+0	1.55E+1				1.98E+1	1.68E+0
Xe-138									
Xe-135m	Curies		1.11E+1	5.56E+1				6.67E+1	5.67E+0

REPORT OF RADIOACTIVE EFFLUENTS

Facility: Surry Power Station Docket: 50-280 and 50-281 Year: 1974

II. AIRBORN RELEASES	UNITS	MONTHS JULY	AUGUST	SEPT.	OCT.	NOV.	DEC.	TOTAL	± ERROR
c) Gases Continued									
Xe-135	Curies	2.56E+0	1.15E+2	8.72E+1	1.03E+1			2.15E+2	1.83E+1
Ar-41	Curies		5.04E+0	1.00E+1	4.48E-5			1.50E+1	1.28E+0
Others As Appropriate (Specify)									
Xe-133M	Curies		7.02E-2	2.53E+0				2.60E+0	2.21E-1
I-134	Curies	3.79E-5	2.64E-5	7.04E-5				1.35E-4	1.14E-5
Cs-137	Curies		6.05E-4	5.89E-6		2.14E-7	1.10E-3	1.71E-3	1.45E-4
Cs-138			7.92E+0	4.15E-4				7.92E+0	6.73E-1
Cs-134						8.51E-8	1.58E-8	1.01E-7	8.58E-9
III. SOLID RADIOACTIVE WASTE DISPOSAL									
1. a) Total Amount Solid Waste Packaged	FT^3	1.53E+3	1.35E+4*	6.7 E+3	4.99E+3	2.0 E+3	2.26E+3	3.10E+4	
b) Estimated Total Activity	Curies	1.19E+0	8.37E+0	7.89E-1	1.66E+0	5.06E-1	1.02E+1	2.27E+1	
c) Date Of Shipment And Disposition		Morehead Ky.	Morehead Ky.	Morehead Ky.	Morehead Ky.	Barwell S.C.	Barwell S.C.		
		7-16-74	8-01-74	9-17-74	-	11-1-74	12-6-74		
		7-18-74	8-02-74			11-8-74	12-10-74		
		7-31-74	8-09-74	Barwell	Barwell	11-19-74	12-18-74		
			8-15-74	S.C.	S.C.	11-26-74	12-20-74		
			8-19-74	9-09-74	10-3-74				
				9-11-74	10-8-74				
			Barwell	9-12-74	10-10-74				
			S.C.	9-14-74	10-12-74				
			8-10-74	9-17-74	10-15-74				
		(2)	8-13-74	9-23-74	10-19-74				
			8-14-74	9-26-74	10-22-74				
			8-15-74						
			8-16-74						
			8-22-74						
			8-25-74						
			8-28-74						
		(2)	8-29-74						
			8-31-74						

* Total included 668 Ft^3 of Liquid Waste Shipped to Barnwell, S.C.

6.0 FUEL SHIPMENTS

Fourteen (14) shipments of reactor fuel containing a total of one hundred and four (104) assemblies have been received during the reporting period. One (1) shipment of new fuel containing one (1) assembly was shipped from the station.

A summary of the fuel shipments received and sent is tabulated in Table 6.0-1.

TABLE 6.0-1

FUEL SHIPMENT RECEIVED

ANSI ASSEMBLY NUMBER	ENRICHMENT	DATE
LMOOTK	2.60	8-07-74
LMOOTJ	2.60	8-07-74
LMOOTG	2.60	8-07-74
LMOOTH	2.60	8-07-74
LMOOTZ	2.60	8-08-74
LMOOTL	2.60	8-08-74
LMOOTP	2.60	8-08-74
LMOOTT	2.60	8-08-74
LMOOTX	3.10	8-14-74
LMOOTQ	2.60	8-14-74
LMOOTN	2.60	8-16-74
LMOOU2	2.60	8-16-74
LMOOU4	2.60	8-15-74
LMOOUO	2.60	8-15-74
LMOOWE	1.85	8-16-74
LMOOW8	1.85	8-16-74
LMOOWG	1.85	8-15-74
LMOOWH	1.85	8-15-74
LMOOWF	1.85	8-16-74
LMOOW5	1.85	8-16-74
LMOOUT	2.60	8-26-74
LMOOTV	3.10	8-26-74
LMOOTS	2.60	8-23-74
LMOOU6	2.60	8-23-74
LMOOU3	2.60	8-23-74
LMOOTM	2.60	8-23-74
LMOOWD	1.85	8-22-74
LMOOWA	1.85	8-22-74
LMOOW9	1.85	8-23-74
LMOOW3	1.85	8-23-74
LMOOVZ	1.85	8-22-74
LMOOVY	1.85	8-22-74
LMOOTW	2.60	8-28-74
LMOOTR	3.10	8-28-74
LMOOU5	2.60	8-28-74
LMOOU9	2.60	8-28-74
LMOOU6	2.60	8-28-74
LMOOU7	2.60	8-28-74
LMOOW6	1.85	8-28-74
LMOOW7	1.85	8-28-74
LMOOW8	1.85	8-29-74
LMOOW4	1.85	8-29-74
LMOOWC	1.85	8-28-74
LMOOWO	1.85	8-28-74
LMOO8A	3.35	8-29-74
LMOO73	3.35	8-29-74
LMOOW7	1.85	8-29-74
LMOO8C	3.35	8-30-74
LMOOWG	1.85	8-30-74
LMOOWO	1.85	8-29-74
LMOO8K	3.35	8-30-74
LMOO89	3.35	8-30-74
LMOO71	3.35	8-30-74
LMOOWH	1.85	8-30-74
LMOO7V	2.60	8-30-74
LMOO7Z	2.60	8-30-74
LMOOTY	2.60	9-03-74
LMOOUV	2.60	9-03-74
LMOOUC	2.60	9-04-74
LMOOUU	2.60	9-04-74
LMOOU9	2.60	9-04-74
LMOOUN	2.60	9-04-74
LMOOUR	2.60	9-03-74
LMOOUT	2.60	9-03-74
LMOOUF	2.60	9-04-74
LMOOUX	2.60	9-04-74
LMOOTU	2.60	9-04-74
LMOOUP	2.60	9-04-74
LMOOWP	1.85	9-03-74
LMOO8L	3.35	9-03-74

TABLE 6.0-1 (Con't)

FUEL SHIPMENT RECEIVED

ANSI ASSEMBLY NUMBER	ENRICHMENT	DATE
LM00CB	3.35	9-03-74
LM008M	3.35	9-03-74
LM007Y	3.35	9-03-74
LM0075	2.60	9-03-74
LM008G	3.35	9-03-74
LM00VY	1.85	9-03-74
LM0087	3.35	9-04-74
LM00W4	1.85	9-04-74
LM0070	2.60	9-04-74
LM00WC	1.85	9-04-74
LM00V1	3.10	9-06-74
LM00UY	2.60	9-06-74
LM00V6	3.10	9-06-74
LM00US	2.60	9-06-74
LM00UW	3.10	9-06-74
LM00UE	2.60	9-06-74
LM00V9	3.10	9-05-74
LM00V3	2.60	9-05-74
LM00UD	2.60	9-05-74
LM00UJ	2.60	9-05-74
LM00V8	3.10	9-06-74
LM00VA	3.10	9-06-74
LM008E	3.35	9-06-74
LM0083	3.35	9-06-74
LM007W	3.35	9-06-74
LM008B	3.35	9-06-74
LM008D	3.35	9-09-74
LM007U	3.35	9-09-74
LM007N	3.35	9-09-74
LM00VC	3.10	9-10-74
LM00VB	3.20	9-10-74
LM00VH	2.60	9-10-74
LM00V7	3.10	9-10-74
LM00VE	3.10	9-10-74
LM00VQ	3.10	9-10-74
LM00U8	2.60	9-11-74
LM00V4	3.10	9-11-74
LM00UZ	3.10	9-10-74
LM00UA	2.60	9-10-74
LM00VM	3.10	9-11-74
LM00VF	3.10	9-11-74
LM0086	3.35	9-11-74
LM007A	3.35	9-11-74
LM003N	2.60	9-11-74
LM0088	3.35	9-11-74
LM00CC	3.35	9-11-74
LM0078	2.60	9-11-74
LM008J	3.35	9-11-74
LM007C	3.35	9-13-74
LM007K	2.60	9-13-74
LM0072	2.60	9-13-74
LM007H	3.35	9-13-74
LM0076	2.60	9-13-74
LM007X	2.60	9-13-74
LM007M	3.35	9-13-74
LM0074	2.60	9-13-74
LM0077	3.35	9-13-74
LM00CD	3.35	9-13-74
LM0085	2.60	9-13-74
LM008F	3.35	9-13-74
LM0082	3.35	9-13-74
LM0075	3.35	9-09-74
LM00CA	3.35	9-09-74
LM007E	3.35	9-09-74
LM007J	3.35	9-09-74
LM0082	3.35	9-09-74
LM007B	3.35	9-09-74
LM007G	3.35	9-09-74
LM0079	3.35	9-09-74
LM00WE	1.85	9-11-74
LM00W8	1.85	9-11-74
LM00W5	1.85	9-11-74

TABLE 6.0-1 (Con't)

FUEL SHIPMENT RECEIVED

ANSI ASSEMBLY NUMBER	ENRICHMENT	DATE
LMOOWD	1.85	9-11-74
LMOOWA	1.85	9-11-74
LMOOW9	1.85	9-11-74
LMOOW3	1.85	9-11-74
LMOOW6	1.85	9-11-74
LMOOUZ	1.85	9-11-74
LMOOW1	1.85	9-11-74
LMOOVD	3.10	9-12-74
LMOOVR	2.60	9-12-74
LMOOVH	3.10	9-12-74
LMOOUM	2.60	9-12-74
LMOOUB	2.60	9-12-74
LMOOVO	2.60	9-12-74
LMOOV2	2.60	9-12-74
LMOOVG	2.60	9-12-74
LMOOV5	3.10	9-20-74
LMOOVL	2.60	9-20-74
LMOOVK	3.10	9-19-74
LMOOVX	2.60	9-19-74
LMOOVN	3.10	9-19-74
LMOOVT	2.60	9-19-74
LMOOVW	2.60	9-19-74
LMOOVV	2.60	9-19-74
LMO158	1.85	10-29-74
LMO157	1.85	10-29-74
LMOOW7	1.85	10-29-74
LMOOW2	1.85	10-29-74

FUEL SHIPPED

ANSI ASSEMBLY NUMBER	ENRICHMENT	DATE
LMOOUB	3.10	12-10-74

7.0 SUMMARY OF OCCURRENCES IN WHICH TEMPERATURE LIMITATIONS ON COOLING WATER DISCHARGE WERE EXCEEDED

The licensee is required to report any deviation from cooling water discharge limitations as specified in Technical Specification 4.14. There were no deviations during this reporting period.

8.0 Changes to Station Organization

The following changes were made in the station operating organization involving positions for which minimum qualifications are specified in Technical Specifications:

1. Mr. N.J. MacArthur was transferred to Richmond effective 9-1-74.
2. Mr. G.E. Kane was promoted to Shift Supervisor effective 10-1-74.
3. The following personnel were transferred to North Anna:

C.T. Phythian	11-01-74
T.A. Harding	11-01-74
G.B. Crisman	11-15-74

4. The following personnel were promoted to Control Room Operator:

J.J. Simpson	8-08-74
V.C. West	10-19-74
J.M. Prucinsky	12-01-74

5. The following personnel were promoted to Assistant Control Room Operator:

H.L. Miller	8-08-74
G.N. Marshall	8-08-74

6. The following personnel terminated their position as Control Room Operator:

R.F. Carlson	7-15-74
J.R. Good	10-18-74

7. The following terminated his position as Assistant Control Room Operator:

M.J. Spies	7-30-74

9.0 OCCUPATIONAL PERSONNEL RADIATION EXPOSURE (T.S.6.6.A.10)

9.1 The whole body exposures for this reporting period have been recorded in Table 9.1-1.

The whole body exposures for the calendar year have been recorded in Table 9.1-2.

9.2 The numbers of personnel receiving more than 500 mrem during this reporting period are listed by duty function in Table 9.2-1.

The numbers of personnel receiving more than 500 mrem during this calendar year are listed by duty function in Table 9.2.2.

OCCUPATIONAL PERSONNEL RADIATION EXPOSURE

TECHNICAL SPECIFICATION 6.6.A.10

JULY - DECEMBER 1974

Dose Range (mrem)	Number of Individuals
No measurable exposure	648
1 - 99	584
100 - 249	175
250 - 499	119
500 - 749	67
750 - 999	37
1000 - 1999	102
2000 - 2999	57
3000 - 3999	6
4000 - 4999	1
Greater than 5000	0
Total Number of Individuals Reported	1,796

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION

LICENSE NOS. DPR-32 and DPR-37

RECORDED ANNUAL WHOLE BODY EXPOSURES
CALENDAR YEAR 1974

Dose Range (mrem)	Number of Individuals
No measurable exposure	1004
1 - 99	870
100 - 249	218
250 - 499	171
500 - 749	95
750 - 999	67
1000 - 1999	176
2000 - 2999	81
3000 - 3999	22
4000 - 4999	8
5000 - 5999	5
6000 - 6999	2
Greater than 7000	0
Total Number of Individuals Reported	2,719

The above information is submitted for the total number of individuals for whom individual monitoring was provided during the calendar year.

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION
LICENSE NOS. DPR-32 and DPR-37

MAN - REM EXPOSURE - JOB FUNCTION
JULY - DECEMBER 1974

Technical Specification 6.6A.10

Dose Range (mrem)	Station Employees			Utility Employees			Sub-Contractual Employees		
	Job Function	Number of Individuals	Total Dose Rem	Job Function	Number of Individuals	Total Dose Rem	Job Function	Number of Individuals	Total Dose Rem
500 - 749	Refueling	5	3.208	Primary System Maintenance	5	3.350	Refueling	3	1.911
	Primary System Mainteance	11	6.985				Primary System Maintenance	31	17.874
	Routine Surveillance	7	4.120				High Energy Line Modif.	5	3.231
750 - 999	Refueling	2	1.667	Primary System Maintenance	6	5.405	Stm. Gen. Eddy Current Test	3	2.873
	Primary System Maintenance	3	2.447				Primary System Maintenance	14	12.722
	Routine Surveillance	3	2.496				High Energy Line Modif.	4	3.489
							Routine Surveillance	2	1.825
1000 - 1999	Refueling	6	9.108	Refueling	4	6.048	Stm. Gen. Eddy Current Test	10	15.149
	Primary System Maintenance	9	12.548	Primary System Maintenance	9	12.290	Primary System Maintenance	44	63.075
	Routine Surveillance	6	7.536				High Energy Line Modif.	4	6.562
							Refueling	10	13.645
2000 - 2999	Refueling	3	7.155		0	0	Stm. Gen. Eddy Current Test	9	21.307
	Primary System Maintenance	4	10.184				Primary System Maintenance	33	94.314
	Routine Surveillance	3	6.827				High Energy Line Modif.	5	10.716
3000 - 3999	Primary System Maintenance	2	6.530		0	0	Primary System Maintenance	4	13.252
4000 - 4999		0	0		0	0	Primary System Maintenance	1	4.663
Greater than 5000		0	0		0	0		0	0

Table 9.2-1

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION
LICENSE NOS. DPR-32 and DPR-37

MAN - REM EXPOSURE - JOB FUNCTION
JANUARY - DECEMBER 1974

Technical Specification 6.6A.10

Dose Range (mrem)	Station Employees			Utility Employees			Sub-Contractual Employees		
	Job Function	Number of Individuals	Total Dose Rem	Job Function	Number of Individuals	Total Dose Rem	Job Function	Number of Individuals	Total Dose Rem
3000 - 3999	Primary System Maintenance	14	46.742	Primary System Maintenance	1	3.112	Primary System Maintenance.	4	12.761
							Stm. Gen. Eddy Current Test	3	10.279
4000 - 4999	Primary System Maintenance	4	19.025	Primary System Maintenance	2	9.056	Primary System Maintenance.	1	4.663
							Stm. Gen. Eddy Current Test	1	4.599
5000 - 5999	Primary System Maintenance	1	5.406		0	0	Primary System Maintenance	1	5.010
	Routine Surveillance	3	16.118						
6000 - 6999	Primary System Maintenance	2	12.658		0	0		0	0
Greater than 7000		0	0		0	0		0	0

Table 9.2-2

10.0 UNIT NO. 1 OPERATING SUMMARY

10.1 POWER GENERATION

10.1.1 A summary of power generated during each month of the reporting period, the total for the reporting period, and the accumulative total since commercial operations commenced is tabulated in Table 10.1.1-1.

10.1.2 A histogram of thermal power versus time for the reporting period is given in Figure 10.1.2-1.

10.1.3 Operating statistics during the period from initial criticality until the date Unit No. 1 was declared commercial (July 1, 1972 to December 21, 1972) are tabulated in Table 10.1.3-1.

10.1.4 A summary of the power generated by the combustion turbines is tabulated in Table 10.1.4-1.

10.1.5 The Maximum Dependable Capacity (MDC) and Reserve Shutdown Hours (RSH) for the Surry Power Station Units are contained in Table 10.1.5-1.

POWER GENERATION SUMMARY
SURRY POWER STATION

UNIT NO. 1

JULY THROUGH DECEMBER, 1974

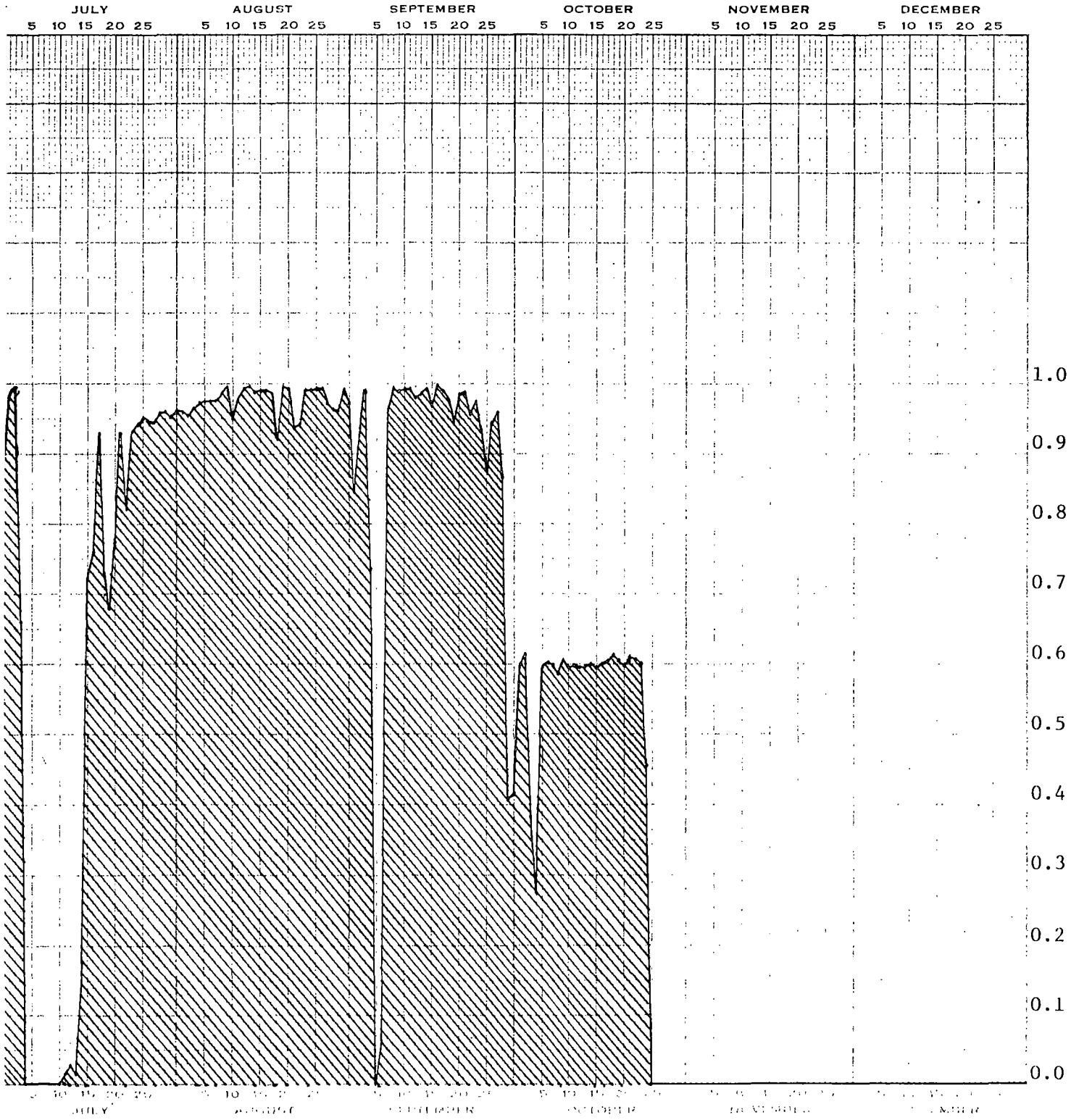
DESCRIPTION	JULY	AUGUST	SEPT.	OCTOBER	NOV.	DEC.	TOTAL FOR PERIOD	* CUMULATIVE TOTAL
1. Gross Thermal Power Generated (MWH)	1,041,653	1,773,564	1,508,172	839,890	0	0	5,163,279	22,055,410
2. Gross Electrical Power Generated (MWH)	344,990	577,745	494,042	260,458	0	0	1,677,235	7,327,763
3. Station Service (MWH)	18,434	29,708	25,935	16,977	0	0	91,054	397,410
4. Net Electrical Power Generated (MWH)	326,556	548,037	468,107	243,481	0	0	1,586,181	6,930,353
5. Number of Hours Reactor Critical (HRS)	550.5	744	654.2	553.3	0	0	2,502	10,724.1
6. Number of Hours Generator On Line (HRS)	476.7	744	649.4	551.8	0	0	2,421.9	10,417.7

* Since Commercial Operation

Table 10.1.1-1

Figure 10.1.2-1

POWER GENERATION HISTOGRAM
UNIT NO. 1
SURRY POWER STATION
JULY THROUGH DECEMBER 1974



YEAR 1974

Table 10.1.3-1

PRE-COMMERCIAL OPERATION STATISTICS
SURRY POWER STATION
UNIT NO. 1

Gross Thermal Power Generated (MWH):	851,218
Gross Electrical Power Generated (MWH):	265,435
Net Electrical Power Generated (MWH):	237,457
Hours Reactor Was Critical	1107.4
Hours Generator On-Line	1076.9

POWER GENERATION

COMBUSTION TURBINES

SURRY POWER STATION

JULY THROUGH DECEMBER, 1974

UNIT NO.	MONTH						TOTAL FOR PERIOD	CUMMULATIVE TOTAL
	JULY	AUGUST	SEPT.	OCTOBER	NOVEMBER	DECEMBER		
GT 191 (MW)	0	0	0	38	869	2,012	2,919	40,810
GT 251 (MW)	1,968	0	0	0	0	0	1,968	59,771
Total (MW)	1,968	0	0	38	869	2,012	4,887	100,581

Readings are in Megawatt hours.

Table 10.1.4-1

MAXIMUM DEPENDABLE CAPACITY (MDC)

RESERVE SHUTDOWN HOURS (RSH)

SURRY POWER STATION

	MDC	RSH
Unit No. 1	824.3 MW Gross 788.3 MW Net	0
Unit No. 2	824.3 MW Gross 788.3 MW Net	0

10.2 OUTAGES

The outages occurring during this reporting period are tabulated in Table 10.2-1.

OUTAGE REPORT
UNIT NO.1
SURRY POWER STATION
JULY THROUGH DECEMBER, 1974

OUT OF SERVICE		RETURN TO SERVICE		NO. HRS. OUT		UNIT STATUS	METHOD OF SHUTDOWN	CAUSE	CORRECTIVE ACTION
TIME	DATE	TIME	DATE	HRS	MIN				
1650	7-03-74	1547	7-11-74	190	57	CSD	Reactor Trip	Exciter malfunction tripped turbine which tripped reactor	Installed temporary exciter.
1617	7-11-74	1645	7-11-74		30	HSD	Reactor Trip	Steam Flow/Feed flow mismatch with low S/G level. Operator error.	Reinstructed operator to method & techniques required for manual steam generator level control during start-up.
1356	7-14-74	1420	7-14-74		24	HSD	Reactor Trip	Steam Flow/Feed flow mismatch with low S/G level. Operator error.	Reinstructed operator to method & tehcniques required for manual steam generator level control during start-up.
0223	7-16-74	0357	7-16-74	1	34	HSD	Reactor Trip	Generator differential lockout trip caused by technician resetting field forcing alarm.	Reinstructed technician about importance of being extremely careful when working protection equipment.
2020	9-04-74	1910	9-06-74	46	50	ISD	Scheduled	Excessive packing leak MOV-1700 (RHR inlet valve).	Repacked MOV-1700.
1016	9-29-74	1048	9-29-74		32	HSD	Turb. Trip & Rx Trip	Hi level in the 6th point feed water heater.	Re-evaluate 6th point level trip setpoints considering secondary transients.
1149	9-29-74	1200	9-29-74		11	HSD	Reactor Trip	Steam Generator lo-lo level result of operator error.	Reinstructed operator to method & techniques required for manual steam generator level control during start-up.

Table 10.2-1

OUTAGE REPORT
UNIT NO. 1
SURRY POWER STATION
JULY THROUGH DECEMBER, 1974

OUT OF SERVICE		RETURN TO SERVICE		NO. HRS. OUT		UNIT STATUS	METHOD OF SHUTDOWN	CAUSE	CORRECTIVE ACTION
TIME	DATE	TIME	DATE	HRS	MIN				
1220	9-29-74	0616	9-30-74	17	56	HSD	Reactor Trip	Safety injection signal resulting from an apparant hi steam line to header ΔP.	Correct MOV-1590 limit switch. Faulty switch unblocked S.I. in isolated loop.
1553	10-03-74	1036	10-04-74	18	43	HSD	Reactor Trip	Safety injection occurred during PT-9 on reactor coolant loop isolation valve.	Revise PT-9 to allow testability while on a 2 loop operation.
2004	10-24-74	Still Out				CSD	Reactor Trip via Turb. Trip	Failure of Permissive P-7 to interlock. Reactor trip via turbine trip below 10% power (blown fuse).	None required. Reactor scheduled off for 1st. Refueling.

Table 10.2-1

10.3 CHANGES IN FACILITY DESIGN

The following changes were implemented on Unit No. 1 during the report period:

1. Design Change 73-38 - Modification to Liquid Waste Disposal Radiation Monitor, RM-LW-108 (Common System)

Description

This change was completed during the month of October. The modification was designed to prevent buildup of "crud" in the sleeve passing through the radiation monitor. The "crud" buildup caused the background level in the area to increase and thus decreased the sensitivity of the monitor. The change consisted of moving the monitor and orienting the sleeve vertically instead of horizontally thus allowing the "crud" to flush through.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of this equipment with regard to the safety evaluation given in the safety analysis is not increased since the function of the monitor is not changed.

b. The possibility for an accident or malfunction of a different type than any previously evaluated is not created since the basic design of the system is the same.

c. The margin of safety as defined in the basis for any technical specification is not reduced by this design change since the system function is unchanged.

Conclusion

This design change does not constitute an unreviewed safety question.

2. Design Change 73-103 - Relocate Main Steam Trip Valve Test Station

Description

This change was completed in December. This modification was a part of the high energy line modification being performed. The purpose of the change was to move the entire test station, which included the control solenoids, from the high energy line (main steam lines) area in safeguards building. The test station was relocated to the auxiliary building. Other considerations for moving the test station were personnel safety while conducting periodic tests and a more suitable environment for the solenoid valves.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report is not increased because neither the functions nor the method of operation of the equipment is changed.

b. The possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report is not created because the equipment is being moved to a safer place.

c. The margin of safety as defined in the basis for any technical specification is not reduced because there are no changes to the equipment or to their functions.

Conclusion

This design change does not constitute an unreviewed safety question.

3. Design Change 73-108 - Auxiliary Feedwater Booster Pump Addition

Description

The Unit No. 1 portion of this design change was completed in December. This design change to the auxiliary feed system is one of several modifications proposed as a result of a study made on the effects of piping system breaks outside containment, FSAR, Appendix D. One of these proposed changes, #73-122, is the cross connecting of auxiliary feed discharges. This means that the unaffected unit is required to supply both unit's steam generators, and hence, the residual heat removal capacity from the existing 110,000 gallon condensate storage tank is halved. To supply the additional emergency feedwater, the following modification was implemented:

The unused 100,000 gallon condensate storage tank was used to supply added feedwater makeup. Two (2) booster pumps were added to supply the suction of the auxiliary feedwater pumps.

Summary of Safety Evaluation

a. The probability of an accident or malfunction of equipment important to safety is not increased with this modification. Sufficient feedwater makeup will be supplied to the steam generators to prevent a loss of main feedwater accident from resulting in adverse

conditions (i.e., water relief from pressurizer safety valves or uncovering of steam generator tube sheets).

b. The possibility of an accident of malfunction other than that already evaluated by the FSAR is not created. The physical location of the booster pumps and lines is such that it would not be affected by high-pressure feed line or steam line breaks. The possibility of serious damage to related equipment due to low water level (steam generators) is decreased.

c. The margin of safety of the auxiliary feed system is not reduced by this design change. Adding an alternate source of makeup feedwater and two (2) booster pumps to each unit assures safe shutdown reliability under all possible conditions.

Conclusion

This design change does not constitute an unreviewed safety question.

4. Design Change 73-113 - Modify Low Pressure Heater Drain Pump Miniflow Line

Description

This modification was completed in November. The purpose of the change was to prevent flashing of steam in the line downstream of the orifice and subsequent erosion of the line. A flash chamber was added downstream of the orifice to preclude aforementioned problems.

Summary of Safety Evaluation

a. The probability of an accident or malfunction of equipment important to safety previously evaluated is not increased. The operation of the L.P. Heater Drain Pump is not safety related.

b. The possibility for an accident or malfunction of a different type than any previously evaluated in the FSAR is not created. A failure of the L.P. Heater Drain Pump would cause the drains to be diverted to the condenser with a resulting loss of secondary efficiency.

c. The margin of safety as defined in the basis for any technical specification is not reduced. The operation of the L.P. Heater Drain Pump is not a limiting condition for operation.

Conclusion

An unreviewed safety question does not exist as the change is to the miniflow line of the L.P. Heater Drain Pump which is not a safety system.

5. Design Change 73-120 - Excess Flow Instrumentation for Steam Generator Blowdown

Description

This modification was completed in December as a part of the high energy line modifications. This change consisted of installing a flow orifice in each steam generator blowdown line with associated vent solenoids to shut off the inside containment isolation valves. An alarm shared by each blowdown line indicates high flow in the steam generator blowdown lines.

Upon high flow indication, 350 gpm, the associated solenoid vents and closes the inside containment isolation valve.

Summary of Safety Evaluation

a. The probability of an accident or malfunction of equipment important to safety, previously evaluated, is not increased. The design change allows another method of closing the blowdown lines without impairing the system as it is at present.

b. The possibility for an accident or malfunction of a different type than any previously evaluated in the FSAR is not created. The design change does not alter the fail safe closed condition of the present system and adds a high blowdown flow rate closure to the system.

c. The margin of safety as defined in the basis for any technical specification is not reduced, as another parameter is added to close the blowdown lines without affecting the existing systems margin of safety.

Conclusion

An unreviewed safety question does not exist. The solenoid valve and control circuit to be added will not be between the existing solenoid valve and the trip valve. Therefore, the present system's ability to vent air and fail safe closed will not be altered. The addition of the flow orifices upstream from the trip valves does not alter the closing of the system.

6. Design Change 73-121 - Refueling Water Storage Tank Cross Connect

Description

The modification was implemented in December. The purpose of this change is to provide the safety injection system of each unit with emergency water from both refueling water storage tanks (RWST). This modification was designed to insure the integrity of the safety injection system in the event of a missile penetrating one of the RWST's. The change consisted of installing a cross connecting pipe between the suction side of the charging pumps of Units 1 and 2 and four trip valves also being added, with two in parallel on each side of the cross connect. One trip valve in each side is opened automatically by an "A" train steam line break (SLB) input from either unit. The other trip valve on each side is opened automatically by a "B" train (SLB) input from either unit.

Summary of Safety Evaluation

a. The probability of an accident or malfunction of equipment important to safety previously evaluated is not increased. The design change allows another source of borated water to the charging pumps.

b. The possibility for an accident or malfunction of a different type than any previously evaluated in the FSAR is not created. The cross connect system is closed during normal operation. Single failure analysis does not affect the present system operation.

c. The margin of safety as defined in the basis for any technical specification is not reduced, as another source of borated water is added to the suction of the charging pumps in case of a steam line break (SLB) accident.

Conclusion

This design change does not constitute an unreviewed safety question.

7. Design Change 73-122 - Auxiliary Feedwater Discharge Cross Connect

Description

This change was completed in November. The modification consisted of cross connecting the discharge piping of the auxiliary feedwater system. In the event of a postulated break either unit's main steam line or main feed lines the other unit's auxiliary feed system will be capable of maintaining both units in a shutdown condition.

Summary of Safety Evaluation

a. The probability of an accident or malfunction of equipment is not increased. The cross connection of feed systems provides for redundancy of emergency feedwater supply in the event of a main steam line or feedwater line break. Since this modification provides for maximum separation of feedwater systems from postulated break points, the probability of accident or malfunction is reduced.

b. The possibility of an accident or malfunction occurring other than those previously evaluated, is not created. The cross connect modification to the auxiliary feed system precludes the possibility of any additional accident or malfunction by providing a necessary source of feedwater in the event of a steam or feed line break.

c. The margin of safety of the system is not reduced by the addition of the auxiliary feed line cross connects. By adding a cross connect feed line, additional assurance is provided that the ultimate requirement for a safe shutdown (i.e., feedwater to the steam generators) will be met.

Conclusion

This design change does not constitute an unreviewed safety question.

8. Design Change 73-124 - Reactor Coolant Pump Seal Water Bypass Low Flow Alarm Modification

Description

This design change was implemented in September. The change consisted of adding a set of contacts to the hand control valve in the RCP seal water bypass line to override the low flow alarm when the valve is closed. The bypass flow which provides cooling to the RCP lower bearing and No. 1 seal is not needed during normal operation, so it is desirable to have the annunciator bypassed when the valve is closed in order to maintain the "blackboard concept".

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report is not increased by this change. RCP seal water bypass flow is not evaluated in the safety analysis report.

b. The possibility of an accident or malfunction of a different type than any evaluated previously in the safety analysis report is not created. When HCV-1307 (2307) is closed the subject alarms are meaningless; this modification simply clears them from the annunciator board under this condition.

c. The margin of safety as defined in the basis for any technical specification is not reduced. This modification will not affect the operation of the chemical and volume control system.

Conclusion

This design change does not constitute an unreviewed safety question.

9. Design Change 74-1 - Refueling Water Storage Tank (RWST)

Description

This change was completed in November. The modification consisted of installing an eight (8) inch overflow pipe from the RWST to the safeguards sump which flows to the liquid waste system. The purpose of the change was to prevent RWST from overflowing from the vent and possible release of contaminated water to the yard area.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of this equipment with regard to the safety evaluation given in the safety analysis is not increased. No portion of the system referred to in the FSAR is changed.

b. The possibility for an accident or malfunction of a different type than any previously evaluated is not created since no safety system function is affected.

c. The margin of safety as defined in the basis for any technical specification is not reduced by this design change since the systems referenced in these specifications are not changed.

Conclusion

This design change does not constitute an unreviewed safety question.

10. Design Change 74-49 - Fuel Transfer System Air Line Modification

Description

This modification was implemented in November. As related in Westinghouse Engineering Change Recommendations, VPA-006 and VIR-005, a potential hazard exists in the fuel transfer system. The conveyor car is operated by an air motor which is started by shifting one side to exhaust (either containment or spent fuel pit). Since the control system controls on the exhaust side, a break in the air line would be the same as shifting that side to exhaust and would cause the car to move. This movement could only be halted by shutting off the main supply to the system. The proposed modification is to install a solenoid valve in the supply line that would open only when the operator controls were energized to move the conveyor car to or from the containment. In this way, (1) a line break would only exhaust the remaining air in the lines up to the new valve if the control switches were not calling for car motion and (2) leaking air from a line break could be stopped if the

car were already in motion by placing the control switch to the off position (which would close the new valve and stop the supply of air).

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of this equipment with regard to the safety evaluation given in the safety analysis is not increased. The change will not affect the fuel transfer system operation or characteristics.

b. The possibility for an accident or malfunction of a different type than any previously evaluated is not created. The additional valve will not change the operation of the system and the fail closed feature of the valve makes any failure in the conservative direction.

c. The margin of safety as defined in the basis for any technical specification is not reduced by this design change.

Conclusion

This design change does not constitute an unreviewed safety question.

11. Design Change 74-61 - Modification to Eliminate Spikes Which Enable Load Frequency Control

Description

This modification was completed in July. The purpose of the change was to prevent electrical spikes which enabled the LFC while conducting valve freedom tests on the turbine. The modification consisted of grounding the signal in the

logic circuitry for the LFC since this function is not used. No problems have been experienced since this change has been made.

Summary of Safety Evaluation

a. The probability of an accident or malfunction of equipment important to safety previously evaluated is not increased. The present operation of the turbine is not affected except to hinder spurious "enables" or any "enable" to the LFC circuit.

b. The possibility for an accident or malfunction of a different type than any evaluated in the FSAR is not created. The change is conservative in that it will not allow external changes to the turbine load control.

c. The margin of safety as defined in the basis for any technical specification is not reduced. The LFC is not a technical specification item and does not affect any item.

Conclusion

This design change does not constitute an unreviewed safety question.

12. Design Change 74-71 - Installation of Modified Piston/Disc Assemblies in Main Steam Non-Return Valves

Description

This change was completed in December. This modification was implemented as a result of piston/disc assembly failures on Unit 2 main steam non-return valves. The details of the failure

are enumerated in AO-S2-74-04. The change consisted of installing modified piston/disc assemblies as provided by the valve manufacturer. The modification to the piston/disc assembly involved increasing the thickness of the transition between the piston and disc and addition of a generous radius at the joint between the transition piece and valve disc. The aforementioned failure of the old assembly occurred at the joint of the transition piece and the valve disc. The new piston/disc assembly should improve resistance to fatigue failure.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of equipment important to safety and previously evaluated in the safety analysis report is not increased. This design change is a modification of the structure of the Main Steam Non-Return Valve (NRV) disc and piston assembly. This modification improves the fatigue strength of the disc to piston weld joint which would reduce the probability of in-service failure.

b. The possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report is not created. No new components have been added to the NRV's, nor has any existing component been functionally modified. Therefore, the NRV's will function exactly as before, but will be able to withstand more fatigue cycles.

c. The margin of safety as defined in the basis for any

technical specification is not reduced. The margin of safety for a steam line break between any Main Steam Trip Valve and its NRV should actually be increased since the likelihood for NRV failure is now reduced.

Conclusion

This design change does not constitute an unreviewed safety question.

13. Design Change 74-72 - Spent Resin Catch Tank Filter Modification (Common System)

Description

This modification was implemented in July. The change consisted of increasing the length of water overflow filter of the spent resin catch tank. The purpose of the change was to provide more filter area thus reducing the chance of filter restriction by resin beads and thus increasing flow to the dewatering tank. This allows a greater dewatering rate of the catch tank.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report would not be increased. Section 11.2-4.1, page 3 of the Final Safety Analysis Report states that the flush water for transferring spent resin from the demineralizer to the catch tank passes through a filter and discharges to the dewatering tank. The present filter element is inapporpriate and should be redesigned.

b. A possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report would not be created. Since all piping will be consistent with system design, there will be no foreseeable problems.

c. The margin of safety as defined in the basis for technical specifications would not be reduced. Technical specifications do not cover spent resin.

Conclusion

This design change does not consititute an unreviewed safety question.

14. Design Change 74-82 - Increase Range of Condenser Hotwell Conductivity Readout

Description

This change was implemented in October. The change consisted of installing conductivity cells having a higher constant. The previous low constant conductivity cells became saturated and thus made surveillance of an increase in salinity impossible. Cells of ten times higher range were installed in the condenser outlets.

Summary of Safety Evaluation

a. The probability of an accident or malfunction of equipment important to safety previously evaluated is not created. The condenser salinity cells have not been evaluated.

b. The possibility for an accident or malfunction of a different type than any previously evaluated in the FSAR is not created. Increase in the conductivity

cell in the condenser poses no new accident possibilities.

c. The margin of safety as defined in the basis for any technical specification is not reduced. The conductivity of the condenser is not a limiting factor.

Conclusion

This design change does not constitute an unreviewed safety question.

15. Design Change 74-92 - Installation of Vortex Breakers to Intake Canal

Description

This design change was implemented in October. The modification consisted of adding a structure to the intake screens to prevent air from being drawn in at the traveling screens. The structure breaks the air flow thus preventing the formation of the vortex at the screens. This is accomplished by effectively "sealing" the surface of the water with the vortex breaker thus eliminating the flow path of air which forms the vortex.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the FSAR is not increased by this change. This change does not change the accident analysis because the modification does not change the function of any safety system.

b. The probability for an accident or malfunction of a

different type than previously evaluated in the FSAR is not created. No new accident situation is created.

c. The margin of safety as defined in the technical specifications is not reduced since the operation of the service water system is not affected.

Conclusion

This change does not constitute an unreviewed safety question.

16. Design Change 74-94 - Charging Pump Service Water Strainer Valve Removal

Description

This design change was implemented in August. The change was to remove the strainer blowdown piping and valves and place a 1/2 inch pipe plug in the strainer cap. This will allow the cap to be removed more readily for the bi-weekly cleaning. The bi-weekly blowdown of these strainers through these valves was not adequate for strainer cleaning.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of the charging pump service water pumps with regard to the safety evaluation given in the safety analysis report is not increased. Operation of the system remains the same.

b. The possibility for an accident or malfunction of a different type than any previously evaluated is not created. The new pipe plug would be subject to the

same failures as the closed valve.

c. The margin of safety as defined in the basis for any technical specification is not reduced by this design change, since service water system requirements will remain unchanged.

Conclusion

This change does not constitute an unreviewed safety question.

17. Design Change 74-101 - Reduce Diameter of Guide Pins on Spent Fuel Handling Tool (Common System)

Description

This change was complete in October. The modification consisted of reducing the diameter of the guide pins along the last 4.2 inches of length. The remaining upper length remains the .860 diameter to maintain alignment. The purpose of this modification is to increase the clearance between the guide pins and the corresponding holes in the fuel assembly top nozzle. This will allow easier operation on bowed fuel assemblies.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of this equipment with regard to the safety evaluation given in the safety analysis is not increased. This particular component is not evaluated.

b. The possibility for an accident or malfunction of a

different type than any previously evaluated is not created. No new accident situation is created.

c. The margin of safety as defined in the basis for any technical specification is not reduced by this design change.

Conclusion

This modification does not constitute an unreviewed safety question.

18. Design Change 74-106 - Control Rod Drive Mechanism Interference Modification

Description

This modification was implemented in October. The NSSS supplier outlines a Control Rod Shaft Interference problem which has been experienced at other power stations. As stated in the letter, the interference occurs between the top surface of the control rod drive shaft and the bottom surface of the CRDM guide tube. There is a possibility during the reactor vessel head lowering that the interference may occur, possibly causing drive rod bowing. The NSSS supplier contends that this is not a design deficiency which could adversely affect the safety of plant operation since operating plant experience has shown that trip times have been unaffected. Also, rod drop tests would have detected any bow severe enough to compromise plant safety. The modification was to modify all drive rods to enlarge the lead-in chamber on the top end.

Summary of Safety Evaluation

a. The probability is not increased since this modification will not affect the operation of the control rods. The chambered portion of the drive rod assembly is not part of the actual latching mechanism. This change will prevent the possibility of bowed rods and increased rod drop times.

b. The possibility is not created since the modification will not affect the performance or operation of the drive rod assembly and the effect of the cutting tool on the operating deck will be minimal.

c. The margin of safety is not reduced since rod performance and rod drop times will remain within the requirements outlined in technical specifications.

Conclusion

This design change does not constitute an unreviewed safety question.

19. Design Change 74-107 - Manipulator Crane Fuel Gripper Pin Modification

Description

This design change was implemented in November. The modification consisted of providing more clearance between the gripper guide pin and fuel assembly nozzle. This was accomplished by reducing the length of guidance diameter of the pin to approximately 1.2 inches. The guidance diameter remains at 0.855 inches. Beyond this the diameter has been reduced to 0.750 inches. This will prevent gripper pin interference in a bowed fuel assembly. The bow may be as much as 1.45 inches in the center of the assembly before in-

terference occurs which is more than has been previously experienced. This modification was made at the recommendation of the NSSS vendor.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of this equipment with regard to the safety evaluation given in the safety analysis is not increased since the pin is not a structural member.

b. The possibility for an accident or malfunction of a different type than any previously evaluated is not created. No new accident situation is created with this change.

c. The margin of safety as defined in the basis for any technical specification is not reduced by this design change.

Conclusion

This change does not constitute an unreviewed safety question.

20. Design Change 74-110 - Manipulator Crane Controls Modification Unit No. 1

Description

This modification was implemented in November. The change enabled the manipulator crane bridge and trolley to be moved without having the gripper in the full up position when fuel is not engaged in the gripper. This results in time savings during refueling operations.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of this equipment with regard to the safety evaluation given in the safety analysis is not increased. This equipment is not evaluated in the accident analysis.

b. The possibility for an accident or malfunction of a different type than any previously evaluated is not created. No new accident situation is created.

c. The margin of safety as defined in the basis for any technical specification is not reduced by this design change.

Conclusion

This design change does not constitute an unreviewed safety question.

10.4 PERFORMANCE CHARACTERISTICS

10.4.1 Abnormal Occurrences

A tabulation of the Abnormal Occurrences as defined by Technical Specification 1.0.I which occurred during the reporting period is contained in Table 10.4.1-1. These reports have been previously submitted to the U.S. Atomic Energy Commission.

10.4.2 Unusual Safety Related Events

A tabulation of the Unusual Safety Related Events which occurred during the reporting period is contained in Table 10.4.2-1.

10.4.3 Equipment Performance

Section 10.6 of this report summarizes the important maintenance which was performed on unit equipment and is indicative of equipment performance.

Equipment problems experienced in the performance of surveillance tests are summarized in section 10.7.

The abnormal occurrences and unusual safety related events enumerated above also provide information on equipment performance.

ABNORMAL OCCURRENCE REPORTS
UNIT NO. 1
SURRY POWER STATION

JULY THROUGH DECEMBER, 1974

NUMBER	TITLE	OCCURRENCE DATE
AO-S1-74-10	Release of Low Level Radioactive Waste to Storm Drains	8-02-74
AO-S1-74-11	Gaseous Release From Gas Stripper Surge Tank	8-20-74
AO-S1-74-12	Malfunction of Pressurizer Level Comparator	8-25-74
AO-S1-74-13 & suplement	Unplanned Release of Low Level Radioactive Water to James River	11-07-74
AO-S1-74-14	Intake Canal Level Magnetic Amplifiers	11-19-74
AO-S1-74-15	Steam Generator Tube Deterioration	12-19-74
AO-S1-74-16	Unplanned Release of Low Level Radioactive Component Cooling Water to James River	12-30-74

UNUSUAL SAFETY RELATED EVENTS
UNIT NO. 1
SURRY POWER STATION

JULY THROUGH DECEMBER, 1974

NUMBER	TITLE
USRE-S1-74-01	Potential Degradation of Auxiliary Feed-water System Inside Containment
USRE-S1-74-02	Reduction in Capactiy of Liquid Radiation Waste System
USRE-S1-74-03	Service Water Radiation Monitor System

10.4.4 Fuel Performance

A summary of fuel performance is contained in the attached report.

VEP-FRD-9

SURRY UNIT 1
CORE PERFORMANCE REPORT
Cycle 1 - July 1, 1972 to October 24, 1974

by

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Nuclear Fuel Design and
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January, 1975

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INTRODUCTION AND SUMMARY

On October 24, 1974, after twenty three months of commercial operation, Surry 1 completed Cycle 1. Since its initial criticality on July 1, 1972, the reactor core has produced some 78 x 10^6 MBTU (13,547 Megawatt days per metric ton of contained uranium) which has resulted in the generation of over 7.4 x 10^9 kwhr of electrical energy. The purpose of this report is to present an analysis of the core performance for routine operation during Cycle 1. Non-routine operation was covered in the Surry 1 startup physics test report(1) and, therefore, will not be included here.

Routine core follow involves the analysis of four principal performance indicators. These are burnup distribution, reactivity depletion, power distribution, and primary coolant activity. The core burnup distribution is followed to verify both burnup symmetry and proper batch burnup sharing, thereby ensuring that the fuel held over for the next cycle will be compatible with the new fuel inserted. Reactivity depletion is monitored to: detect the existence of any abnormal reactivity behavior, determine if the core is depleting as designed, and indicate at what burnup level refueling will be required. Core power distribution follow includes the monitoring of nuclear hot channel factors to verify that they are within the Technical Specifications limits thereby ensuring that adequate margins to linear power density and critical heat flux thermal limits are maintained. Lastly, as part of normal core follow, the primary coolant activity is monitored to assess the integrity of the fuel.

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(1) Gardner, D. A., and Keck, S. P., Surry Unit 1 Startup Physics Test Report, VEP-FRD-1, Richmond, Virginia, February, 1973.

In addition to the above, the effects of fuel densification were monitored. Although not normally part of routine core follow, this phenomenon is treated here because of its impact on core performance.

Each of the four performance indicators, as well as the status of observed fuel densification effects, is discussed in detail for the Surry 1 Cycle 1 core in the body of this report.(2) The results are summarized below;

1. Burnup Follow - The burnup tilt (deviation from quadrant symmetry) on the core is less than $\pm$ 0.5% with the burnup accumulation in each batch deviating from design prediction by less than 3%.
2. Reactivity Depletion Follow - The critical boron concentration, used to monitor reactivity depletion, has consistently been within $\pm$ 0.4% $\Delta K/K$ of the design prediction which is well within the $\pm$ 1% $\Delta K/K$ margin allowed by the Technical Specifications.
3. Power Distribution Follow - Maps taken during each month indicate that the radial power distributions were generally within $\pm$ 4% of the design predictions with all hot channel factors meeting the Technical Specifications limits.
4. Primary Coolant Activity Follow - The iodine-131 activity level in the primary coolant at the end of Cycle 1 was approximately 2.5×10^{-2} μCi/ml, which indicates that there are three or four defects in the core. This corresponds to a 99.99% core integrity factor.
5. Fuel Densification Status - There are 18 confirmed and 4 suspected assembly locations with power spikes due to gap formation. However, all power spikes are less than 5% in magnitude.

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(2) See Appendix A for definition of terms used in this report.

Section 2

CORE PERFORMANCE ANALYSIS

2.1 Burnup Follow

The burnup history for the Surry Unit 1 core is graphically depicted in Figure 2.1.1. A chronology of the associated operating power level is given in Figure 2.1.2. Cycle 1 burnup for the Surry 1 core was 13,547 MWD/MTU, which is approximately 800 MWD/MTU short of the normal reactivity end-of-life. As shown in Figure 2.1.3, the average Surry 1 load factor for Cycle 1 is 60% when referenced to maximum permitted power or 56% when referenced to rated power (2441 MW (t)). The capacity factor for Surry 1 as of December 31, 1974 is 51%.

The burnup sharing on a batch basis is monitored to verify that the core is operating as designed and to enable accurate end-of-cycle batch burnup predictions to be made for use in reload fuel design studies. As seen in Figure 2.1.4, the batch burnup sharing for Surry 1 is following design predictions very closely with each batch deviating less than 3% from design; this is considered excellent agreement.

Radial (X-Y) burnup maps distribute the gross core burnup among the various assemblies and thereby allow a more detailed burnup distribution analysis. The TOTE computer code (see Appendix B) is used to calculate these assemblywise burnups. Figure 2.1.5 is a radial burnup map in which the core's assemblywise burnup accumulation as of October 24, 1974 (end of Cycle 1) is given. For comparison purposes, the predicted values are also given. As can be seen from this figure, the accumulated assembly burnups are generally within $\pm$ 4% to the predicted values. In addition, deviation from quadrant symmetry in the core, as indicated by the burnup tilt factors, is less than $\pm$ 0.5%. Therefore, symmetric burnup in conjunction with good agreement between actual and predicted assemblywise burnups and batch burnup sharing indicate that the Cycle 1 core depleted as designed.

2.2 Reactivity Depletion Follow

The primary coolant critical boron concentration is monitored for the purposes of following core reactivity and flagging any anomalous reactivity behavior. The FOLLOW computer code (see Appendix C) is used to normalize "actual" critical boron concentration to design conditions taking into consideration off-normal rod positions, xenon and samarium concentrations, moderator temperatures, and power levels. The normalized critical boron concentration versus burnup curve for the Surry 1 Cycle 1 core is shown in Figure 2.2.1. It can be seen that the measured data compare within $\pm$ 20 to 30 ppm of the design prediction. This corresponds to within $\pm$ 0.3 to 0.4% $\Delta K/K$ which is well within the $\pm$ 1% $\Delta K/K$ criteria for reactivity anomalies set forth in Section 4.10 of the Technical Specifications.

In conclusion, the trend indicated by the critical boron concentration verifies that the Cycle 1 core depleted as expected with no reactivity anomalies.

2.3 Power Distribution Follow

Analysis of core power distribution data on a routine basis is necessary to verify that the hot channel factors are within the Technical Specifications limits and to ensure that the reactor is operating with no abnormal conditions which could cause an "uneven" burnup distribution. Three-dimensional core power distributions are determined from movable detector flux map measurements using the INCORE computer program (see Appendix D). A summary of all flux maps taken since completion of startup physics testing for Surry 1 is given in Table 2.3.1. Power distribution maps are generally taken monthly with additional maps taken as needed.

Radial (X-Y) core power distributions for a representative series of maps are given in Figures 2.3.1 through 2.3.3. Figure 2.3.1 shows a map that was taken early in cycle life, Figure 2.3.2 shows one that was taken near mid-cycle burnup and Figure 2.3.3 shows a map that was taken late in Cycle 1 life. All of the radial maps shown were taken under equilibrium operating conditions with the Unit operating at 90% to 100% power. In each case, the measured assembly powers are generally within 4% of the predicted values, which is considered good agreement. In addition, as indicated by the INCORE tilt factors, the power distributions are essentially symmetric for all cases.

Core average axial power distributions for a representative series of maps are given in Figures 2.3.4 through 2.3.6. One can observe from this sequence of figures the power-flattening effect caused by the preferential depletion in the high-power central core axial region. In Map 44 (Figure 2.3.4), taken at 2240 MWD/MTU, the axial power distribution peaks very strongly just below core midplane and has a peaking factor ($\overline{F}_z$) of 1.33. In Map 59 (Figure 2.3.5) taken at 6800 MWD/MTU, the $\overline{F}_z$ has decreased to 1.19 and the central core axial power shape has flattened markedly as expected. Finally, due to central region burnup effects, a "double hump" forms in the axial power distribution as shown in Figure 2.3.6 of Map 71 taken at 12,670 MWD/MTU. With this "double hump" formation, $\overline{F}_z$ levels off to a value of approximately 1.16. The gradual decrease and leveling off of $\overline{F}_z$ may be noted in a plot of $\overline{F}_z$ vs. burnup, Figure 2.3.7. In Figure 2.3.8, Surry 2 $\overline{F}_z$ values have been added to the graph; it is seen that these values are consistent with those of Surry 1.

The power flattening effect of increasing burnup can also be seen in the plot of axial offset[4] versus burnup, Figure 2.3.9. Axial offset shifts from approximately -5% at the beginning-of-cycle to approximately 0% at 5000 MWD/MTU burnup. It then levels off and hovers around the 0% point. This behavior is consistent with that of Surry 2 as shown by a comparison plot of axial offset versus burnup, Figure 2.3.10.

Another important aspect of core power distribution follow is the monitoring of nuclear hot channel factors. Verification that these factors are within Technical Specifications limits ensures that linear power density and critical heat flux limits will not be violated, thereby providing adequate thermal margins and maintaining fuel cladding integrity.

The Technical Specifications limits on the heat flux hot channel factor, F_Q^N, for the end of Cycle 1 is 2.39. (Prior to the acceptance of the new fuel densification model as described in WCAP-8219, this limit was 2.48.) As shown in Figure 2.3.11, the Surry 1 Cycle 1 core has maintained an F_Q^N (with and without densification penalties) of at least 5% less than the applicable limit. In addition, Surry 1 Cycle 1 core heat flux hot channel factors compare well with the values obtained for Surry 2, as indicated in Figure 2.3.12.

Peak linear power density, which is determined directly from F_Q^N is given in Figure 2.3.13. This is the limiting parameter from a loss-of-coolant accident-ECCS standpoint since it directly relates to the stored thermal energy in the core. As shown in Figure 2.3.13, the Surry 1 Cycle 1 core has maintained a peak linear power density of at least 6% below the allowable limit. Figure 2.3.14 shows that Surry 1 and 2 peak linear power densities with burnup compare closely.

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(4) Axial Offset = $\frac{Pt - Pb}{Pt + Pb} \times 100$ where Pt = power in core top and Pb = power in core bottom

A radial hot channel factor routinely followed is $F^N_{\Delta H}$, the enthalpy rise hot channel factor. The Technical Specifications limit for this parameter is set such that the critical heat flux (DNB) limit will not be violated. Figure 2.3.15 shows that at least a 4% margin to this limit has been maintained. Also, as indicated in Figure 2.3.16, the Surry 1 Cycle 1 core enthalpy rise hot channel factors compare closely with those of Surry 2.

Another radial hot channel factor routinely monitored is F_{xy}, the horizontal plane peaking factor. This peaking factor is a ratio of the peak to average power in a given horizontal plane. It is related to, but is not identical to, $F^N_{\Delta H}$ which is the ratio of integral of power along the rod with the highest integrated power to that of the average rod. As shown in Figure 2.3.17, the measured F_{xy} peaking factors, evaluated at core mid-plane, are as much as 3% higher than the nominal design prediction. However, this is well within the design uncertainty of 8%. In addition, as indicated in Figure 2.3.18, Surry 1 Cycle 1 core F_{xy} peaking factors compare well with values obtained for Surry 2.

In conclusion, the Surry 1 Cycle 1 core performed very satisfactorily with power distribution analyses verifying that design predictions are accurate and that hot channel factors are meeting Technical Specifications limits. In addition, the Surry 1 Cycle 1 core power distribution characteristics followed the Surry 2 Cycle 1 core characteristics closely, which was expected since startup tests results of the two units compared well.(5)

2.4 Primary Coolant Activity Follow

Activity levels of iodine-131 and 133 are important in core performance follow analyses because they are used as indicators of defective fuel. These two isotopes leak into the primary coolant system through a breach in

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(5) Gardner and Keck, op. cit.

the cladding. I-131 activity is directly correlatable to the number of cladding defects; the ratio of I-131 to I-133 is used to determine if the iodine activity is originating from the inside of the fuel rod or if it is coming from "tramp"[6] uranium on the exterior of the fuel rod. Use of the ratio for this determination is feasible because I-133 has a short half-life (approximately 24 hours) compared to that of I-131 (approximately eight days) so that for small cladding defects where the diffusion time through the defect is on the order of days, the I-133 decays out leaving I-131 dominant in activity thereby causing the ratio to be 0.6 or more. For a pure "recoil" source such as "tramp" uranium, however, where there is little decay of I-133 before it enters into the primary coolant, the ratio will be 0.07 or less.

Figure 2.4.1 shows the I-131 activity history for the Surry 1 Cycle 1 core with the FSAR value for one fuel defect[7] (which is equivalent to one defective rod) and five defects (an equivalent to five defective rods) delineated for comparison purposes. The data shows considerable scatter but the trend of the last few months of operation indicates that on the order of three or four defective fuel rods exist in the core. This is also born out by the data in Figure 2.4.2 where the iodine ratio is trending in the high range (0.6 or so) indicating iodine is diffusing into the primary coolant. Periodically, large spikes in the ratio occur due to transient thermal effects on the fuel causing "burst" release of iodine.

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(6) "Tramp" uranium consists of small particles of uranium which adhere to the outside surface of the fuel during the manufacturing process.

(7) This is derived from FSAR Table 9.1-5 where cladding defects in 1% of the fuel rods gives an I-131 primary coolant activity concentration of 1.68 μCi/cc @ 560° F. Samples are analyzed at room temperature; hence, this value is 2.35 μCi/cc when a density correction is made.

Small quantities of fuel defects are not uncommon in operating reactors, and in fact, the reactor systems are normally designed to operate with up to approximately 1% failed fuel present. With only three or four defects present, Surry 1 has a Cycle 1 core integrity factor of 99.99% which is quite acceptable.

2.5 Fuel Densification Status

Densification-induced power spikes in the Surry 1 Cycle 1 core have been observed in all regions. The number has decreased since the last core performance report (June 30, 1974) from 26 to 22. The magnitudes of a few of the power spikes have increased since the last report, however, the majority of the power spikes have remained relatively small. In any event, all power spikes are less than 5% in magnitude.

Table 2.5.1 gives the assembly locations, along with related data, in which densification induced power spikes have been observed. Over 90% of the confirmed[8] spikes are located in Regions 2 and 3 which is consistent with the effects of densification being more pronounced in lower fuel density regions.

The largest single power spike observed is located in Assembly B-10 (Region 3) and has a magnitude of approximately 4.8%. It has been noticed that the power spike locations do not generally change perceptibly from one map to the next although in a few instances confirmed power spikes have disappeared, undoubtedly due to settling of the fuel column.

Table 2.5.2 compares Surry 1 and Surry 2 densification induced power spikes. It should be noted that power spike formation in Surry 2 Cycle 1 fuel is reduced both in magnitude and number from that observed in Surry 1 Cycle 1 fuel. This may be attributed, at least in part, to the fact that a less

(8) A confirmed power spike is one which has been observed in two or more recent maps. A suspected power spike is one which has been observed generally only in the most recent map.

active powder (manufactured at Westinghouse Columbia plant) was used and the sintering temperatures were higher in Regions 2 and 3 of Surry 2 as compared with those of Surry 1.

Figures 1 through 20 of Appendix E are the latest Surry 1 strip-chart traces for all confirmed and suspected assemblies with densification induced gaps. Note that in nearly all cases the power spike is located above the midplane and usually is in the top one-third of the fuel, which is where gap formation of notable size is most likely to occur. Unfortunately, the width of the power spike is not a direct indication of gap width since the detector is running down the center of the assembly and "sees" a composite effect of many fuel pins.

The first sign of gap formation in the Surry 1 Cycle 1 fuel was observed in Map 45 taken at approximately 2400 MWD/MTU. Since previous traces taken at 1900 MWD/MTU showed no signs that gap formation had occurred, it is evident that the actual onset was somewhere between 1900 to 2400 MWD/MTU which is consistent with the R. E. Ginna Nuclear Unit in which the first signs of densification appeared at about 2200 MWD/MTU in their twelve 92% UO_2 density, prepressurized assemblies.

In conclusion, while the number of densification induced power spikes has decreased, the magnitudes of a few of the power spikes have increased since the last report. However, all power spikes are less than 5% in magnitude.

SURRY UNIT 1 - CYCLE 1

CORE BURNUP HISTORY

FIGURE 2.1.1

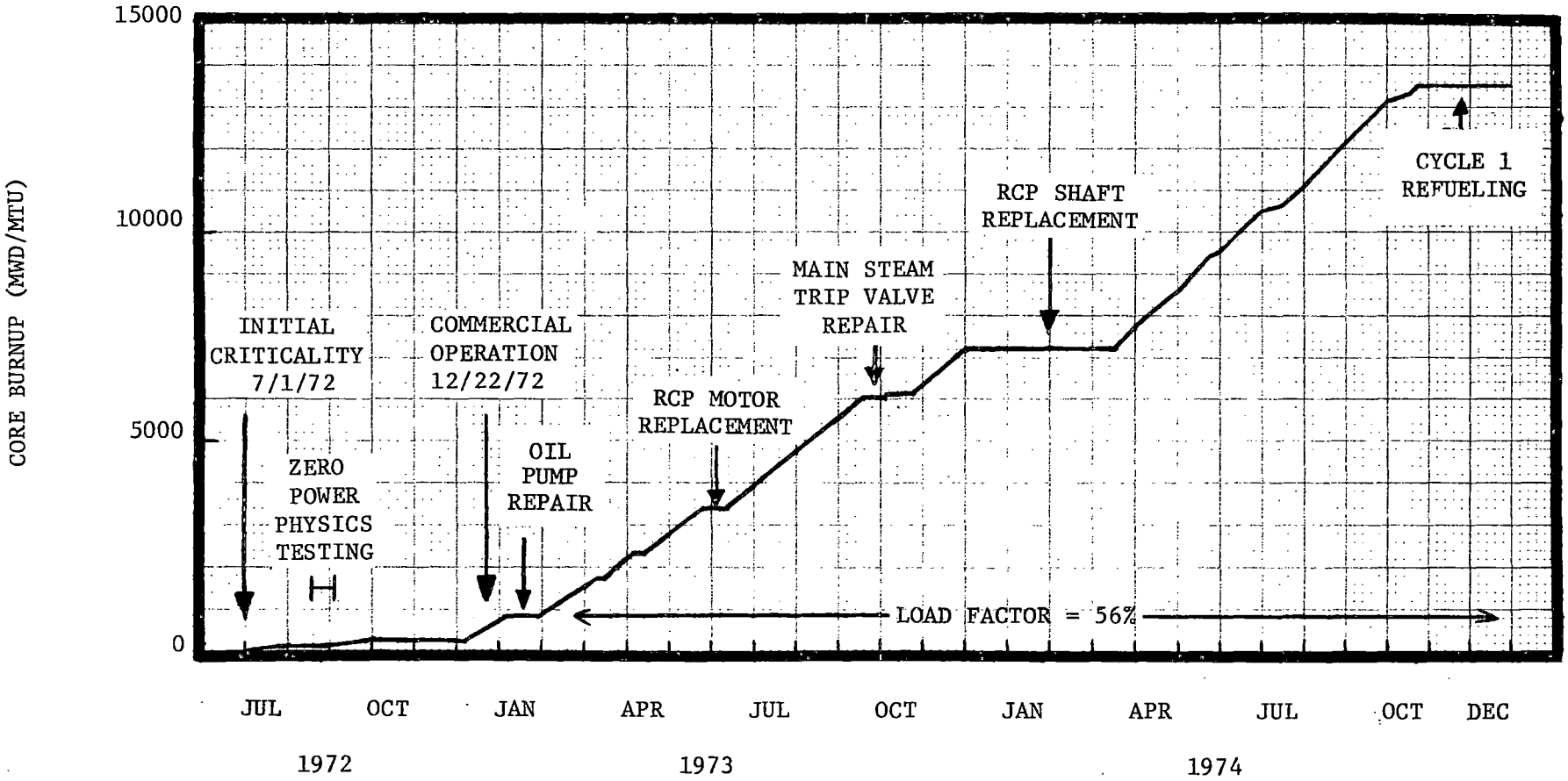
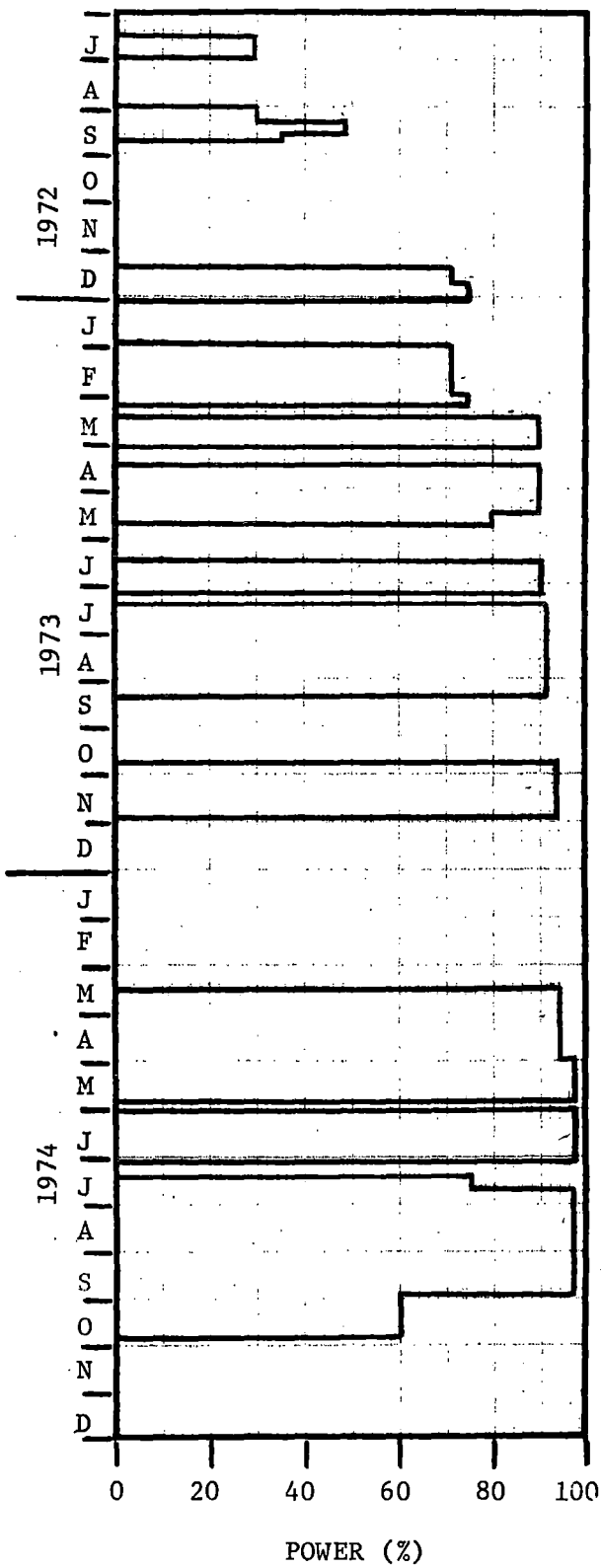


FIGURE 2.1.2

SURRY UNIT 1 - CYCLE 1

CHRONOLOGY OF OPERATING POWER LEVEL



← Initial criticality (7/1/72)

← Decay heat release valve incident

← Physics testing

← Steam generator feedwater line repair

← Commercial operation (12/22/72)

← Oil pump repair

← Reactor coolant bypass valve repack

← Steam leak repair

← Reactor coolant pump motor replacement

← Main steam trip valve repair

← Main steam trip valve repair

← Reactor coolant pump shaft replacement

← Main steam stop valve repack

← Exciter replacement

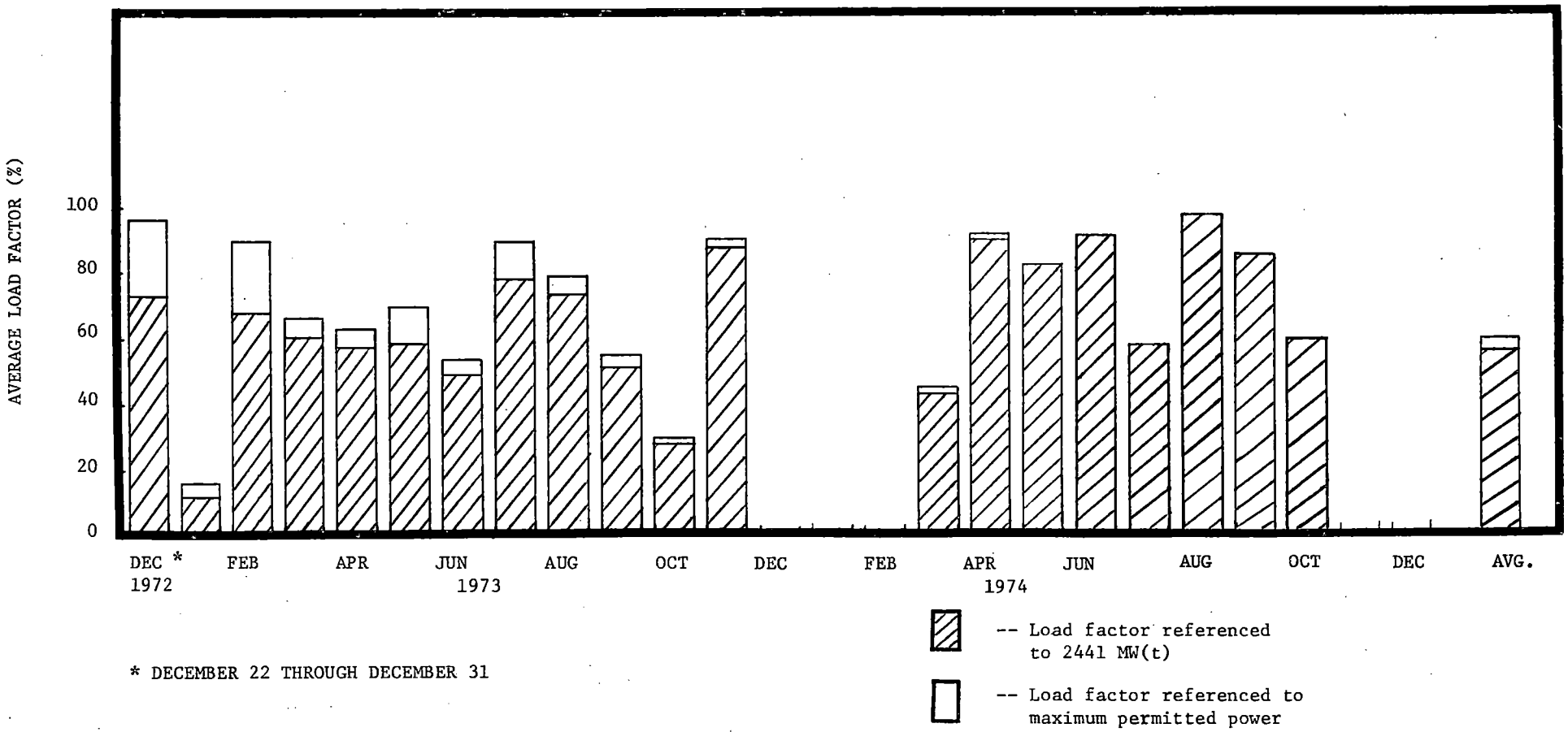
← Steam generator tube leak (two-loop operation)

← Cycle 1 refueling

SURRY UNIT 1 - CYCLE 1

MONTHLY AVERAGE LOAD FACTORS

FIGURE 2.1.3

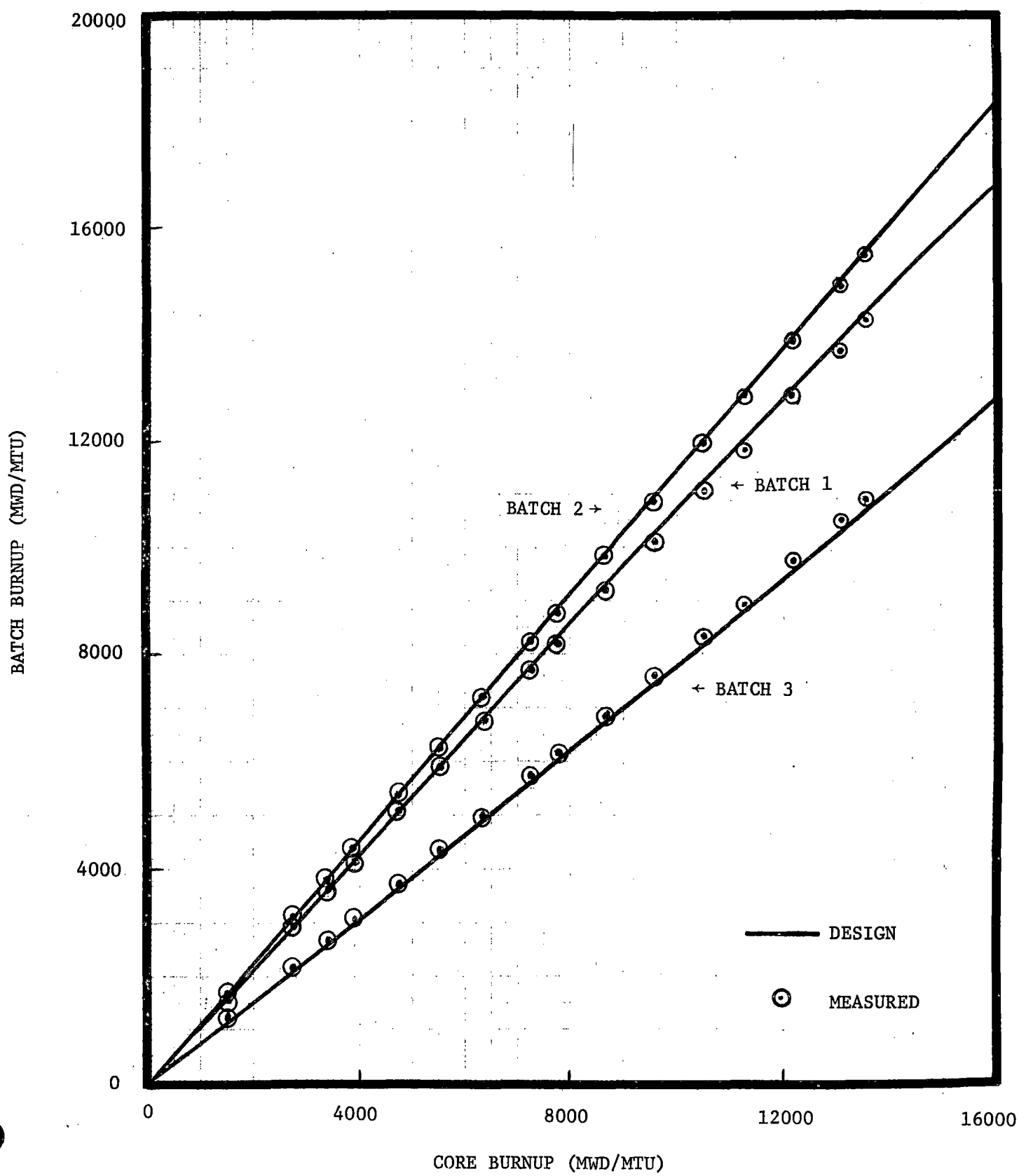


* DECEMBER 22 THROUGH DECEMBER 31

SURRY UNIT 1 - CYCLE 1

FIGURE 2.1.4

BATCH BURNUP SHARING



SURRY UNIT 1 - CYCLE 1

FIGURE 2.1.5

ASSEMBLYWISE ACCUMULATED BURNUP:
COMPARISON OF MEASURED WITH PREDICTED
10^3 MWD/MTU

	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A
1							8.22 8.41 +2.4	10.28 10.48 +2.0	8.22 8.35 +1.6						
2					8.39 8.74 +4.2	12.09 12.18 +0.7	13.70 13.84 1.0	12.77 12.35 -3.3	13.70 13.78 +0.6	12.09 12.15 +0.5	8.39 8.67 +3.3				
3				8.85 9.23 +4.3	12.97 13.47 +3.8	14.29 14.44 +1.1	14.08 13.81 -1.9	15.30 14.99 -2.0	14.08 13.82 -1.9	14.29 14.15 -1.0	12.97 13.50 +4.1	8.85 9.46 +6.9			
4			8.85 9.08 +2.6	11.44 11.51 +0.6	14.35 14.58 +1.6	14.08 14.40 +2.2	15.88 15.71 -1.1	14.86 14.69 -1.1	15.88 15.80 -0.5	14.40 14.32 -0.6	14.35 14.48 +0.9	11.44 11.48 +0.4	8.85 9.18 +3.7		
5		8.39 8.52 +1.6	12.97 13.07 +0.8	14.35 14.30 -0.4	14.37 14.37 +0.0	16.00 15.85 -0.9	15.11 14.87 -1.6	16.34 16.31 -0.2	15.11 15.09 -0.1	16.00 15.97 -0.2	14.37 14.23 -1.0	14.35 13.89 -3.2	12.97 13.06 +0.7	8.39 8.67 +3.3	
6		12.09 12.36 +2.2	14.29 14.17 -0.8	14.40 14.12 -1.9	16.00 15.48 -3.3	15.16 14.58 -3.8	16.47 16.40 -0.4	15.34 15.36 +0.1	16.47 16.44 -0.2	15.16 14.76 +2.7	16.00 15.87 +0.8	14.40 14.07 +2.4	14.29 14.07 -1.5	12.09 12.27 +1.5	
7	8.22 8.54 +3.9	13.70 14.20 +3.7	14.08 13.98 -0.7	15.88 15.84 -0.3	15.11 14.77 -2.3	16.47 16.26 -1.3	15.38 15.28 -0.7	16.60 16.63 +0.2	15.38 15.19 -1.2	16.47 16.44 -0.2	15.11 15.19 +0.5	15.88 16.09 +1.3	14.08 14.01 -0.5	13.70 13.67 -0.2	8.22 8.28 +0.7
8	10.28 10.89 +5.9	12.77 12.78 +0.1	15.30 15.55 +1.6	14.86 14.93 +0.5	16.34 16.41 +0.4	15.34 15.28 -0.4	16.60 16.61 -0.1	15.43 15.32 -0.7	16.60 16.58 -0.1	15.34 15.37 +0.2	16.34 16.43 +0.6	14.86 15.00 +0.9	15.30 15.44 +0.9	12.77 12.58 -1.5	10.28 10.35 +0.7
9	8.22 8.43 +2.6	13.70 14.01 +2.3	14.08 13.89 -1.4	15.88 15.86 -0.1	15.11 15.07 -0.3	16.47 16.35 -0.7	15.38 15.11 -1.8	16.60 16.52 -0.5	15.38 15.23 -1.0	16.47 16.18 -1.8	15.11 14.92 -1.3	15.88 15.92 +0.3	14.08 14.11 +0.2	13.70 13.94 +1.8	8.22 8.19 -0.4
10		12.09 12.03 -0.5	14.29 13.89 -2.8	14.40 14.10 -2.0	16.00 16.04 +0.2	15.16 14.72 -2.9	16.47 16.17 -1.8	15.34 15.01 -2.2	16.47 16.14 -2.0	15.16 14.59 -3.8	16.00 15.75 -1.6	14.40 14.22 -1.3	14.29 14.17 -0.8	12.09 12.22 +1.1	
11		8.39 8.64 -3.0	12.97 13.32 +2.7	14.35 14.44 +0.6	14.37 14.35 -0.1	16.00 15.85 -0.9	15.11 14.70 -2.7	16.34 15.96 -2.3	15.11 14.61 -3.3	16.00 15.83 -1.1	14.37 14.24 -0.9	14.35 14.47 +0.8	12.97 13.39 +3.2	8.39 8.69 +3.6	
12			8.85 9.41 +6.3	11.44 11.69 +2.2	14.35 14.46 +0.8	14.08 14.18 +0.7	15.88 15.53 -2.2	14.86 14.44 -2.8	15.88 15.54 -2.1	14.40 14.08 -2.2	14.35 14.35 +0.0	11.44 11.54 +0.9	8.85 9.26 +4.6		
13				8.85 9.22 +4.2	12.97 13.15 +1.4	14.29 14.07 -1.5	14.08 13.73 -2.5	15.30 14.91 -2.6	14.08 13.65 -3.1	14.29 14.06 -1.6	12.97 13.19 +1.7	8.85 9.23 +4.6			
14					8.39 8.60 +2.5	12.09 12.62 +4.4	13.70 14.36 +4.8	12.77 12.43 -2.7	13.70 13.62 -0.6	12.09 12.15 +0.5	8.39 8.48 +1.1				
15							8.22 8.75 +6.5	10.28 10.75 +4.8	8.22 8.19 -0.4						

DATE October 24, 1974

CORE AVERAGE BURNUP 13,547 MWD/MTU

PREDICTED
MEASURED
% DIFFERENCE

BURNUP SHARING

	ACTUAL	PREDICTED
BATCH 1	14.25	14.37
BATCH 2	15.46	15.56
BATCH 3	10.93	10.67

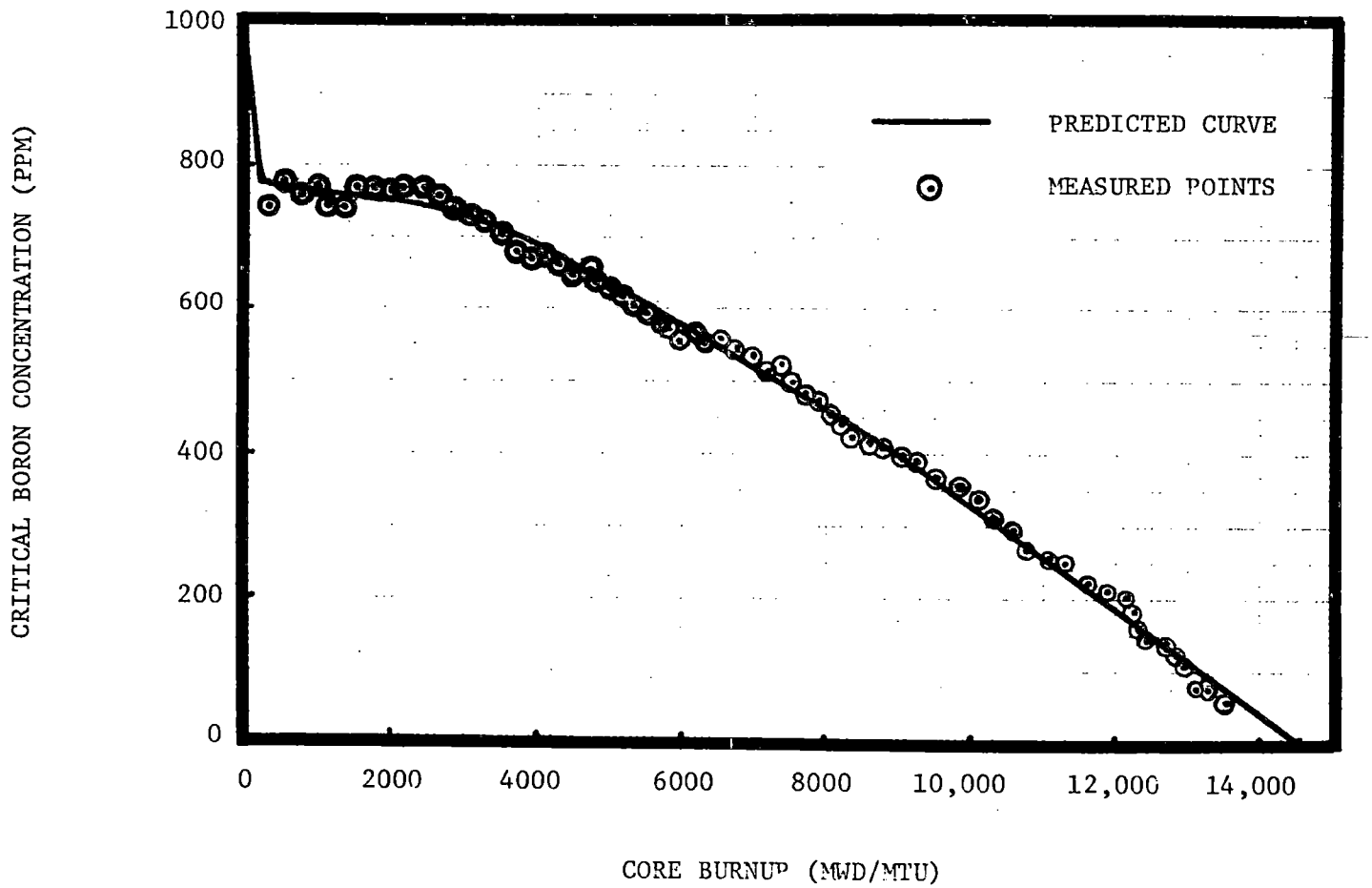
BURNUP TILT

NW - 1.002
NE - 1.001
SW - 1.001
SE - 0.996

FIGURE 2.2.1

SURRY UNIT 1 - CYCLE 1

CRITICAL BORON CONCENTRATION
vs.
BURNUP



SURRY UNIT 1 - CYCLE 1

TABLE 2.3.1

SUMMARY TABLE OF INCORE FLUX MAPS
FOR ROUTINE OPERATION

MAP NO.	DATE	% PWR	BANK D	BANK P/L	CORE $\overline{F}_z$	F_Q HOT CHANNEL FACTOR						$F_{\Delta H}$ HOT CHANNEL FACTOR			TILT		AVG AXIAL OFFSET	BURNUP (MWD/MTU)	NO. OF MONITORED THIMBLES
						ASSY.	PIN	AXIAL POINT	F_Q^N	S(Z)	$F_Q^{N'}$	ASSY	PIN	$F_{\Delta H}^N$	MAX	QUAD LOC			
34	12/18/72	75	199	70	1.37	J-10	HG	44	1.99	1.062	2.13	J-10	HG	1.38	1.011	SW	-8.3	440	11
35	12/26/72	75	194	228	1.43	H-7	GH	34	2.09	1.096	2.29	H-7	GH	1.44	1.010	SW	-9.6	620	39
37(1)	1/2/73	75	196	228	1.44	J-8	HG	34	2.12	1.096	2.32	J-8	HG	1.44	1.007	SW	-8.0	780	39
39(2)	2/7/73	0	130	228	1.79	K-14	KD	45	2.77	1.059	2.93	K-14	KD	1.50	1.011	SW	-41.4	1020	50
40	2/12/73	75	189	228	1.43	J-8	HG	34	2.13	1.096	2.33	J-8	HG	1.47	1.001	SE	-7.0	1150	30
41	2/28/73	75	196	228	1.41	J-2	OO	34	2.11	1.096	2.31	J-2	OO	1.50	1.020	NW	-8.2	1530	38
43(1)	3/19/73	92	203	228	1.36	J-8	HG	34	2.03	1.096	2.22	J-8	HG	1.48	1.003	SW	-5.0	1900	38
44	4/2/73	92	206	228	1.33	J-8	HG	34	1.95	1.096	2.14	J-8	HG	1.46	1.002	SE	-4.9	2240	26
45	4/17/73	88	185	228	1.40	J-8	HG	34	2.06	1.096	2.25	H-7	GH	1.48	1.008	NE	-10.3	2380	47
47(1)	5/3/73	88	203	228	1.32	G-8	HG	33	1.91	1.100	2.11	G-8	HG	1.45	1.015	NE	-4.2	2830	31
48	5/14/73	90	202	228	1.29	J-8	HG	33	1.88	1.100	2.07	J-8	HG	1.45	1.002	SE	-1.6	3175	47
49	6/19/73	90	203	228	1.28	H-9	GH	24	1.85	1.128	2.09	H-9	GH	1.46	1.002	NE	-2.2	3550	47
50	7/2/73	91	201	228	1.27	E-8	HG	33	1.81	1.100	1.99	E-8	HG	1.42	1.004	NW	-0.6	3960	31
51	7/13/73	91	201	228	1.26	J-8	HG	33	1.81	1.100	2.00	J-8	HG	1.43	1.003	NW	-3.1	4190	39
53(1)	8/1/73	91	203	228	1.24	E-8	HG	33	1.75	1.100	1.92	E-8	HG	1.41	1.003	NW	-3.2	4750	30
54	8/5/73	75	195	228	1.25	L-8	HG	33	1.82	1.100	2.00	E-8	HG	1.41	1.004	NW	-2.8	4900	26
55	8/20/73	95	211	228	1.23	K-14	KC	23	1.74	1.131	1.97	K-14	KC	1.40	1.006	NE	+1.4	5275	47
56	9/4/73	96	213	228	1.21	E-8	HG	22	1.71	1.134	1.93	E-8	HG	1.39	1.002	SE	+0.4	5600	26
57	9/17/73	95	211	228	1.21	G-8	HG	22	1.68	1.134	1.90	G-8	HG	1.38	1.004	NW	+0.8	5975	45
58	10/31/73	94	213	228	1.20	H-7	GH	23	1.62	1.131	1.83	J-8	HG	1.37	1.004	NE	-1.3	6340	46
59	11/14/73	94	210	228	1.19	E-8	HG	21	1.58	1.137	1.80	E-8	HG	1.35	1.004	NE	-1.7	6790	44
60	3/16/74	39	177	228	1.23	J-10	HE	23	1.67	1.131	1.89	J-10	HE	1.34	1.007	SW	-3.9	7270	41
61	3/17/74	75	196	228	1.18	H-7	GH	22	1.59	1.134	1.81	H-7	GH	1.35	1.008	SW	-1.8	7285	34
62	3/26/74	95	215	228	1.18	H-11	GH	20	1.56	1.140	1.78	H-7	GH	1.34	1.004	NE	-1.7	7540	43
63	4/5/74	97	218	228	1.15	H-7	GH	13	1.57	1.158	1.81	H-5	GH	1.33	1.002	NW	-0.2	7878	23
64	4/6/74	51	169	228	1.41	J-4	HK	46	1.97	1.056	2.08	J-4	HK	1.37	1.010	SW	-21.0	7890	16
65	4/23/74	94	214	228	1.17	D-7	EH	14	1.59	1.156	1.76	D-7	EH	1.34	1.002	NW	-1.5	8435	41
66(3)	5/16/74	100	216	228	1.17	D-7	EH	46	1.58	1.028	1.63	E-8	HG	1.34	1.002	NE	-1.6	9150	41
68(1)	6/19/74	100	210	228	1.18	H-7	GD	13	1.58	1.060	1.67	D-7	DG	1.31	1.003	NE	+1.3	10100	45
69	7/23/74	92	213	228	1.15	J-6	GD	13	1.54	1.060	1.63	H-5	GD	1.32	1.004	NW	-1.5	10820	42
70	8/23/74	100	219	228	1.17	K-5	ID	12	1.57	1.061	1.66	K-5	ID	1.32	1.006	SW	+0.8	11875	43
71	9/18/74	100	225	228	1.15	D-11	GD	12	1.56	1.061	1.66	D-11	GD	1.35	1.005	NW	-0.2	12670	40
72	10/01/74	60	210	228	1.16	N-11	LE	12	1.59	1.061	1.69	N-11	LE	1.31	1.005	SW	-0.5	13065	26
73	10/18/74	60	213	228	1.20	L-13	KD	12	1.59	1.061	1.69	L-13	KD	1.31	1.009	SW	+1.9	13415	42

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 O, 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.

All hot channel factor values include measurement uncertainty (1.05 on F_Q and 1.0365 on $F_{\Delta H}$).

The axial location of S(Z) is determined by locating the maximum value of $F_Q^N \times S(Z)$. $F_Q^{N'} = \{F_Q^N(Z) \times S(Z)\}_{MAX}$

(1) Maps 36, 42, 46, 52 and 67 aborted because of insufficient movable detector data.
(2) Map 38 was a series of INCORE/EXCORE experimental correlation tests and will not be reported here.
(3) New densification model WCAP-8219 accepted.

SURRY UNIT 1 - CYCLE 1

FIGURE 2.3.1

ASSEMBLYWISE POWER DISTRIBUTION

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
						0.60 0.58 -3.7	0.76 0.74 -3.9	0.60 0.58 -3.7							1
				0.59 0.62 4.3	0.88 0.85 -3.5	0.99 0.95 -3.7	0.94 0.90 -4.0	0.99 0.95 -3.7	0.88 0.90 1.4	0.59 0.60 1.4					2
			0.62 0.64 4.3	0.89 0.92 4.3	1.00 0.97 -3.4	1.04 1.01 -3.6	1.11 1.07 -3.6	1.04 1.03 -1.6	1.00 1.02 1.4	0.89 0.90 1.4	0.62 0.63 1.4				3
		0.62 0.64 4.3	0.80 0.82 2.8	1.00 1.02 1.9	1.06 1.07 0.5	1.17 1.13 -3.5	1.14 1.10 -3.6	1.17 1.16 -0.5	1.06 1.08 1.4	1.00 1.01 1.2	0.80 0.81 0.9	0.62 0.61 -1.0			4
	0.59 0.62 4.3	0.89 0.89 0.4	1.00 1.00 0.4	1.06 1.07 0.5	1.18 1.19 0.5	1.18 1.17 -0.9	1.24 1.20 -3.6	1.18 1.18 0.7	1.18 1.19 0.8	1.00 1.07 0.9	1.00 1.00 0.9	0.89 0.88 -1.0	0.59 0.59 -0.9		5
	0.88 0.94 6.6	1.00 1.02 2.1	1.06 1.07 0.9	1.18 1.17 0.5	1.17 1.26 -0.2	1.27 1.21 -0.9	1.23 1.25 -1.8	1.27 1.25 -1.4	1.17 1.17 -0.3	1.18 1.19 0.4	1.06 1.07 0.5	1.00 1.00 -0.3	0.88 0.88 -0.8		6
0.60 0.64 6.6	0.99 1.03 4.4	1.04 1.07 2.1	1.17 1.19 2.1	1.18 1.17 -0.9	1.27 1.26 -0.9	1.24 1.23 -0.9	1.31 1.29 -1.8	1.24 1.22 -2.1	1.27 1.27 -0.4	1.18 1.18 0.6	1.17 1.17 0.5	1.04 1.06 1.5	0.99 1.01 2.7	0.60 0.61 2.6	7
0.76 0.81 4.5	0.94 0.97 4.2	1.11 1.13 2.1	1.14 1.15 2.1	1.24 1.27 2.1	1.23 1.22 -0.9	1.31 1.30 -0.8	1.26 1.24 -1.7	1.31 1.30 -0.8	1.23 1.24 1.0	1.24 1.25 1.2	1.14 1.15 1.5	1.11 1.14 2.4	0.94 0.96 2.5	0.76 0.78 2.6	8
0.60 0.64 6.6	0.99 1.00 1.9	1.04 1.04 -0.4	1.17 1.16 -0.3	1.18 1.20 1.7	1.27 1.24 -2.1	1.24 1.22 -2.1	1.31 1.29 -1.8	1.24 1.23 -1.2	1.27 1.27 0.1	1.18 1.20 1.8	1.17 1.20 2.7	1.04 1.07 2.5	0.99 1.01 2.3	0.60 0.61 2.1	9
	0.88 0.96 -3.0	1.00 0.97 -3.1	1.06 1.05 -1.2	1.18 1.20 1.7	1.17 1.16 -0.6	1.27 1.24 -2.1	1.23 1.21 -1.9	1.27 1.25 -1.6	1.17 1.16 -0.9	1.18 1.18 -0.2	1.06 1.06 -0.2	1.00 1.02 2.1	0.88 0.90 2.1		10
	0.59 0.58 -1.0	0.89 0.88 -1.1	1.00 1.00 0.2	1.06 1.08 1.7	1.18 1.18 0.2	1.19 1.15 -2.1	1.24 1.22 -2.1	1.18 1.17 -0.2	1.18 1.18 -0.2	1.06 1.06 0.1	1.00 1.01 1.2	0.89 0.91 2.3	0.59 0.60 2.0		11
		0.62 0.62 1.0	0.80 0.81 1.3	1.00 1.01 1.7	1.06 1.08 1.7	1.17 1.17 -0.3	1.14 1.13 -0.9	1.17 1.16 -1.0	1.06 1.06 -0.8	1.00 1.00 0.8	0.80 0.82 2.3	0.62 0.63 2.6			12
			0.62 0.62 0.2	0.89 0.88 -0.5	1.00 1.00 -0.5	1.04 1.04 -0.3	1.11 1.10 -0.6	1.04 1.03 -1.4	1.00 1.00 -0.6	0.89 0.89 0.7	0.62 0.63 2.6				13
				0.59 0.59 -0.5	0.88 0.88 -0.4	0.99 0.98 -0.3	0.94 0.92 -1.1	0.99 0.97 -1.3	0.88 0.87 -1.1	0.59 0.59 -0.4					14
						0.60 0.60 -0.3	0.76 0.75 -2.1	0.60 0.59 -2.1							15

PREDICTED
MEASURED
P/C DIFFERENCE

MAP NO. 44 DATE 4/2/73 POWER ∿ 2200 MWT

CONTROL ROD POSITIONS

BANK C AT 228 STEPS

BANK D AT 206 STEPS

BANK P/L 228 STEPS

$F^N_{\Delta H}$ = 1.46 AT J-8 HG*

F^N_Q = 1.95 AT J-8 HG*

$\overline{F}_z$ = 1.33

A.O. = -4.9

BURNUP = ∿ 2240 MWD/MTU

INCORE TILT

NW -1.002

NE -0.998

SW -0.998

SE -1.002

* Includes measurement uncertainty
Does not include densification penalties

SURRY UNIT 1 - CYCLE 1 FIGURE 2.3.2

ASSEMBLYWISE POWER DISTRIBUTION

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
						0.59 0.61 2.5	0.73 0.75 2.4	0.59 0.59 0.7							1
				0.62 0.62 0.9	0.89 0.86 -2.5	1.00 1.00 0.1	0.91 0.91 -0.1	1.00 0.99 -0.9	0.89 0.87 -2.2	0.62 0.65 5.8					2
			0.66 0.67 1.4	0.97 1.00 3.6	1.06 1.13 6.2	1.04 1.02 -1.9	1.13 1.10 -2.3	1.04 1.02 -1.3	1.06 1.06 -0.7	0.97 1.04 7.5	0.66 0.78 18.2				3
		0.66 0.65 -1.8	0.85 0.87 1.5	1.07 1.13 5.0	1.07 1.10 2.4	1.19 1.17 -1.4	1.10 1.09 -1.2	1.19 1.18 -0.7	1.07 1.08 0.8	1.07 1.11 3.0	0.85 0.90 4.9	0.66 0.68 3.8			4
	0.62 0.60 -3.6	0.97 0.93 -3.6	1.07 1.07 -0.8	1.07 1.07 0.3	1.19 1.19 -0.1	1.12 1.11 -0.9	1.22 1.22 0.1	1.12 1.13 0.8	1.19 1.20 0.9	1.07 1.07 0.2	1.07 1.02 -4.8	0.97 0.93 -3.3	0.62 0.61 -0.8		5
	0.89 0.87 -1.3	1.06 1.05 -1.3	1.07 1.05 -2.3	1.19 1.14 -4.4	1.10 1.08 -2.0	1.22 1.23 0.5	1.13 1.15 1.7	1.22 1.23 0.4	1.10 1.10 0.1	1.19 1.19 0.2	1.07 1.06 -0.5	1.06 1.05 -0.9	0.89 0.88 -0.8		6
0.59 0.65 10.4	1.00 1.04 4.3	1.04 1.05 1.2	1.19 1.19 0.0	1.12 1.09 -2.3	1.22 1.21 -1.2	1.13 1.14 0.4	1.24 1.24 0.2	1.13 1.12 -1.2	1.22 1.22 0.1	1.12 1.14 2.4	1.19 1.23 3.7	1.04 1.06 2.8	1.00 1.02 2.0	0.59 0.60 2.0	7
0.73 0.81 10.2	0.91 0.96 5.2	1.13 1.16 3.0	1.10 1.12 1.7	1.22 1.23 0.7	1.13 1.14 0.5	1.24 1.24 0.2	1.14 1.13 -0.5	1.24 1.23 -0.3	1.13 1.14 0.9	1.22 1.24 1.4	1.10 1.13 2.9	1.13 1.15 2.1	0.91 0.93 1.7	0.73 0.75 1.9	8
0.59 0.65 10.4	1.00 1.03 2.9	1.04 1.03 -0.9	1.19 1.18 -0.3	1.12 1.12 0.7	1.22 1.22 -0.6	1.13 1.11 -1.8	1.24 1.23 -0.5	1.13 1.13 0.1	1.22 1.21 -1.1	1.12 1.11 -0.5	1.19 1.19 0.3	1.04 1.05 1.3	1.00 1.01 1.7	0.59 0.60 1.6	9
	0.89 0.84 -5.1	1.06 1.01 -5.1	1.07 1.04 -2.8	1.19 1.20 0.8	1.10 1.09 -0.9	1.22 1.20 -1.8	1.13 1.12 -1.0	1.22 1.22 -0.6	1.10 1.09 -1.1	1.19 1.18 -1.2	1.07 1.06 -0.9	1.06 1.07 0.2	0.89 0.90 1.2		10
	0.62 0.61 -1.8	0.97 0.95 -1.8	1.07 1.07 -0.7	1.07 1.08 0.7	1.19 1.18 -0.8	1.12 1.09 -2.0	1.22 1.20 -2.0	1.12 1.10 -1.3	1.19 1.18 -1.3	1.07 1.06 -1.0	1.07 1.07 -0.2	0.97 0.97 0.5	0.62 0.62 0.9		11
		0.66 0.67 1.5	0.85 0.86 1.2	1.07 1.08 0.7	1.07 1.06 -1.0	1.19 1.17 -1.4	1.10 1.12 1.9	1.19 1.21 2.2	1.07 1.05 -1.5	1.07 1.07 -0.4	0.85 0.86 1.0	0.66 0.66 0.4			12
			0.66 0.65 -0.7	0.97 0.94 -2.9	1.06 1.04 -2.5	1.04 1.06 1.9	1.13 1.18 4.5	1.04 1.05 1.0	1.06 1.05 -1.5	0.97 0.96 -0.4	0.66 0.66 0.9				13
				0.62 0.60 -2.9	0.89 0.93 5.6	1.00 1.13 13.5	0.91 0.97 6.1	1.00 0.99 -0.7	0.89 0.87 -1.4	0.62 0.61 -1.6					14
						0.59 0.70 18.4	0.73 0.81 10.6	0.59 0.58 -1.4			PREDICTED MEASURED P/C DIFFERENCE				15

MAP NO. 59 DATE 11/14/73 POWER ∿ 2295 MWT

CONTROL ROD POSITIONS		INCORE TILT
BANK C AT 228 STEPS	$F^N_{\Delta H}$ = 1.35 AT E-8 HG*	NW - 0.998
BANK D AT 210 STEPS	F^N_Q = 1.58 AT E-8 HG*	NE - 1.004
BANK P/L 228 STEPS	$\overline{F}_z$ = 1.19	SW - 1.001
	A.O. = -1.7	SE - 0.997
	BURNUP = ∿6800 MWD/MTU	

* Includes measurement uncertainty
Does not include densification penalties

SURRY UNIT 1 - CYCLE 1 FIGURE 2.3.3

ASSEMBLYWISE POWER DISTRIBUTION

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
						0.61	0.75	0.61							
						0.63	0.77	0.62							1
						2.8	2.7	1.0							
				0.65	0.90	1.03	0.93	1.03	0.90	0.65					
				0.64	0.89	1.03	0.94	1.03	0.89	0.64					2
				-0.7	-1.0	0.5	1.2	0.1	-1.7	-1.6					
			0.69	1.03	1.11	1.04	1.14	1.04	1.11	1.03	0.69				
			0.68	0.99	1.07	1.03	1.15	1.03	1.08	1.01	0.68				3
			-1.2	-3.4	-3.0	-0.7	0.4	-0.9	-2.3	-1.9	-1.4				
		0.69	0.89	1.12	1.07	1.18	1.07	1.18	1.07	1.12	0.89	0.69			
		0.69	0.86	1.05	1.04	1.19	1.09	1.17	1.04	1.11	0.88	0.68			4
		-1.7	-3.1	-5.6	-2.5	0.8	1.6	-0.5	-2.6	-1.3	-0.9	-1.6			
	0.65	1.03	1.12	1.06	1.18	1.07	1.18	1.07	1.18	1.06	1.12	1.03	0.65		
	0.65	1.00	1.09	1.00	1.16	1.08	1.20	1.07	1.17	1.06	1.11	1.01	0.63		5
	-2.7	-2.3	-4.8	-6.1	-1.5	1.5	1.8	0.4	-0.8	-0.3	-0.7	-1.6	-2.4		
	0.90	1.11	1.07	1.18	1.06	1.17	1.06	1.17	1.06	1.18	1.07	1.11	0.90		
	0.88	1.07	1.03	1.22	1.07	1.18	1.08	1.18	1.06	1.17	1.05	1.08	0.86		6
	-3.0	-3.0	-3.0	3.8	1.2	1.5	1.9	1.2	0.2	-0.5	-1.3	-1.9	-2.4		
0.61	1.03	1.04	1.18	1.07	1.17	1.05	1.16	1.05	1.17	1.07	1.18	1.04	1.03	0.61	
0.61	1.03	1.00	1.17	1.11	1.19	1.06	1.17	1.07	1.19	1.07	1.15	1.04	1.05	0.62	7
-0.7	-1.1	-3.6	-0.2	3.8	2.1	1.2	1.5	1.4	1.6	-0.1	-2.2	0.1	1.9	2.5	
0.75	0.89	1.14	1.07	1.18	1.06	1.16	1.05	1.16	1.06	1.18	1.07	1.14	0.89	0.75	
0.74	0.89	1.15	1.08	1.22	1.09	1.17	1.07	1.19	1.09	1.19	1.06	1.15	0.85	0.76	8
-0.8	-0.9	0.4	1.6	3.8	3.2	1.1	2.6	2.9	3.0	1.0	-0.8	0.9	1.8	2.3	
0.61	1.03	1.04	1.18	1.07	1.17	1.05	1.16	1.05	1.17	1.07	1.18	1.04	1.03	0.61	
0.61	1.03	1.04	1.20	1.11	1.20	1.05	1.20	1.10	1.19	1.08	1.18	1.04	1.02	0.61	9
-0.7	-0.1	0.2	2.4	4.2	3.0	0.3	3.4	4.6	1.8	1.4	0.5	0.1	-0.3	-0.8	
	0.90	1.11	1.07	1.18	1.06	1.17	1.06	1.17	1.06	1.18	1.07	1.11	0.90		
	0.90	1.10	1.07	1.20	1.07	1.17	1.08	1.18	1.06	1.17	1.07	1.08	0.87		10
	-0.8	-0.8	0.7	1.9	1.2	0.6	2.5	1.6	-0.1	-0.6	0.2	-1.9	-4.0		
	0.65	1.03	1.12	1.06	1.18	1.07	1.18	1.07	1.18	1.06	1.12	1.03	0.65		
	0.65	1.03	1.12	1.06	1.18	1.09	1.21	1.06	1.13	1.06	1.15	1.04	0.64		11
	-0.2	-0.2	-0.3	-0.6	0.3	1.6	2.5	-1.0	-4.0	0.2	2.2	1.0	-2.1		
		0.69	0.89	1.12	1.07	1.18	1.07	1.18	1.07	1.12	0.89	0.69			
		0.69	0.89	1.11	1.07	1.19	1.08	1.16	1.04	1.13	0.94	0.70			12
		0.4	0.1	-0.5	0.8	1.4	0.8	-1.2	-2.0	1.1	5.6	1.7			
			0.69	1.03	1.11	1.04	1.14	1.04	1.11	1.03	0.69				
			0.69	1.02	1.11	1.03	1.12	1.02	1.09	1.05	0.72				13
			-0.1	-0.5	0.5	-0.2	-1.8	-1.9	-0.9	2.3	4.5				
				0.65	0.90	1.03	0.93	1.03	0.90	0.65					
				0.64	0.88	0.98	0.90	1.00	0.89	0.64					14
				-0.6	-2.7	-4.4	-3.3	-2.6	-1.8	-0.7					
						0.61	0.75	0.61							
						0.57	0.71	0.59							15
						-5.9	-4.7	-2.6							

PREDICTED
MEASURED
P/C DIFFERENCE

MAP NO. 71 DATE 9/18/74 POWER ∿2390 MWT

CONTROL ROD POSITIONS

BANK C AT 228 STEPS

BANK D AT 225 STEPS

BANK P/L 228 STEPS

$F^N_{\Delta H}$ = 1.35 AT D11-GD*

F^N_Q - 1.56 AT D11-GD*

$\overline{F}_z$ = 1.15

A.O. = -0.2 %

BURNUP = ∿12670 MWD/MTU

INCORE TILT

NW - 1.005

NE - 0.990

SW - 1.001

SE - 1.004

*Includes measurement uncertainty
Does not include densification penalties

SURRY UNIT 1 - CYCLE 1

FIGURE 2.3.4

CORE AVERAGE AXIAL POWER DISTRIBUTION

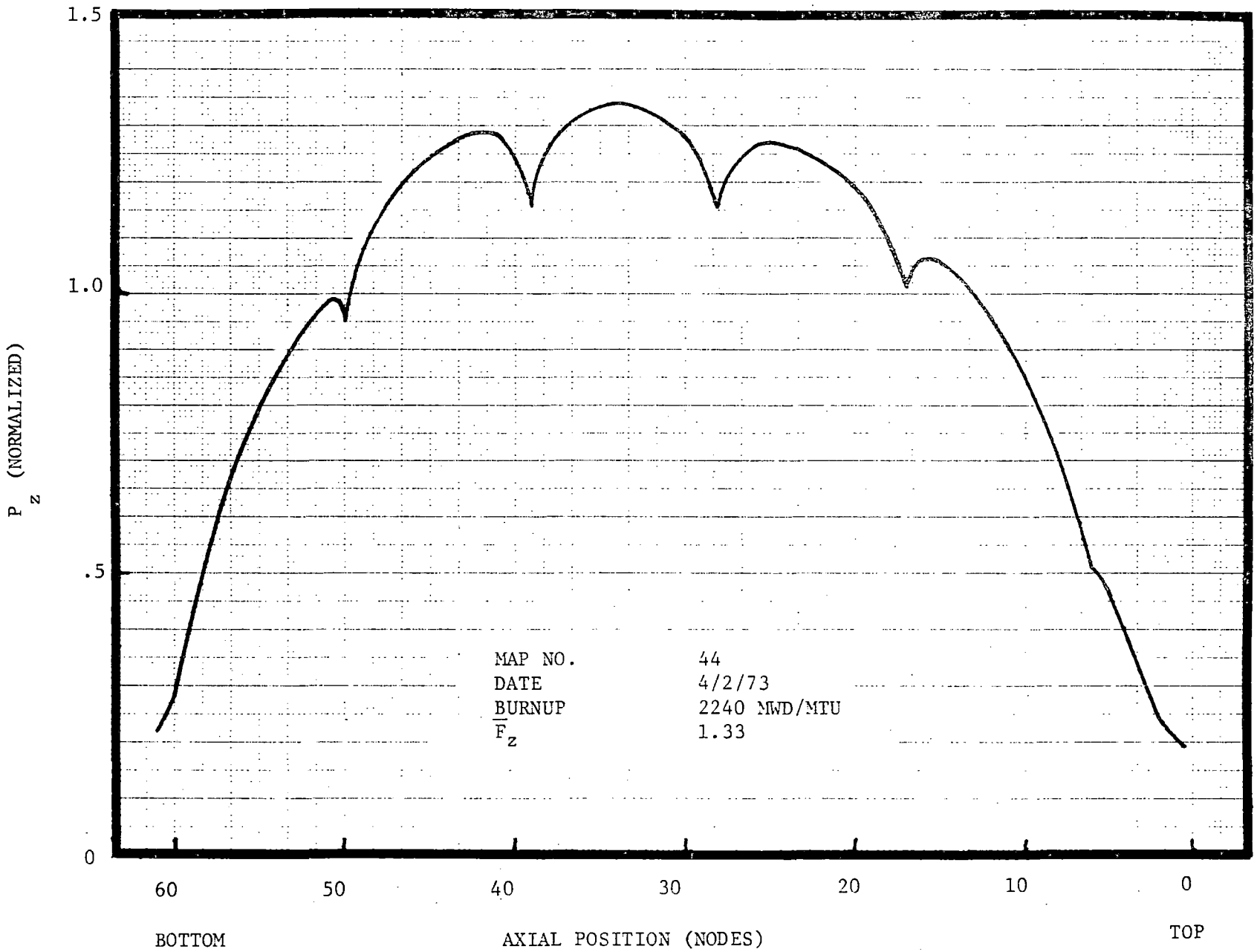
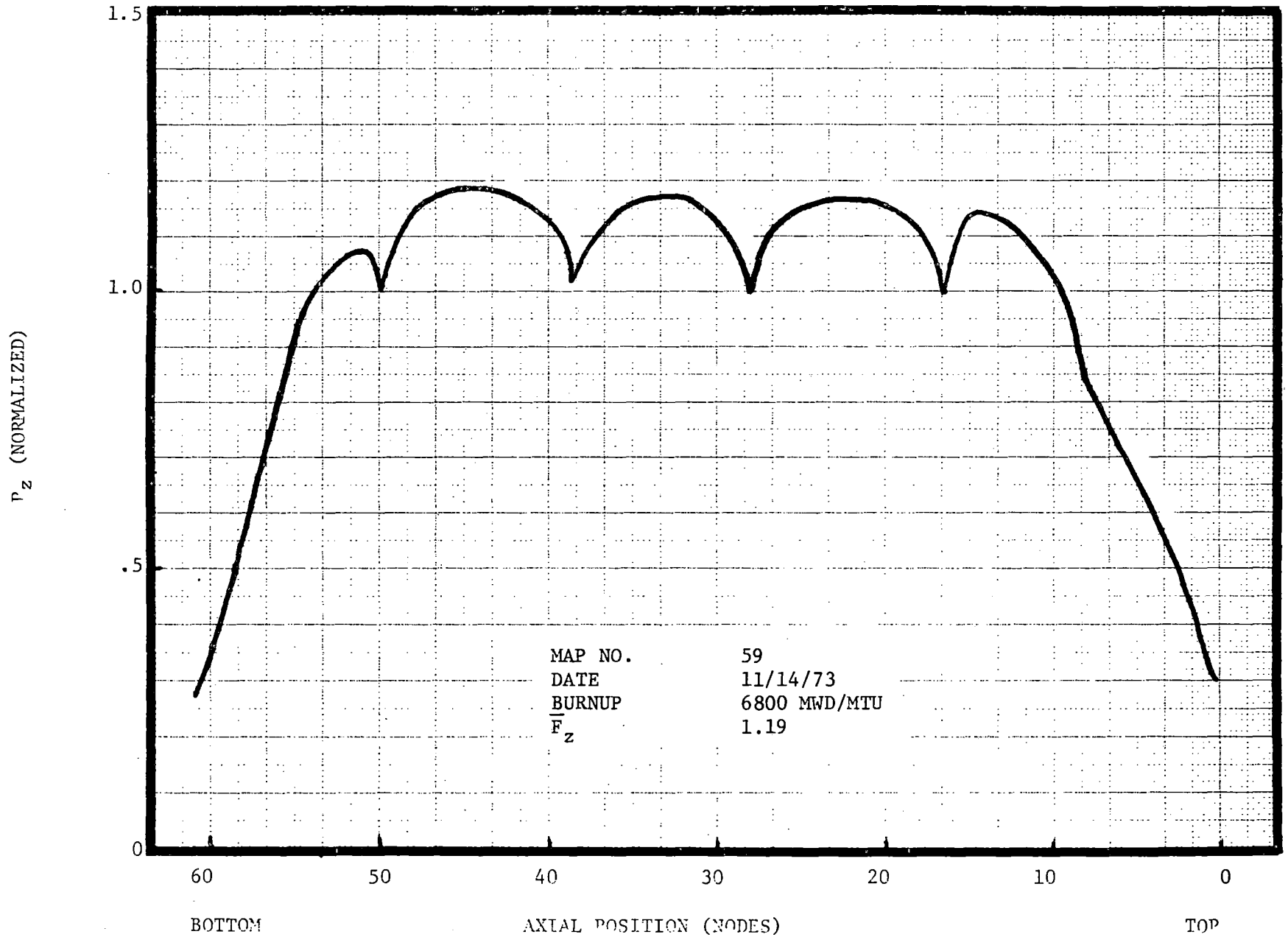


FIGURE 2.3.5

SURRY UNIT 1 - CYCLE 1

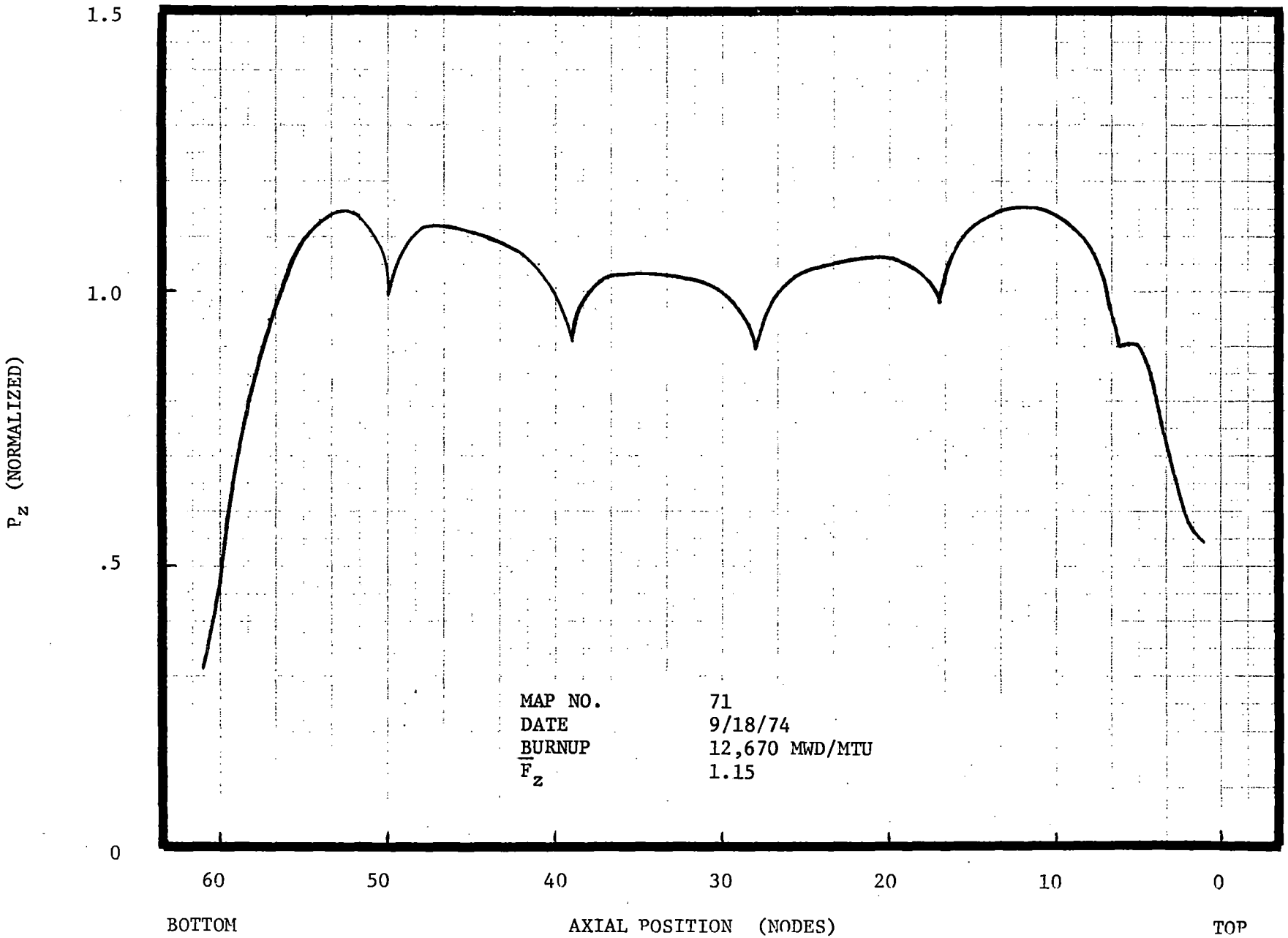
CORE AVERAGE AXIAL POWER DISTRIBUTION



SURRY UNIT 1 - CYCLE 1

FIGURE 2.3.6

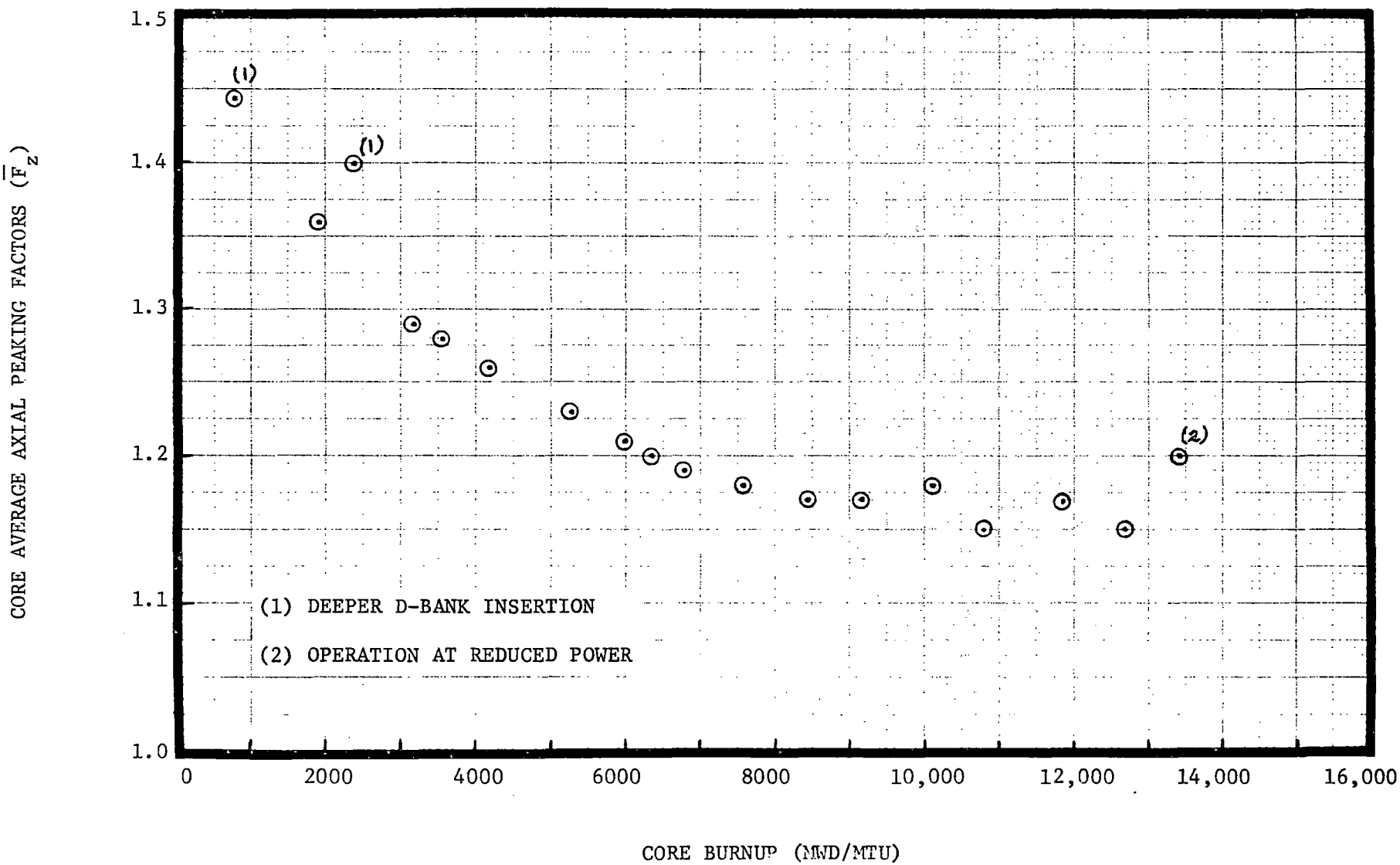
CORE AVERAGE AXIAL POWER DISTRIBUTION



SURRY UNIT 1 - CYCLE 1

FIGURE 2.3.7

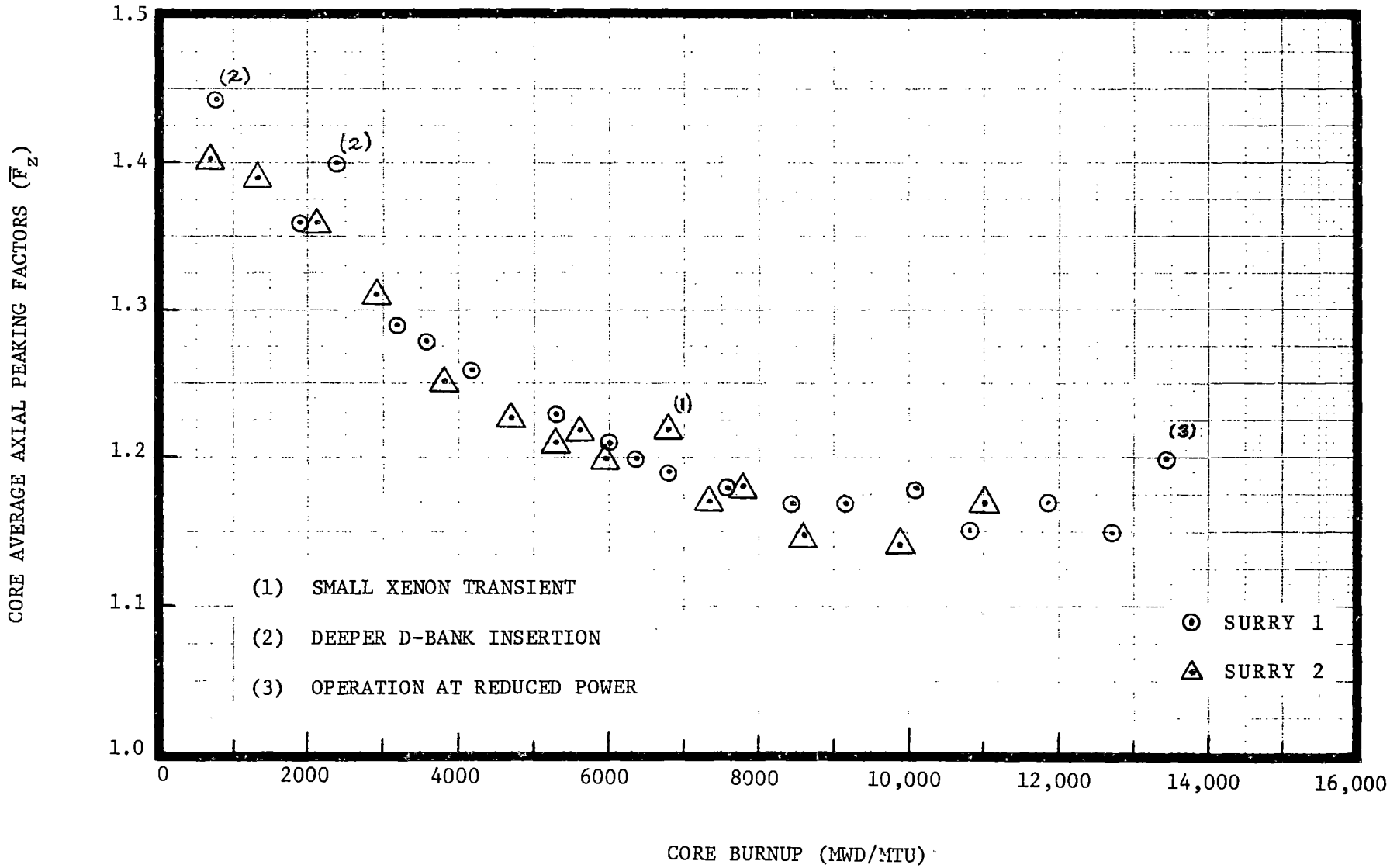
CORE AVERAGE AXIAL PEAKING FACTORS
vs.
BURNUP



COMPARISON: SURRY UNIT 1 AND 2 - CYCLE 1

FIGURE 2.3.8

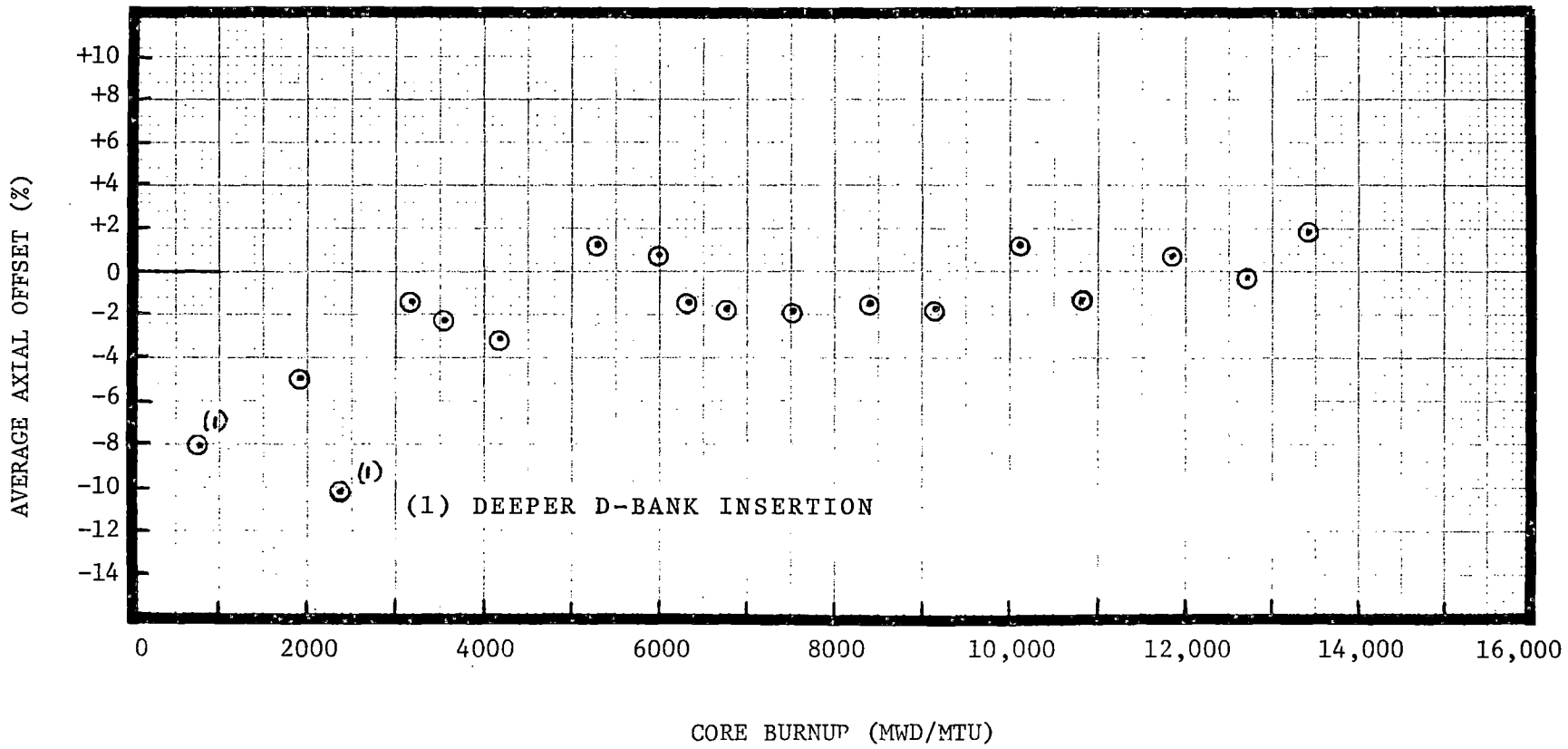
CORE AVERAGE AXIAL PEAKING FACTORS
vs.
BURNUP



SURRY UNIT 1 - CYCLE 1

FIGURE 2.3.9

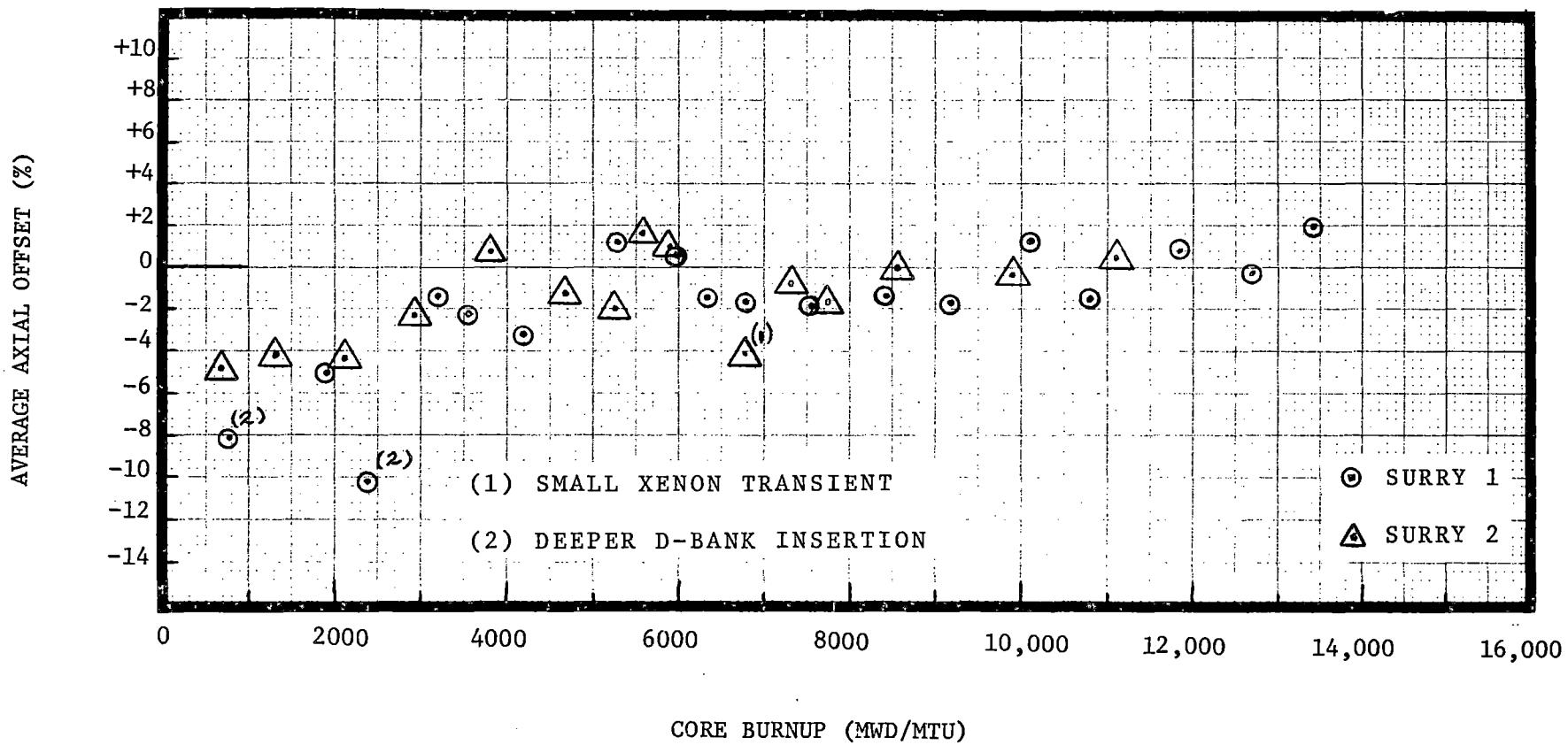
AVERAGE AXIAL OFFSET
vs.
BURNUP



COMPARISON: SURRY UNIT 1 AND 2 - CYCLE 1

FIGURE 2.3.10

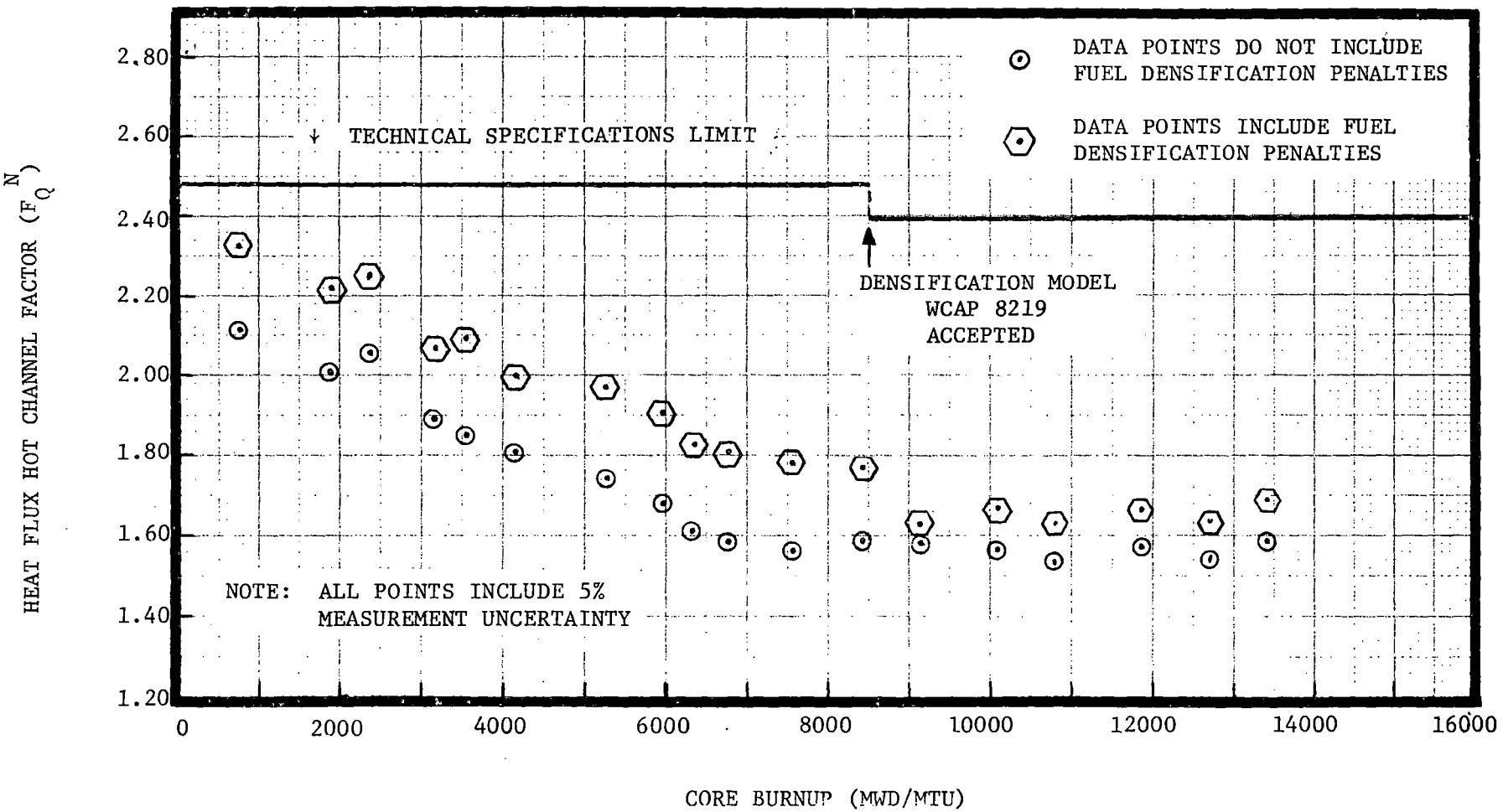
AVERAGE AXIAL OFFSET
vs.
BURNUP



SURRY UNIT 1 - CYCLE 1

FIGURE 2.3.11

HEAT FLUX HOT CHANNEL FACTOR
vs.
BURNUP



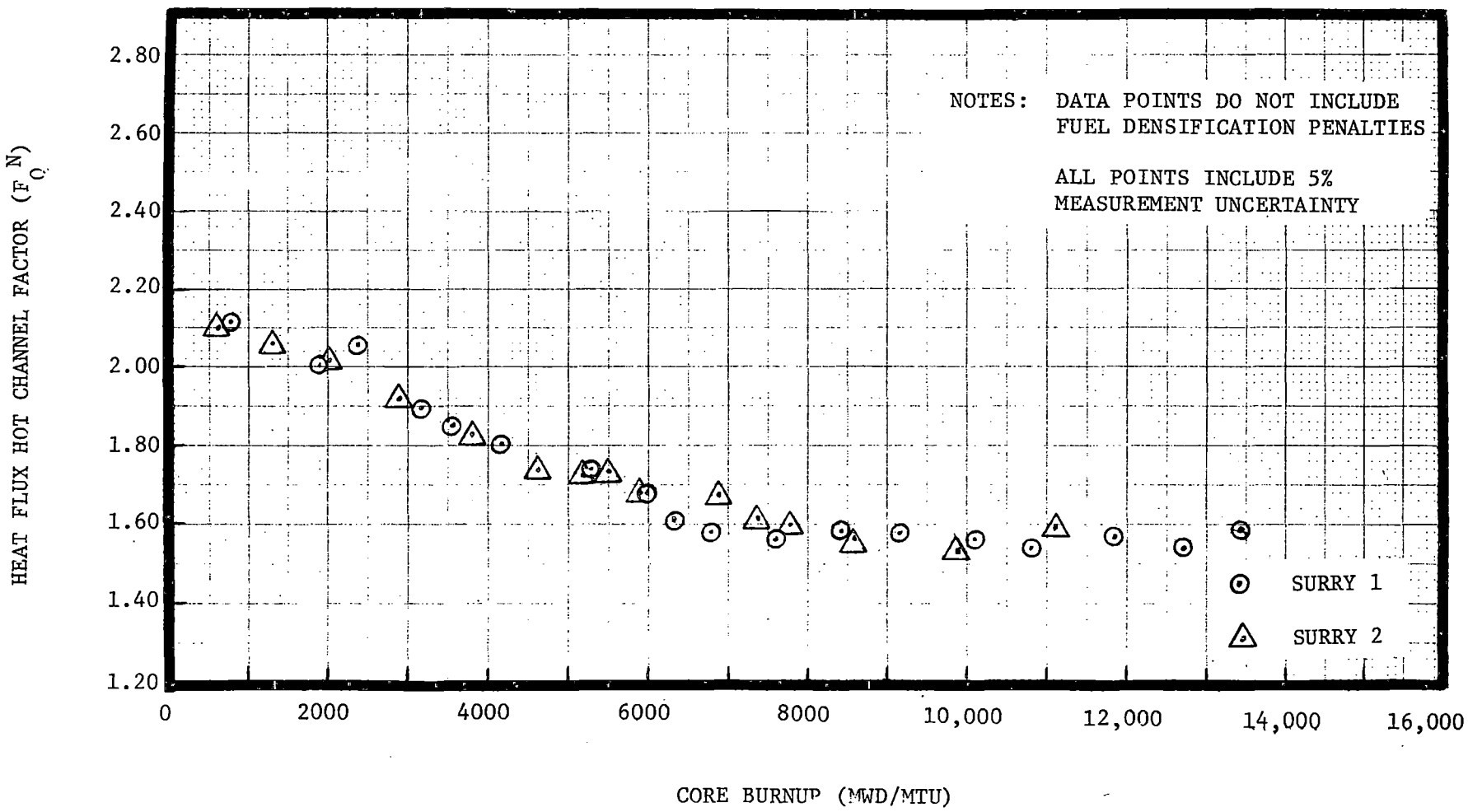
COMPARISON: SURRY UNIT 1 AND 2 - CYCLE 1

FIGURE 2.3.12

HEAT FLUX HOT CHANNEL FACTOR

vs.

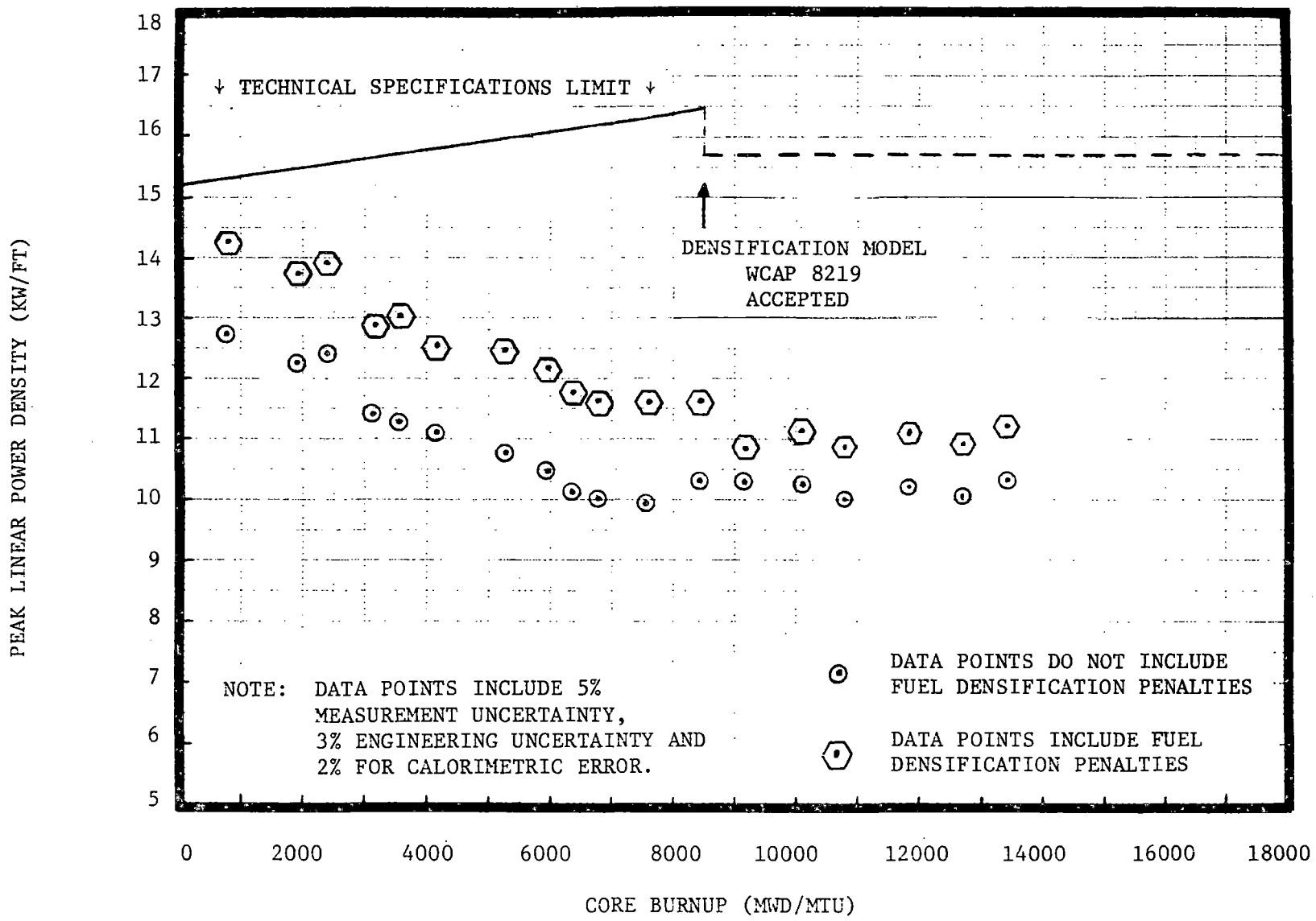
BURNUP



SURRY UNIT 1 - CYCLE 1

FIGURE 2.3.13

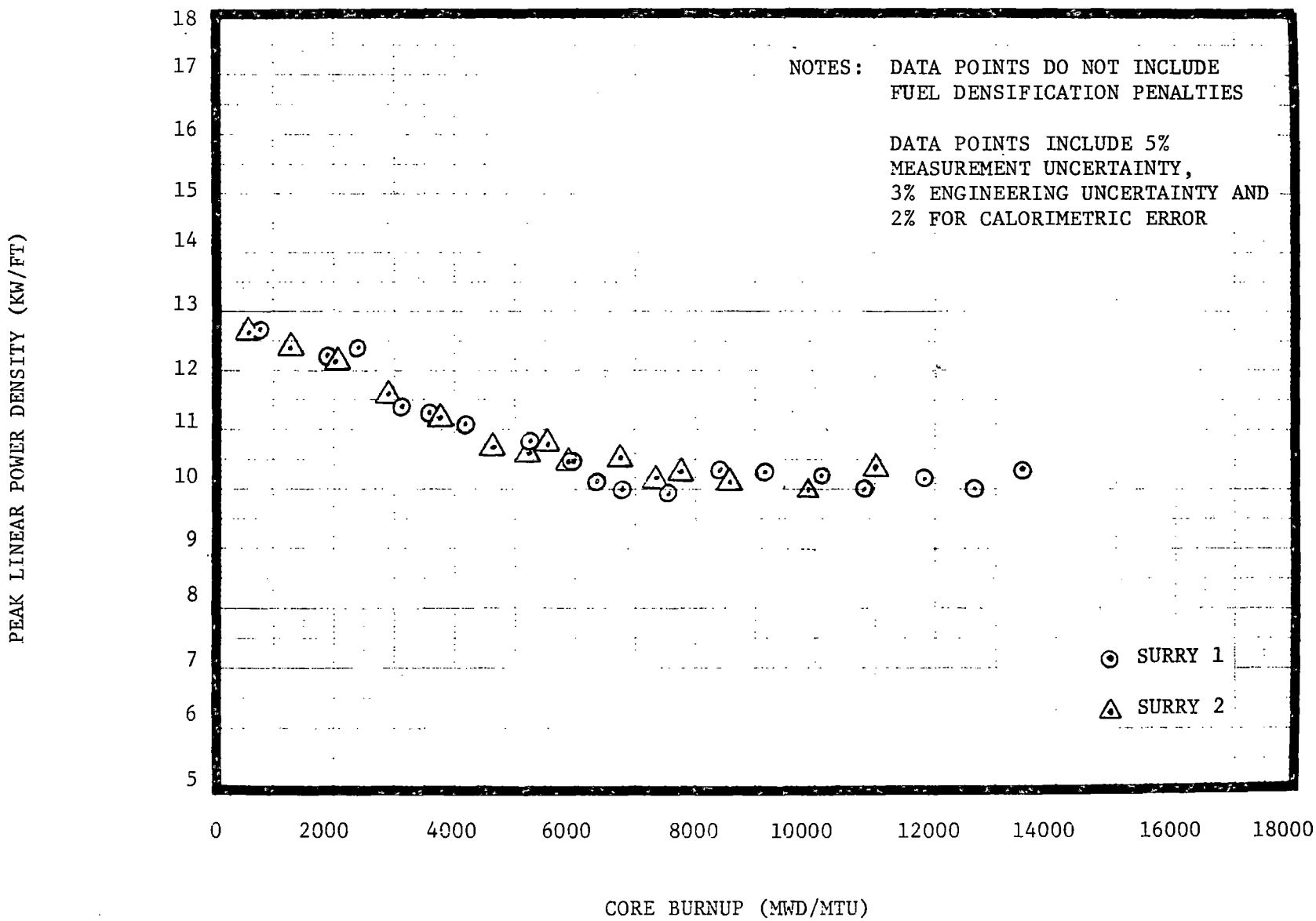
PEAK LINEAR POWER DENSITY
vs.
BURNUP



COMPARISON: SURRY UNIT 1 AND 2 - CYCLE 1

FIGURE 2.3.14

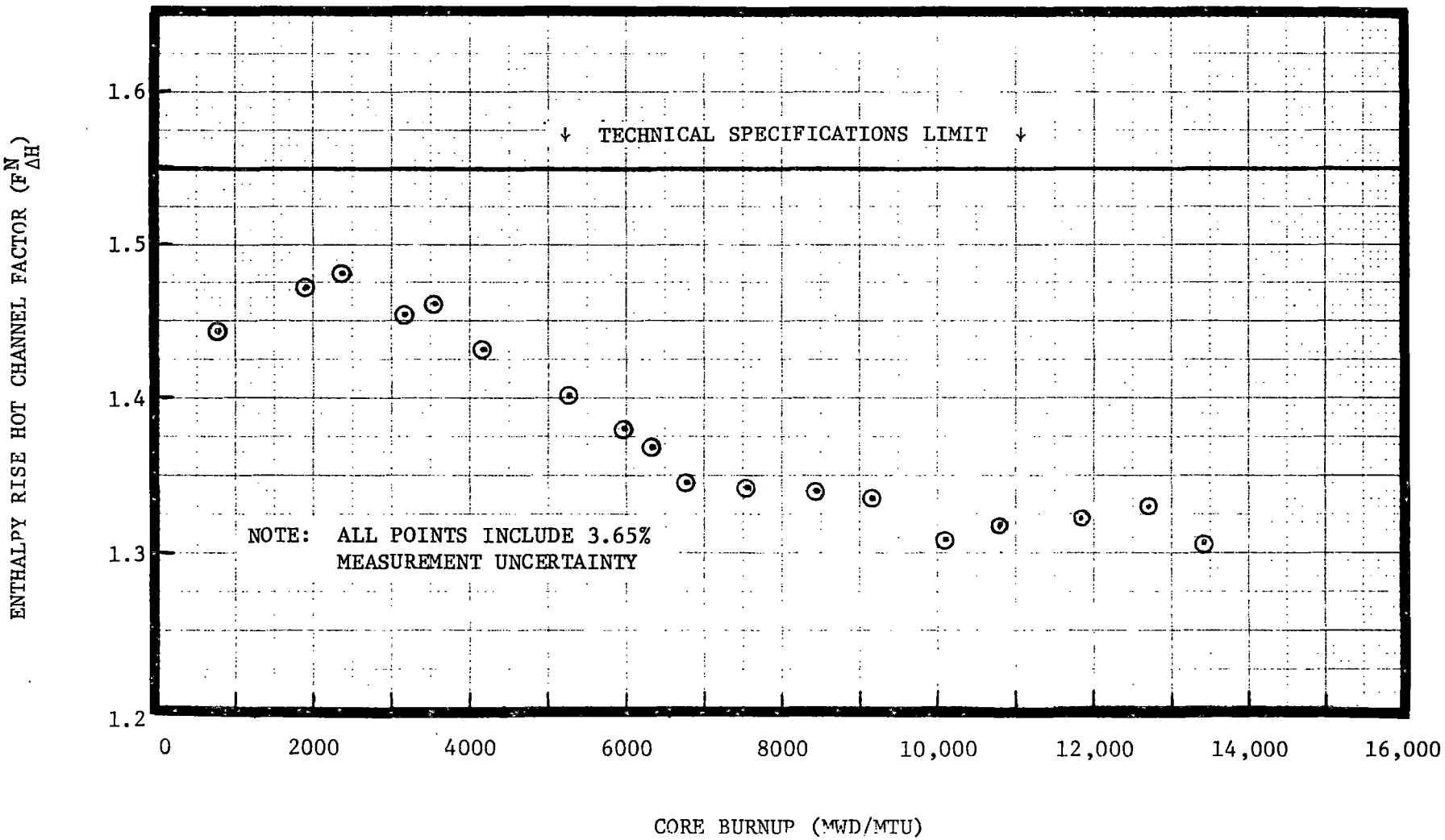
PEAK LINEAR POWER DENSITY
vs.
BURNUP



SURRY UNIT 1 - CYCLE 1

FIGURE 2.3.15

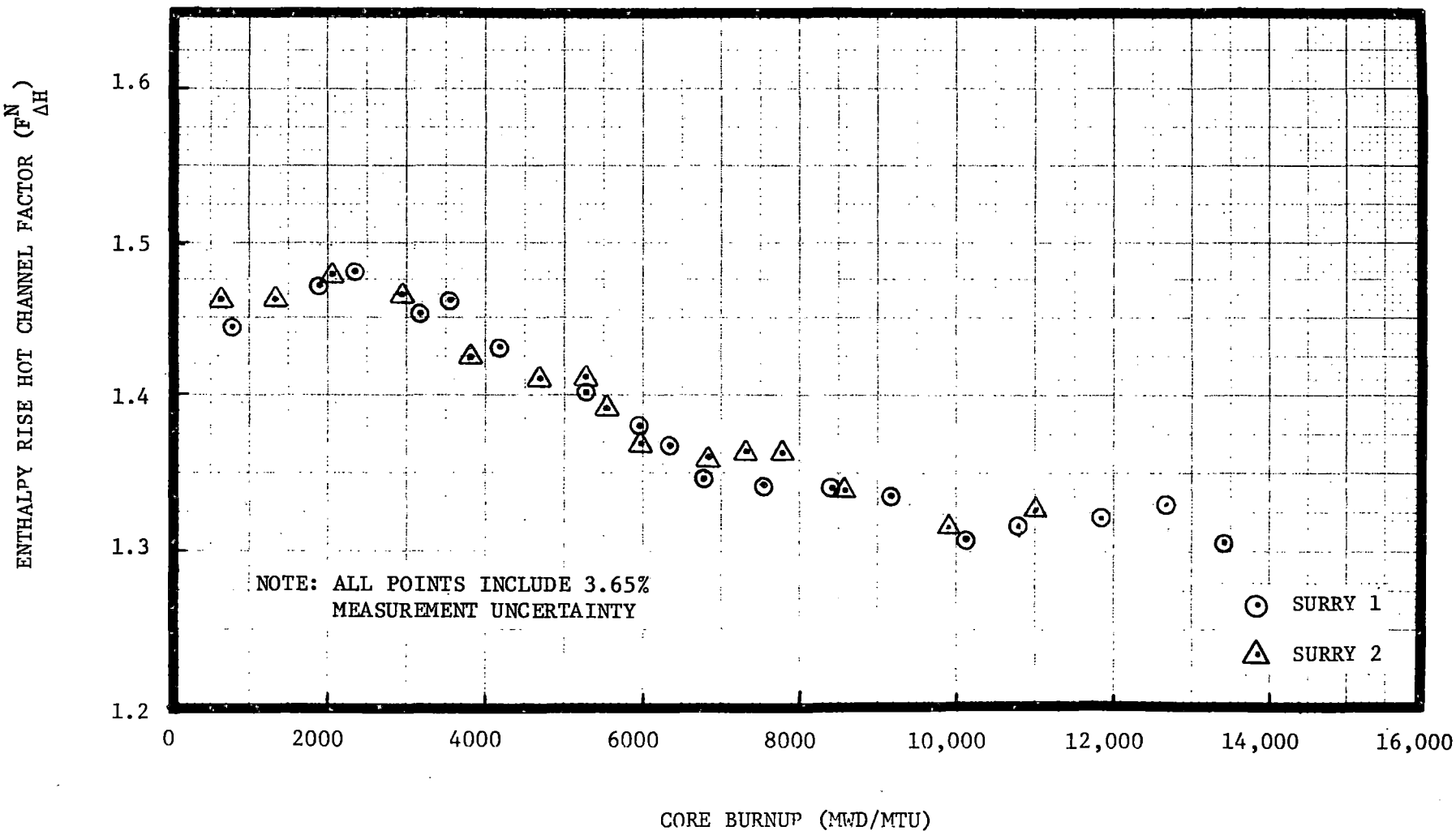
ENTHALPY RISE HOT CHANNEL FACTOR
vs.
BURNUP



COMPARISON: SURRY UNIT 1 AND 2 - CYCLE 1

FIGURE 2.3.16

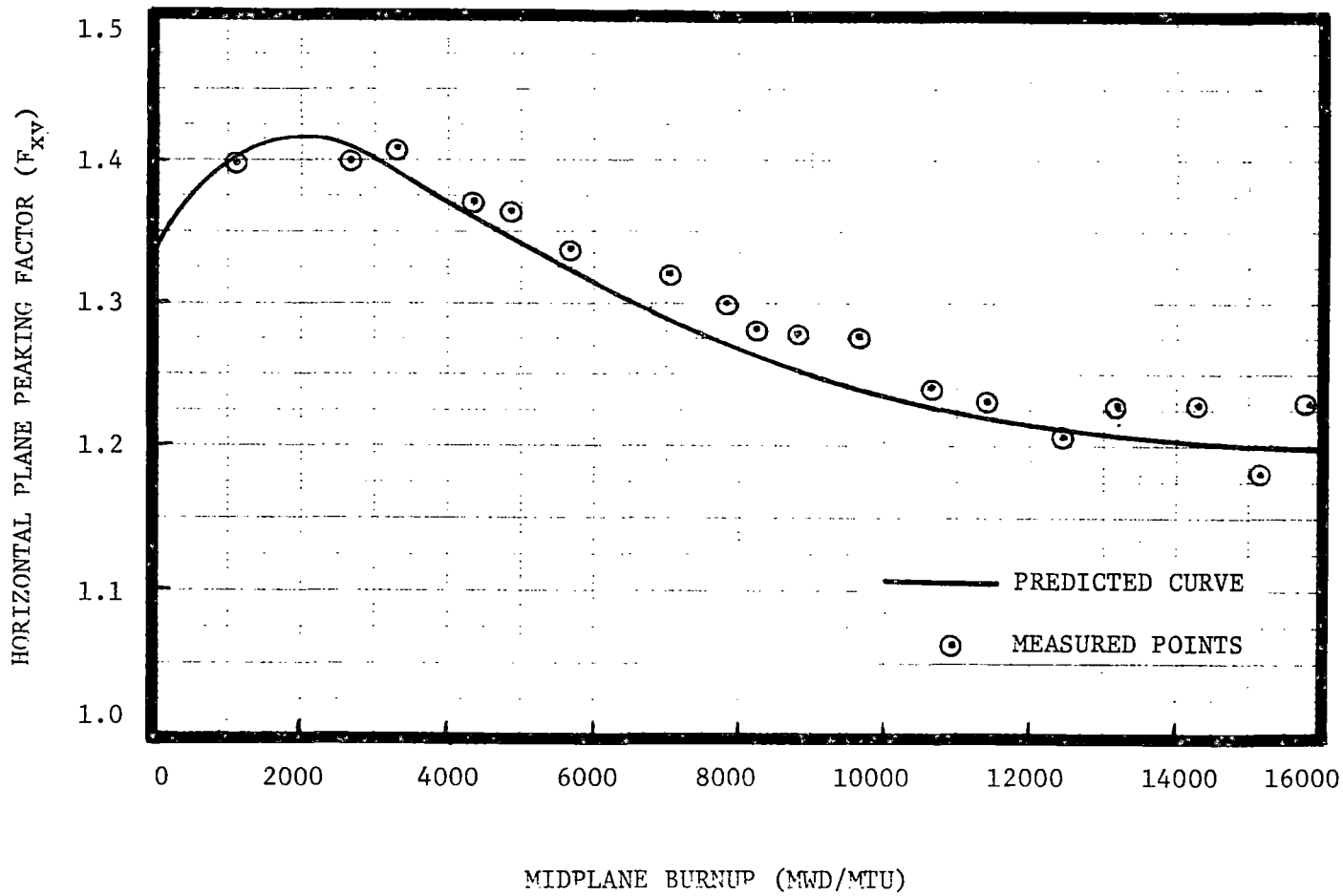
ENTHALPY RISE HOT CHANNEL FACTOR
vs.
BURNUP



SURRY UNIT 1 - CYCLE 1

FIGURE 2.3.17

HORIZONTAL PLANE PEAKING FACTOR AT CORE MIDPLANE
vs.
BURNUP



COMPARISON: SURRY 1 AND 2 - CYCLE 1

FIGURE 2.3.18

HORIZONTAL PLANE PEAKING FACTOR AT CORE MIDPLANE
vs.
BURNUP

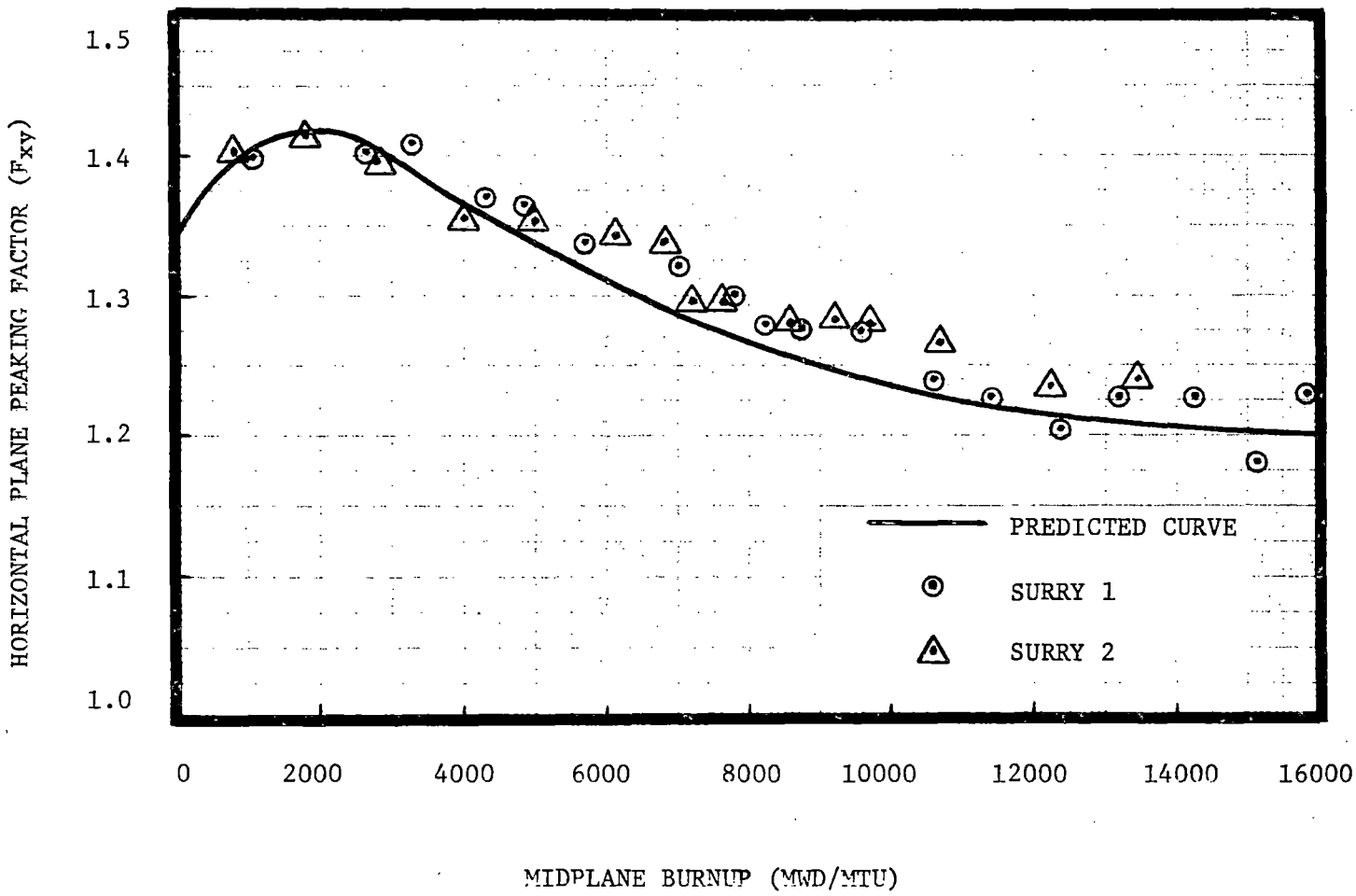
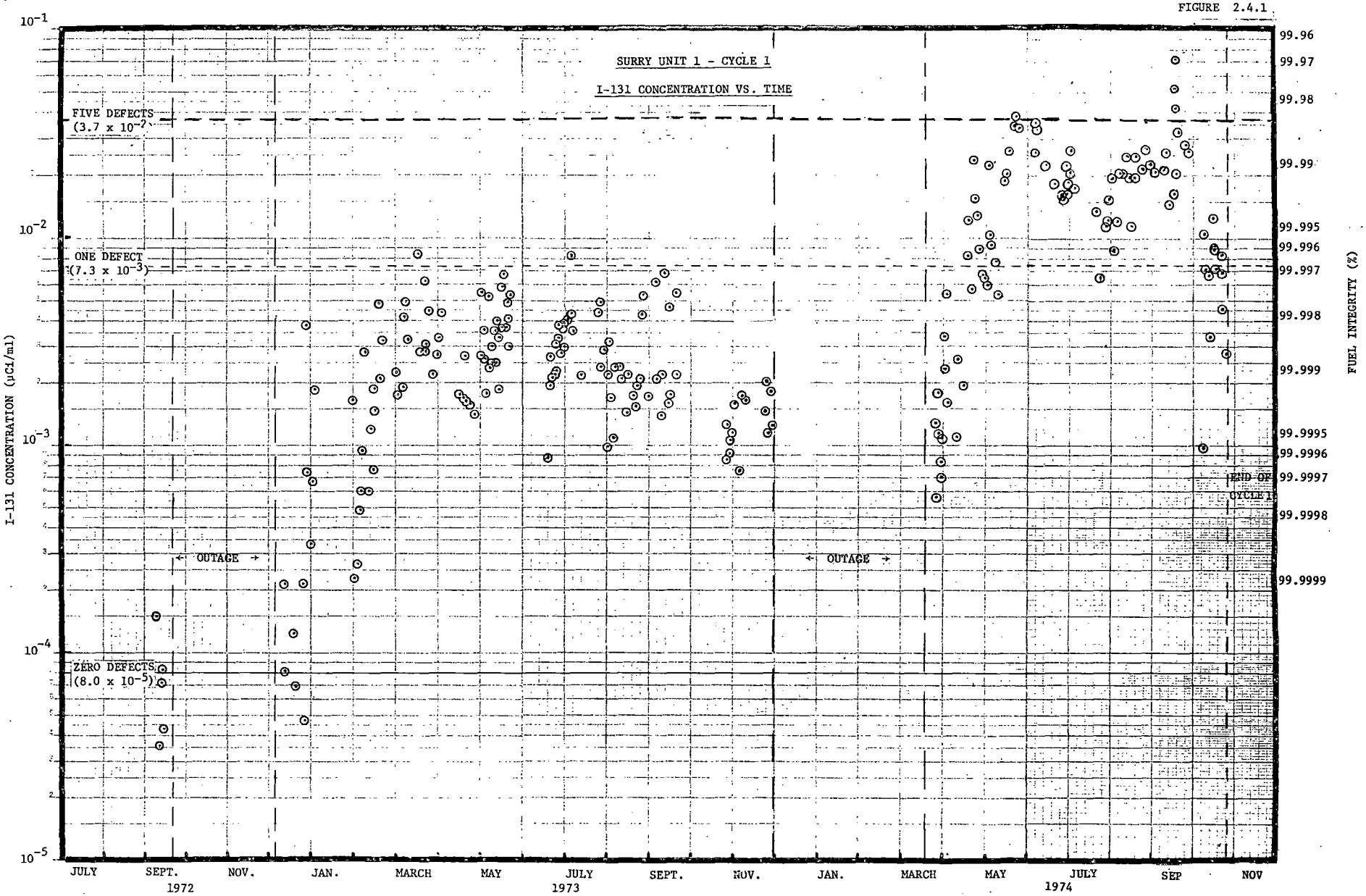


FIGURE 2.4.1


SURRY UNIT 1 - CYCLE 1
I-131 CONCENTRATION VS. TIME
FIVE DEFECTS
(3.7 x 10^-2)
ONE DEFECT
(7.3 x 10^-3)
ZERO DEFECTS
(8.0 x 10^-5)
← OUTAGE →
← OUTAGE →
END OF CYCLE 1
I-131 CONCENTRATION (μCi/ml)
FUEL INTEGRITY (%)
10^-1
10^-2
10^-3
10^-4
10^-5
99.96
99.97
99.98
99.99
99.995
99.996
99.997
99.998
99.999
99.9995
99.9996
99.9997
99.9998
99.9999
JULY
SEPT.
NOV.
JAN.
MARCH
MAY
JULY
SEPT.
NOV.
JAN.
MARCH
MAY
JULY
SEP
NOV
1972
1973
1974

SURRY UNIT 1 - CYCLE 1

I-131/I-133 RATIO vs. TIME

FIGURE 2.4.2

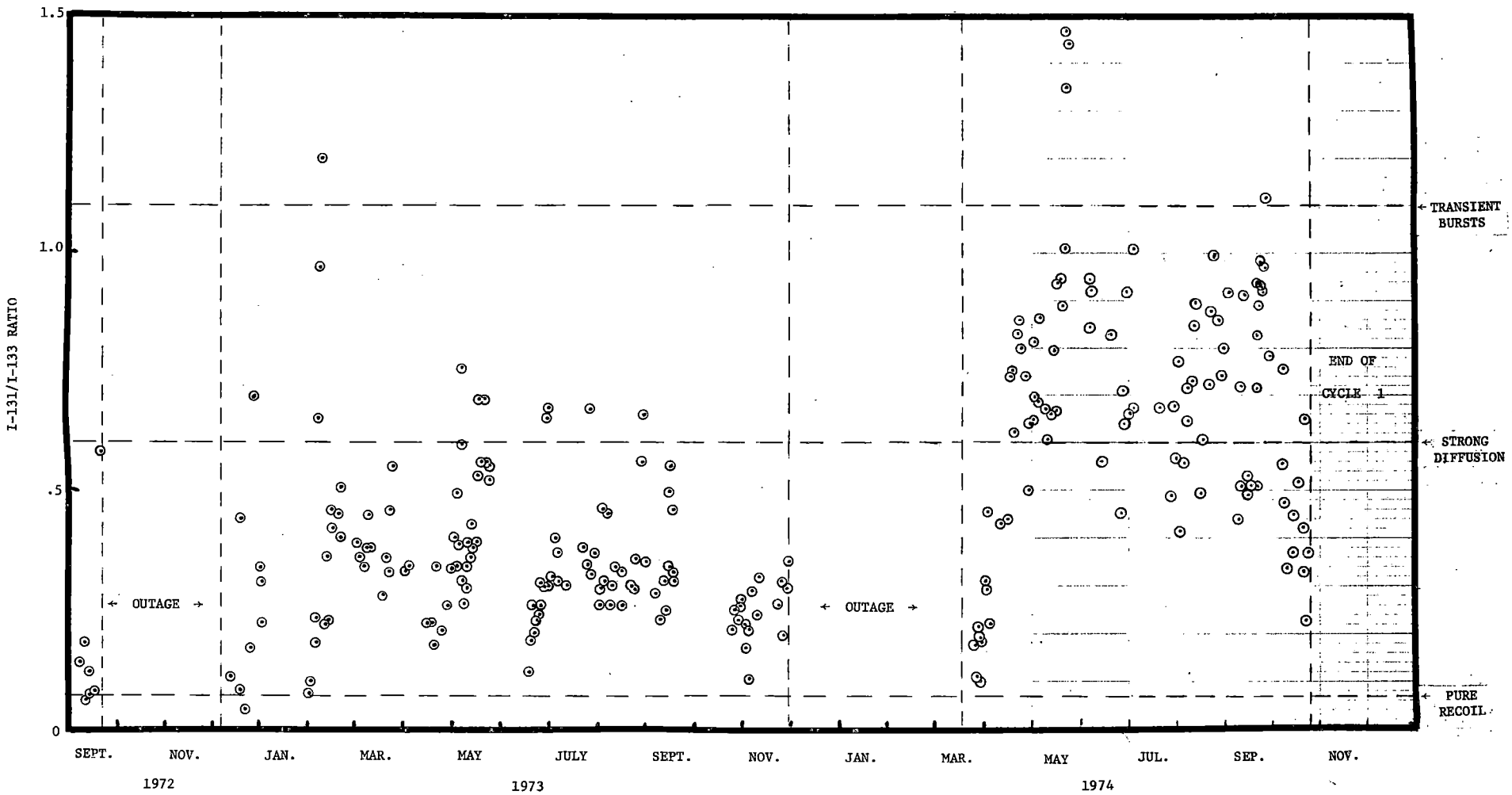


TABLE 2.5.1

LOCATIONS OF DENSIFICATION POWER SPIKES

Strip-Chart Figure Number(1)	Assembly Location	Detector	Fuel Region(2)	Enrich-ment (w/o U235)	UO_2 Density (% Theoretical)	Power Spike (%) June 30, 1974	Power Spike (%) End of Cycle 1	Power Spike (%) Δ	Change in Last 3 Maps	Location of Spike(3)	Status
1	B-10	C	3	3.12	91.9	1.9	4.8	2.9	slight	1	confirmed
2	N-12	E	3	3.12	91.9	2.5	4.3	1.8	moderate	1	confirmed
3	F-2	B	3	3.12	91.9	2.4	2.8	0.4	moderate	1	confirmed
4	B-7	A	3	3.12	91.9	2.0	2.7	0.7	nil	1	confirmed
4	L-8	B	2	2.57	92.9	0.6	1.8	1.2	large	1	confirmed
5	H-13	C	2	2.57	92.9	1.5	1.5	0.0	nil	1	confirmed
6	F-9	B	2	2.57	92.9	0.8	1.5	0.7	moderate	1	confirmed
7	M-3	B	3	3.12	91.9	-	1.5	-	large	1	confirmed
8	R-8	C	3	3.12	91.9	1.4	1.4	0.0	nil	3	confirmed
9	N-5	D	3	3.12	91.9	2.1	1.3	0.8	slight	1	confirmed
10	N-10	A	2	2.57	92.9	0.7	1.2	0.5	slight	1	confirmed
11	A-9	A	3	3.12	91.9	0.5	1.0	0.5	slight	1	confirmed
12	G-9	E	1	1.87	93.5	0.8	0.8	0.0	slight	2	confirmed
3	H-11	A	2	2.57	92.9	0.8	0.8	0.0	nil	2	confirmed
13	H-1	E	3	3.12	91.9	0.6	0.8	0.2	nil	1	confirmed
14	L-14	A	3	3.12	91.9	0.8	0.8	0.0	nil	1	confirmed
15	D-7	C	2	2.57	92.9	0.7	0.7	0.0	nil	2	confirmed
16	L-4	C	2	2.57	92.9	0.5	0.5	0.0	nil	1	confirmed
17	B-5	E	3	3.12	91.9	-	0.9	-	moderate	1	suspected
18	J-7	all	1	1.87	93.5	0.7	0.7	0.0	nil	2	suspected
19	N-7	E	1	1.87	93.5	0.7	0.7	0.0	slight	2	suspected
20	H-4	D	1	1.87	93.5	0.2	0.4	0.2	nil	1	suspected

(1) See Appendix E

(2) Standard W region definition

(3) 1-upper third; 2 midplane third; 3-lower third

COMPARISON: SURRY 1 AND 2

TABLE 2.5.2

DENSIFICATION POWER SPIKES

UNIT	ASSEMBLY LOCATION	FUEL REGION	NOMINAL UO_2 DENSITY (% TD)	BLIP MAGNITUDE (%)	CORE AXIAL LOCATION (1)
SURRY 1	B-10	3	3.12	4.8	1
	N-12	3	3.12	4.3	1
	F-2	3	3.12	2.8	1
	B-7	3	3.12	2.7	1
	L-8	2	2.57	1.8	1
	H-13	2	2.57	1.5	1
	F-9	2	2.57	1.5	1
	M-3	3	3.12	1.5	1
	R-8	3	3.12	1.4	3
	N-5	3	3.12	1.3	1
	N-10	2	2.57	1.2	1
	A-9	3	3.12	1.0	1
	G-9	1	1.87	0.8	2
	H-11	2	2.57	0.8	2
	H-1	3	3.12	0.8	1
	L-14	3	3.12	0.8	1
	D-7	2	2.57	0.7	2
	L-4	2	2.57	0.5	1
SURRY 2	B-8	1	1.86	0.8	1
	J-7	1	1.86	0.6	1,3
	G-9	1	1.86	0.5	1
	G-14	3	3.11	0.5	1
	F-6	1	1.86	0.2	1

(1) 1-upper third; 2-midplane third; 3-lower third

CONCLUSION

The Surry 1 core has completed Cycle 1. Throughout the cycle, all performance indicators compared closely to design predictions and all Technical Specifications limits were met by significant margins. No abnormalities in reactivity, power distribution, or burnup accumulation were detected. Radioiodine analysis for Cycle 1 indicates that a small number of fuel defects did occur, however; the number was small and the mechanical integrity of the core was excellent. As anticipated, there were several assemblies with power spikes caused by the fuel densification effects; however no behavior was observed which deviated from that expected.

DEFINITION OF TERMS

ACTIVITY - Number of nuclear disintegrations per unit time taking place in a radioactive nuclide. Usually expressed in terms of μCi (3.7×10^4 disintegrations per second).

AXIAL OFFSET - The percent difference between the fraction of total core power produced in the upper half of the core and that produced in the lower half of the core.

BATCH - A group of assemblies which are inserted into the reactor at the same time. All of the assemblies in a batch may or may not have the same nuclear characteristics or be discharged at the same time. (See REGION)

BORON (Soluble) - A strong neutron absorber which is dissolved in the reactor coolant and used for reactivity control. The boron concentration in the coolant is expressed in terms of parts per million water (ppm).

BURNUP - The quantity of energy produced per unit weight of fuel. It is a measure of fuel consumption and typically has units of megawatt-days per metric ton of initially contained uranium (MWD/MTU).

CRITICAL - Condition in which the neutron chain reaction in a reactor is just self-sustaining.

CRITICAL BORON CONCENTRATION - The concentration of soluble boron in the coolant at which the reactor is just critical.

CRITICAL HEAT FLUX (DNB) - The point of transition between nucleate boiling and film boiling at the coolant-clad interface. Beyond this critical heat flux point, a vapor blanket forms on the cladding surface and acts as an insulator, thereby resulting in abnormally high clad temperatures.

DENSIFICATION - A recently discovered phenomenon in which the UO_2 fuel pellets shrink both radially and axially as a result of neutron irradiation.

DENSIFICATION-INDUCED GAPS - When a column of UO_2 pellets in a fuel rod shrinks due to densification, gaps may be formed in the pellet column due to pellet-clad interaction.

FISSION PRODUCTS - Residual nuclei which are generated during the fission process and which retain nearly all of the energy formed in the process.

FLUX (Neutron) - A measure of the intensity of neutrons, i.e., the number of neutrons passing through one square centimeter in one second.

FLUX MAP - A three-dimensional representation of the flux distribution throughout the core. It is obtained from measurements made with the movable detector system. (See MOVABLE DETECTOR)

HALF-LIFE - Period of time in which a radioactive element decays to half its original concentration.

IODINE-131; IODINE-133 - Fission products which, because of their radioactive properties, can be used to determine fuel clad defects.

LINEAR POWER DENSITY - Power generated per unit length of fuel rod. This parameter is a measure of the central temperature of the fuel rod and stored heat. Usually expressed in units of Kw/ft.

LOAD FACTOR - The ratio of the actual reactor energy generated over a period of time to the potential energy which could have been generated by the reactor over that same period of time.

MOVABLE DETECTOR - A traversing incore fission chamber which generates a voltage signal proportional to the flux level the chamber "sees". Five such detectors are moved at one time through the core to monitor the flux distribution. A total of 50 locations are traversed to generate a complete flux map of the core (See FLUX MAP)

NODE - The core is divided into 60 equally spaced axial segments by the movable detector monitoring system. Nodal representation is then used by the INCORE program in deriving the power distributions.

POWER DENSITY - Power generated per unit volume in the core. Usually expressed in units of Kw/Liter.

POWER SPIKE - A local increase in power due to densification-induced gaps in the pellet stack.

RADIAL POWER MAP - An X-Y distribution of power on an assembly basis, normalized to the average assembly power.

REACTIVITY - In a nuclear reactor, a measure of the departure from a just critical condition. Usually expressed in units of pcm (10^{-5} $\Delta K/K$), it is normal to refer to a pcm quantity of reactivity associated with some component of the reactor since removing that component will change the reactivity of the reactor by that amount.

REGION - A group of assemblies which have essentially the same nuclear design characteristics and are inserted into the reactor at the same time. (See BATCH)

TECHNICAL SPECIFICATIONS - The document setting forth mandatory operational and surveillance requirements for a nuclear facility. It is issued by the AEC as part of the operating license.

TILT - A deviation from perfect symmetry. Usually used with respect to radial burnup or power distributions and relates each quadrant to the average of all four quadrants.

XENON - A gaseous fission product which has a very strong neutron absorption capability. Unless controlled, xenon concentration can shift up and down the axial axis of the core, thereby causing axial power transients.

$\Delta K/K$ - Mathematical expression for reactivity, where "K" is the ratio of the number of neutrons present in a reactor in any one neutron generation to that in the immediately preceding generation. (See REACTIVITY)

Appendix B

TOTE PROGRAM DESCRIPTION

TOTE is an isotopic and burnup follow program written by Westinghouse to accurately keep track of core isotopics and accumulated burnup. It is presently operational on the Virginia Electric and Power Company's IBM-370 computer system.

In the analysis of in-core flux maps the INCORE code punches out burnup rate information for every fuel region. These regions normally include each fuel assembly (and fueled follower) and about one hundred individual fuel rods of interest. The burnup rate is given as the megawatt-hours generated in a given fuel region per 1000 megawatt-hours generated by the core. The total for the fuel region is given as well as the value for each of four axial segments of approximately equal length. In addition, the core average axial power distribution is punched out.

The TOTE user inputs: (a) the core energy (megawatt-hours) associated with each of the above burnup rate decks; (b) cards describing each fuel region (including MTU, corresponding INCORE source number, previous burnup, isotopic depletion type, etc.); (c) tables of the change in isotopics (U-235, U, Pu, etc., up to ten) with burnup; and, (d) the burnup rate decks from INCORE. Printed output includes input; core, cycle and fuel region burnup; isotopics; the energy weighted core average axial power distribution; and the initial and current uranium values for each fuel batch and the core. Interpolation for isotopics is quadratic generally using the two preceding and one succeeding table entry. Interpolation for uranium value is linear. Punched output consists of Item (b) above for subsequent TOTE runs.

Appendix C

FOLLOW PROGRAM DESCRIPTION

FOLLOW is a data analysis computer program written by Westinghouse to process reactor operation data and calculate nominal boron concentrations. It is presently operational on the Virginia Electric and Power Company's IBM-370 computer system.

The FOLLOW Code is designed to describe the nearly linear relationship between available core reactivity and cycle burnup. It is most convenient to use boron as a measure of core reactivity with off nominal* corrections being made for power, xenon and samarium, temperature, and control rods in terms of their boron worth. These off nominal corrections are made as can be seen from this equation:

$$\begin{array}{ccccc} \text{corrected or nominal boron concentration} & = & \text{measured boron concentration} & + & \left[\text{inverse boron worth}\right] \left[\begin{array}{c}\text{off nominal}\\ \text{reactivity correction}\\ \text{due to rod group}\\ \text{1 position}\end{array}\right. \\ & + & \begin{array}{c}\text{off nominal}\\ \text{reactivity correction}\\ \text{due to rod group}\\ \text{2 position}\end{array} & + & \begin{array}{c}\text{off nominal}\\ \text{reactivity correction}\\ \text{due to moderator}\\ \text{temperature}\end{array} \\ & + & \begin{array}{c}\text{off nominal}\\ \text{reactivity correction}\\ \text{due to power}\end{array} & + & \left.\begin{array}{c}\text{off nominal}\\ \text{reactivity correction}\\ \text{due to xenon and}\\ \text{samarium behavior}\end{array}\right] \end{array}$$

Options should be chosen so as to satisfy the above equation in ways appropriate to the reactor and its method of operation.

---

* Nominal conditions have generally meant hot full power equilibrium conditions with control rods at their upper limits.

The boric acid concentration in the primary loops of operating PWR's is typically measured one to three times per day. After proper normalization, this data is plotted against cycle burnup and form the "boron depletion curve". Since this curve is well behaved and nearly linear from beginning to end of the cycle, it can provide the following information:

1) Detection of abnormal (unexpected) behavior in core reactivity Technical Specifications require boron follow for this purpose.

2) Extrapolation to end-of-cycle life for scheduling refueling, or determination of end-of-life for contractual purposes.

3) Rate of loss of reactivity with burnup for confirmation of design procedures.

4) Indication of the need for updating reactivity coefficients needed for plant operation.

5) Best estimate of beginning of cycle, hot-full-power criticality under equilibrium conditions.

Appendix D

INCORE PROGRAM DESCRIPTION

INCORE is a data analysis computer program written by Westinghouse to process information obtained by in-core instrumentation. It is presently operational on the Virginia Electric and Power Company's IBM-370 computer system.

In the reduction of in-core flux and temperature measurements the INCORE code performs the following:

1. Reads input consisting of (a) a description of the amount and type of data to be read in (such as number of flux traces and thermocouple readings, etc.); (b) a description of the reactor when the measurements were made (such as power level, inlet and outlet temperature, etc.); (c) the actual data and information relevant to it (such as what flux thimbles were used, neutron cross sections of the sensor, etc.); (d) analytical information (such as calculated thimble fluxes); and (e) specification of options as to what thimbles will be employed in local power predictions, what calculations are to be done, etc.
2. Corrects raw pointwise flux measurements for background current, changes in power level between measurements, relative detector sensitivities, etc., to determine pointwise reaction rate in the flux thimbles.
3. Compares the measured reaction rates determined above with expected values and rejects data if they differ from expected values by more than an input rejection criteria. An error analysis is performed for subsequent determination of the uncertainty to attach to calculated peaking factors.

4. Computes relative local power in each fuel assembly, and in each fuel rod chosen for attention. Local relative power is computed as:

$$\frac{\left[\text{Reaction Rate in Flux Thimble}\right]_{\text{Measured}} \times \left[\frac{\text{Local Power}}{\text{Reaction Rate in Flux Thimble}}\right]_{\text{Analytical}}}{\left[\text{Average of Numerator for All Fuel in Core}\right]}$$

Local absolute power or heat flux is then computed by multiplying the above quantity by the average specific power or heat flux in the core determined from the measured total core power at the time the data were taken. A weighted average of data from all nearby thimbles can be used in determining local relative power. Different PDQ ratios of power to reaction rate are used depending on the control rod configuration at each elevation.

5. Calculates the relative quadrant powers and the power weighted average axial distribution in the core. The expected and measured power peaking factors are compared for each power generating region.

6. Outputs the twenty highest values of $F^N_{\Delta H}$ and F^N_Q in descending order with an identifying number so that hot spot locations in the core can be determined.

7. Calculates the rate at which burnup is being accumulated for four axial regions for each fueled area.

8. Corrects thermocouple data for calibration, and converts them to local enthalpy. Relative local enthalpy rise is then calculated using the vessel inlet and outlet temperatures and the core bypass flow. The local enthalpy rise measured by thermocouples is compared with

that predicted from flux measurements using relative local flow rates.

9. Calculates the margin to departure from nucleate boiling (DNB) using the W-3 correlation for selected channels.

10. Outputs the input data, parameters used, and major calculated values.

Appendix E

DENSIFICATION STRIP-CHART TRACES

The following twenty-three figures are strip-chart recorder traces taken during the flux mapping process and show confirmed or potential power spikes encircled:

Figure No.	Thimble
1	B-10
2	N-12
3	F-2, H-11
4	B-7, L-8
5	H-13
6	F-9
7	M-3
8	R-8
9	N-5
10	N-10
11	A-9
12	G-9
13	H-1
14	L-14
15	D-7
16	L-4
17	B-5
18	J-7
19	N-7
20	H-4

PASS 4

FIGURE 1

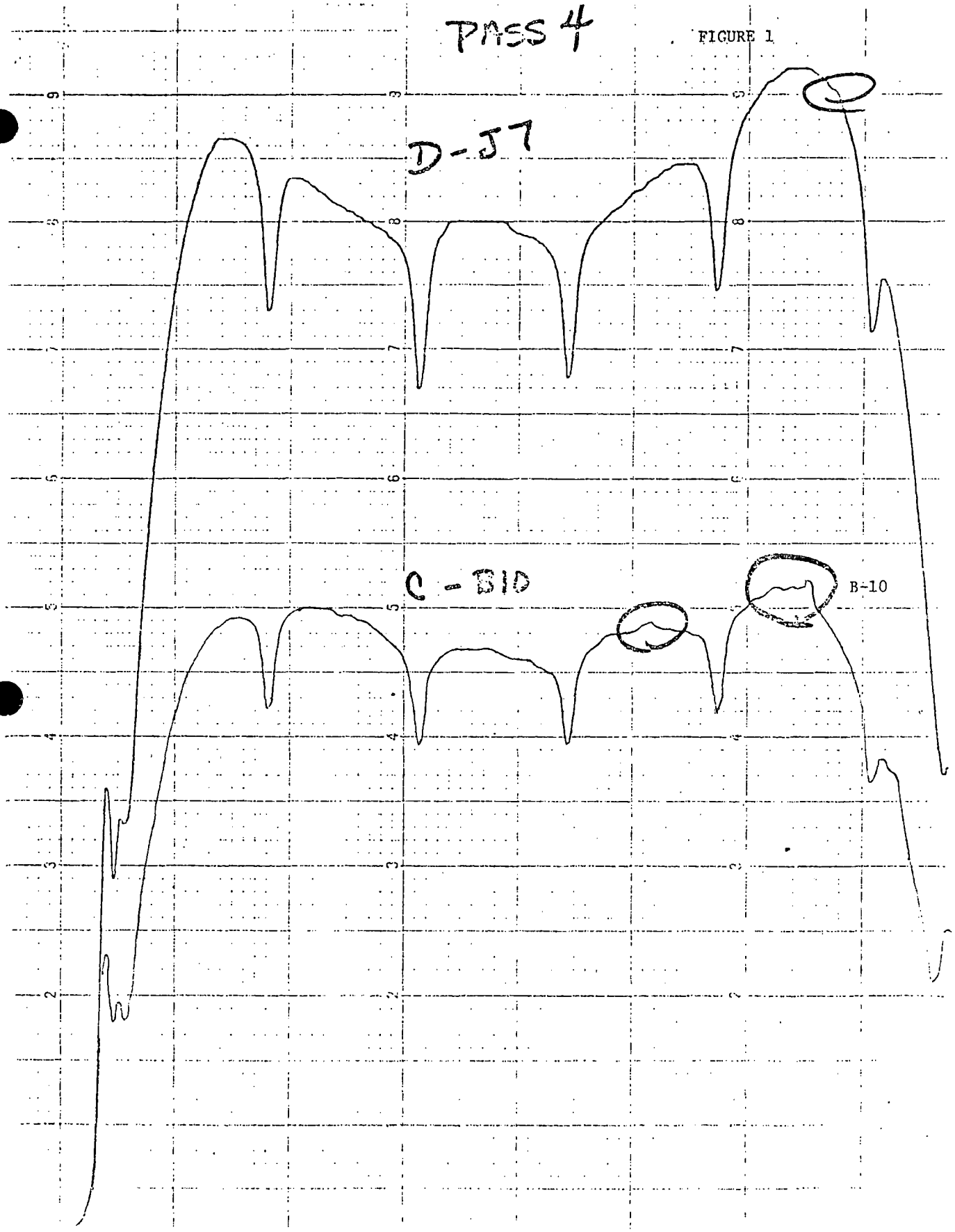
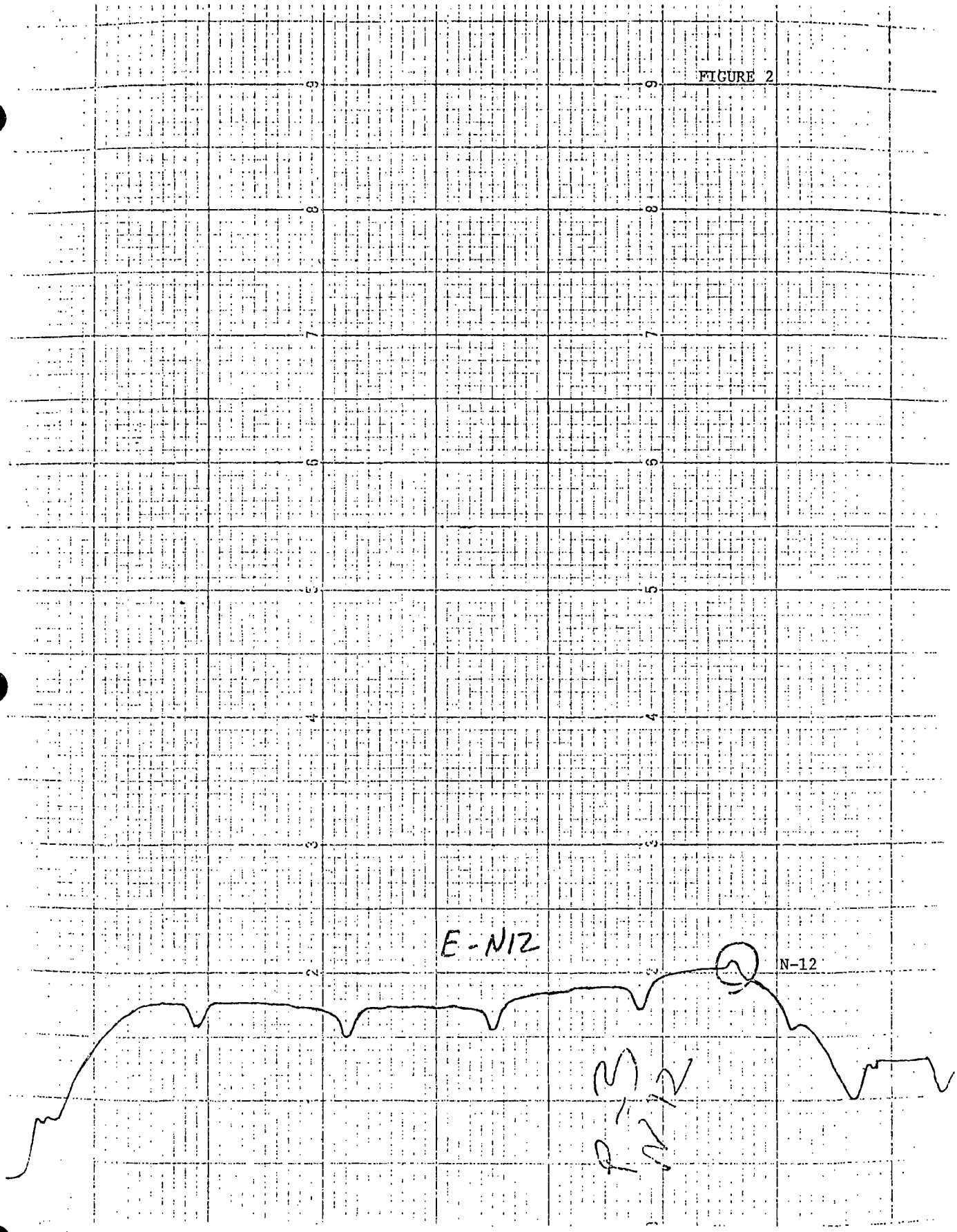


FIGURE 2



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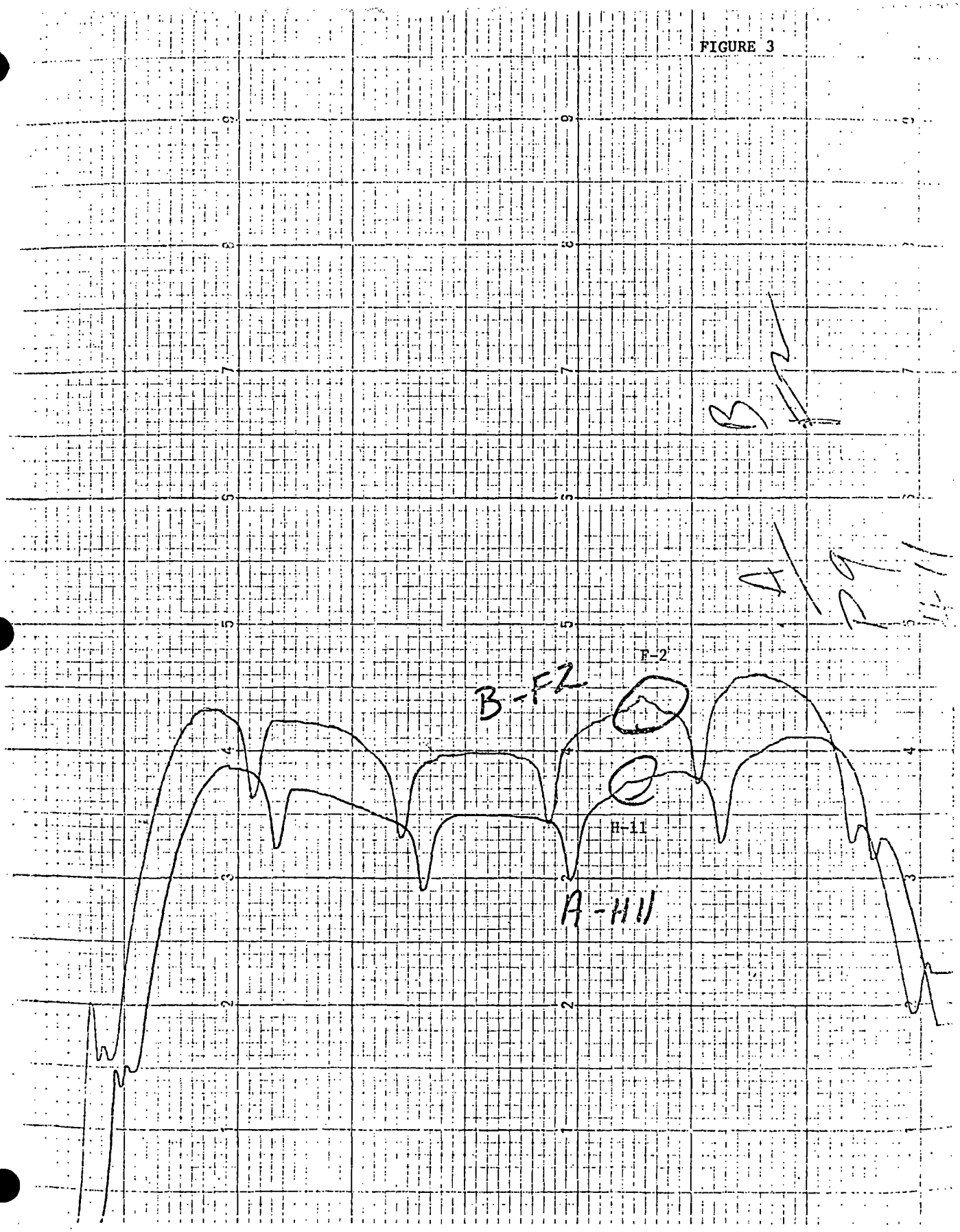

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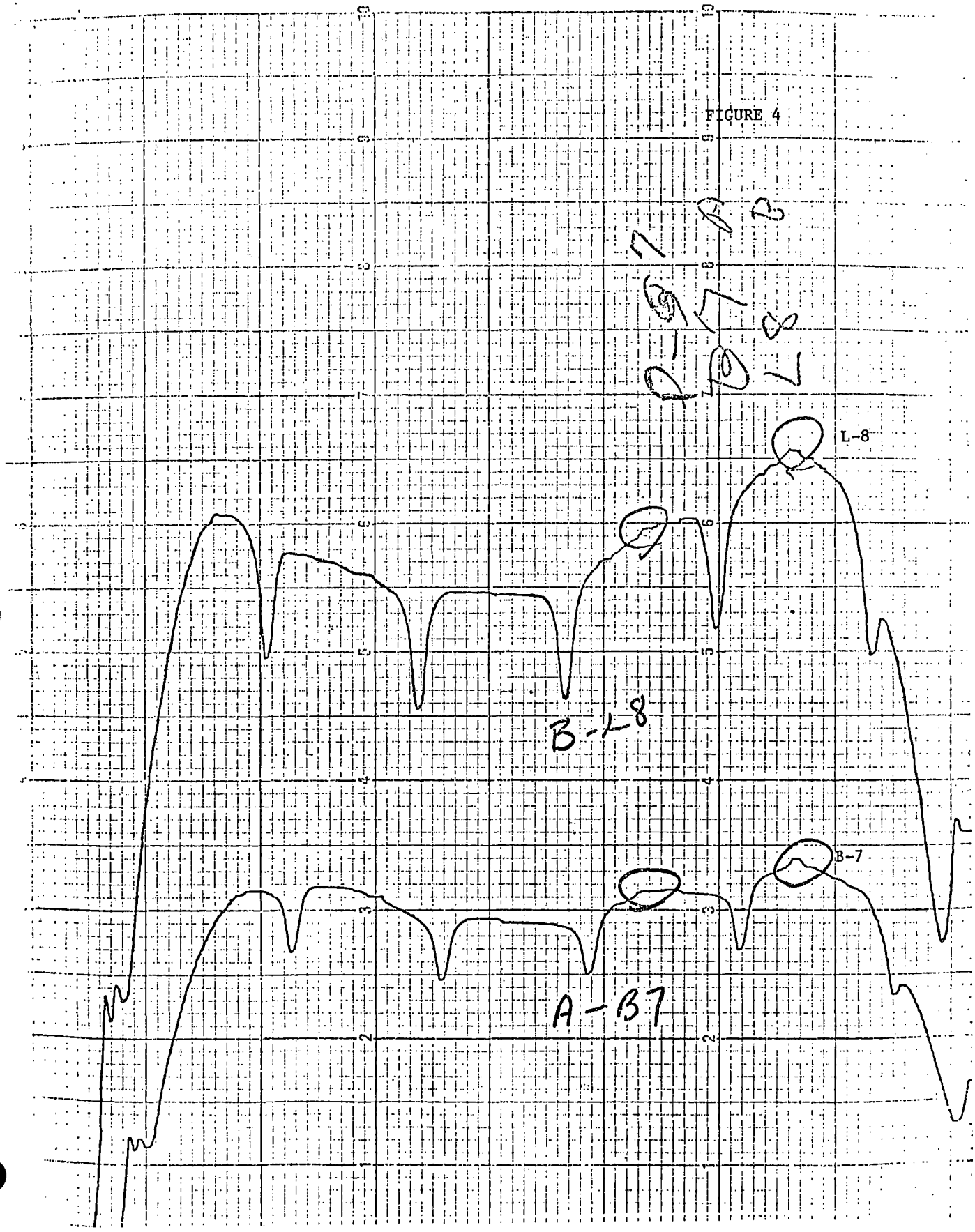

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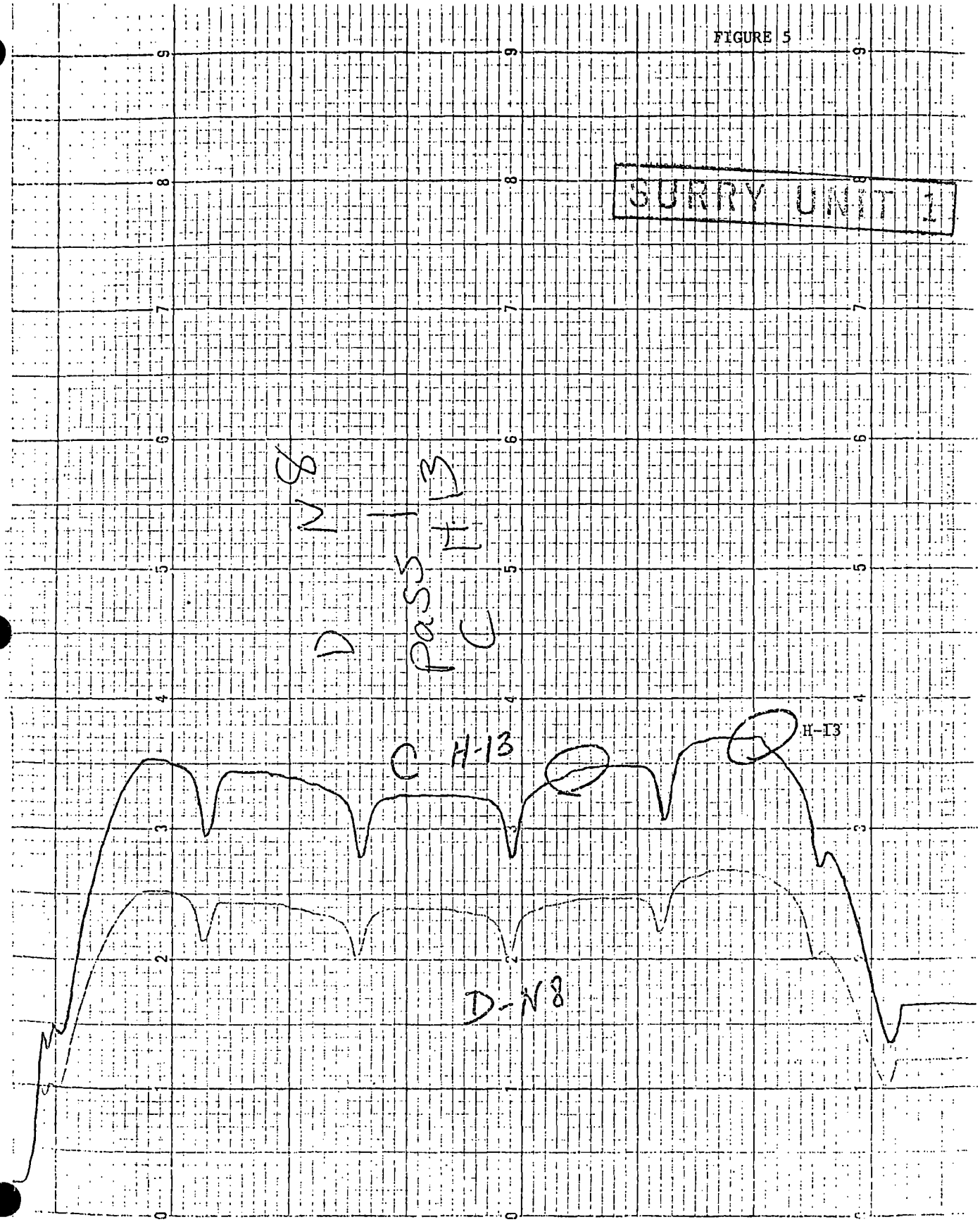

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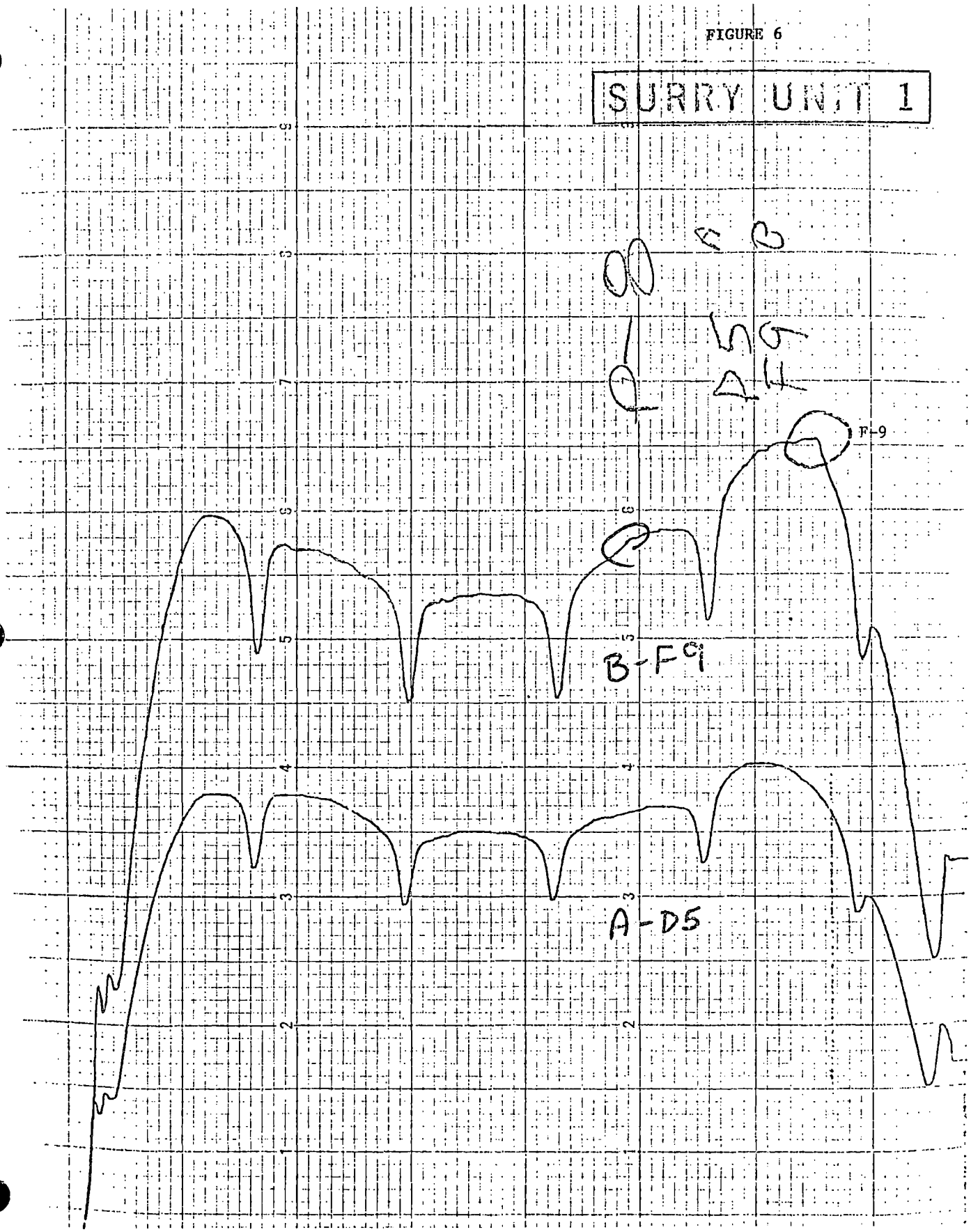

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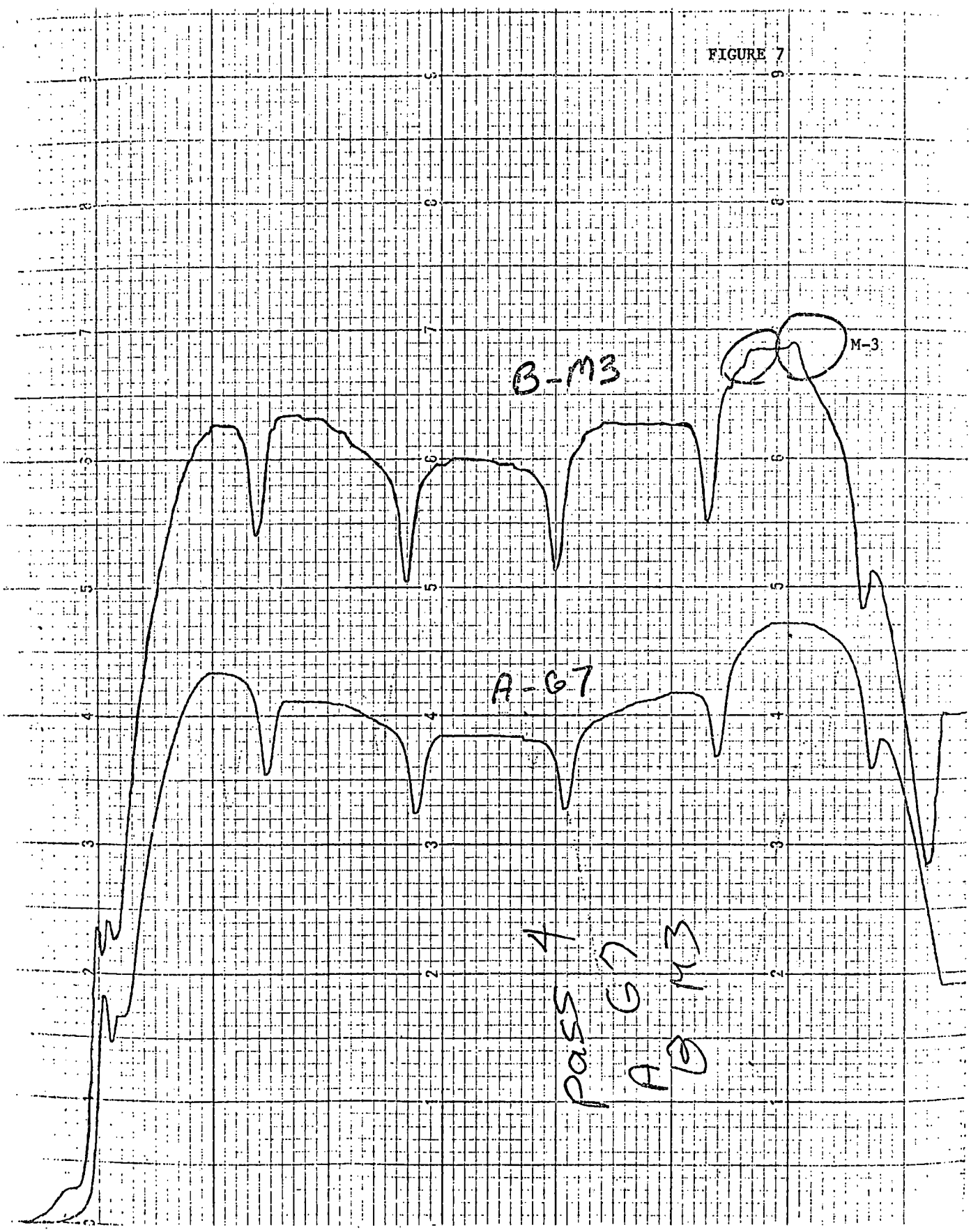

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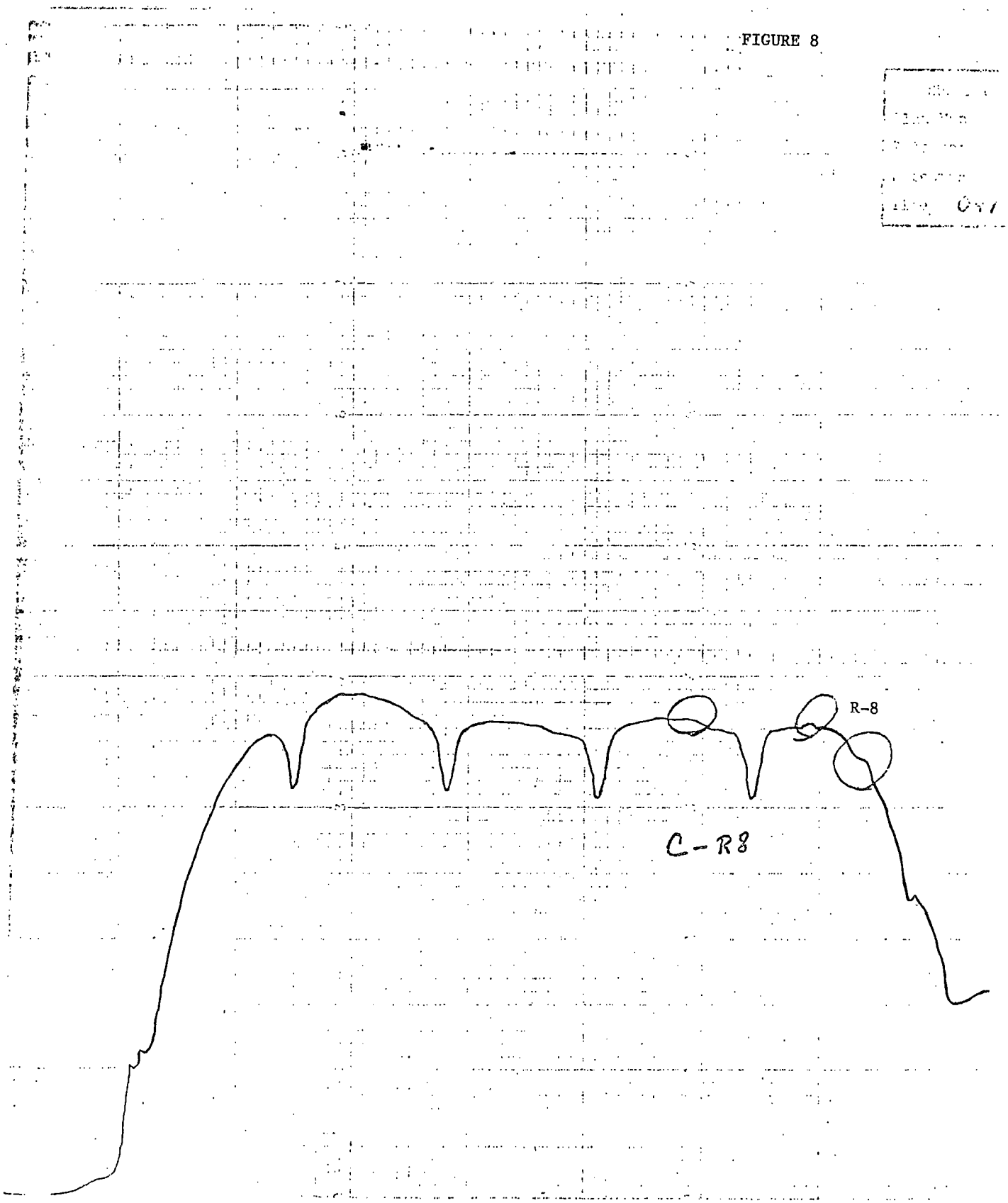


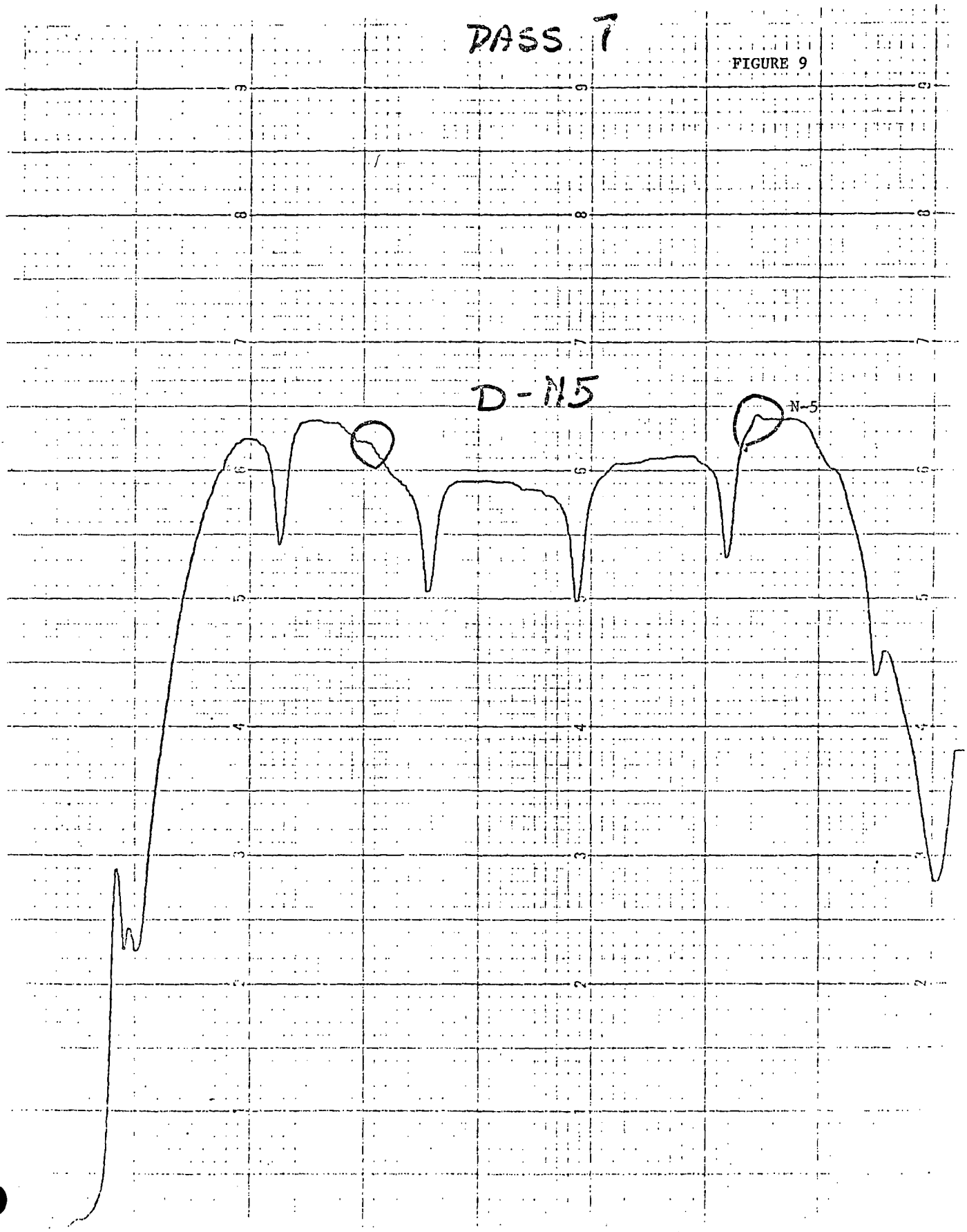
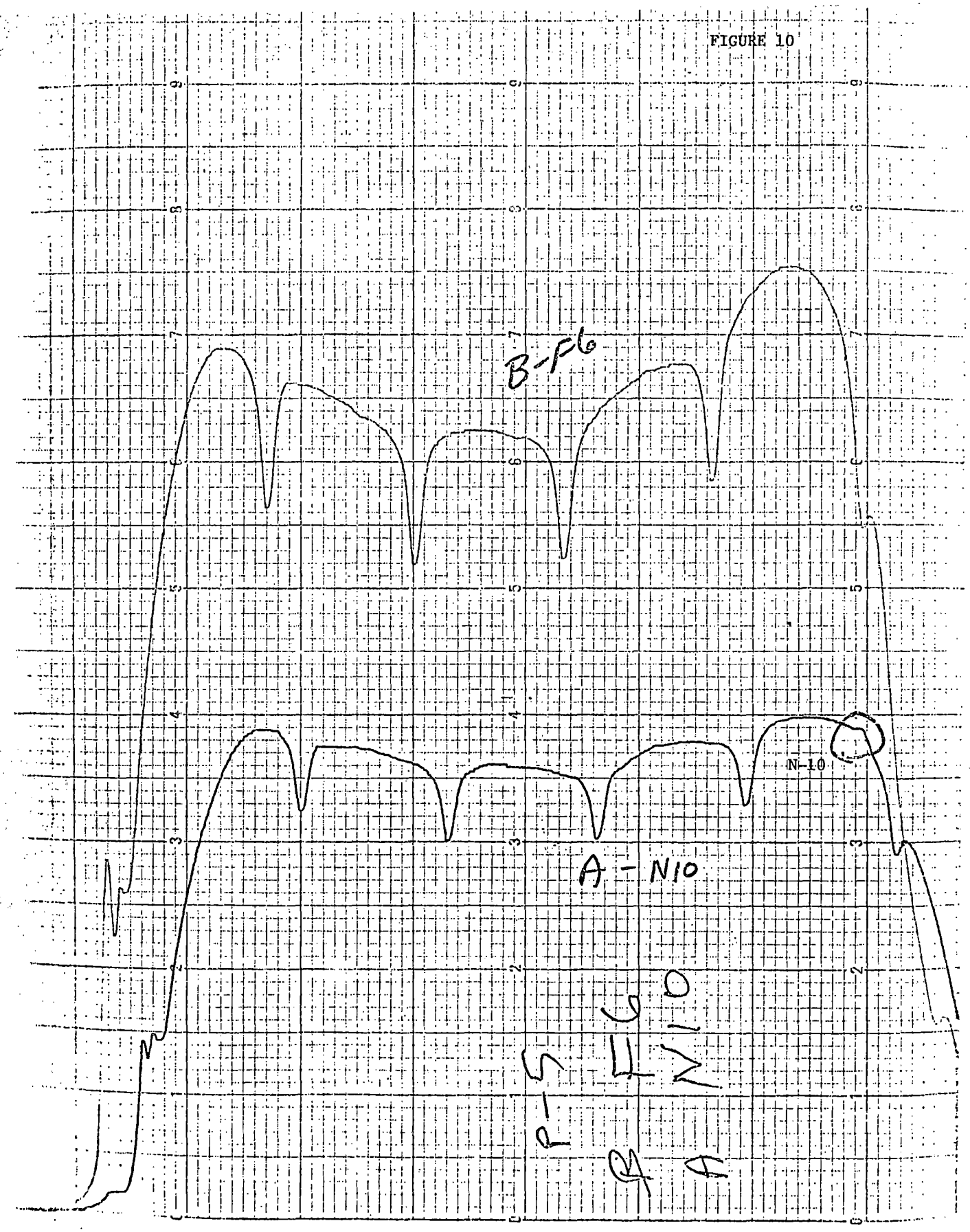


FIGURE 9

FIGURE 10



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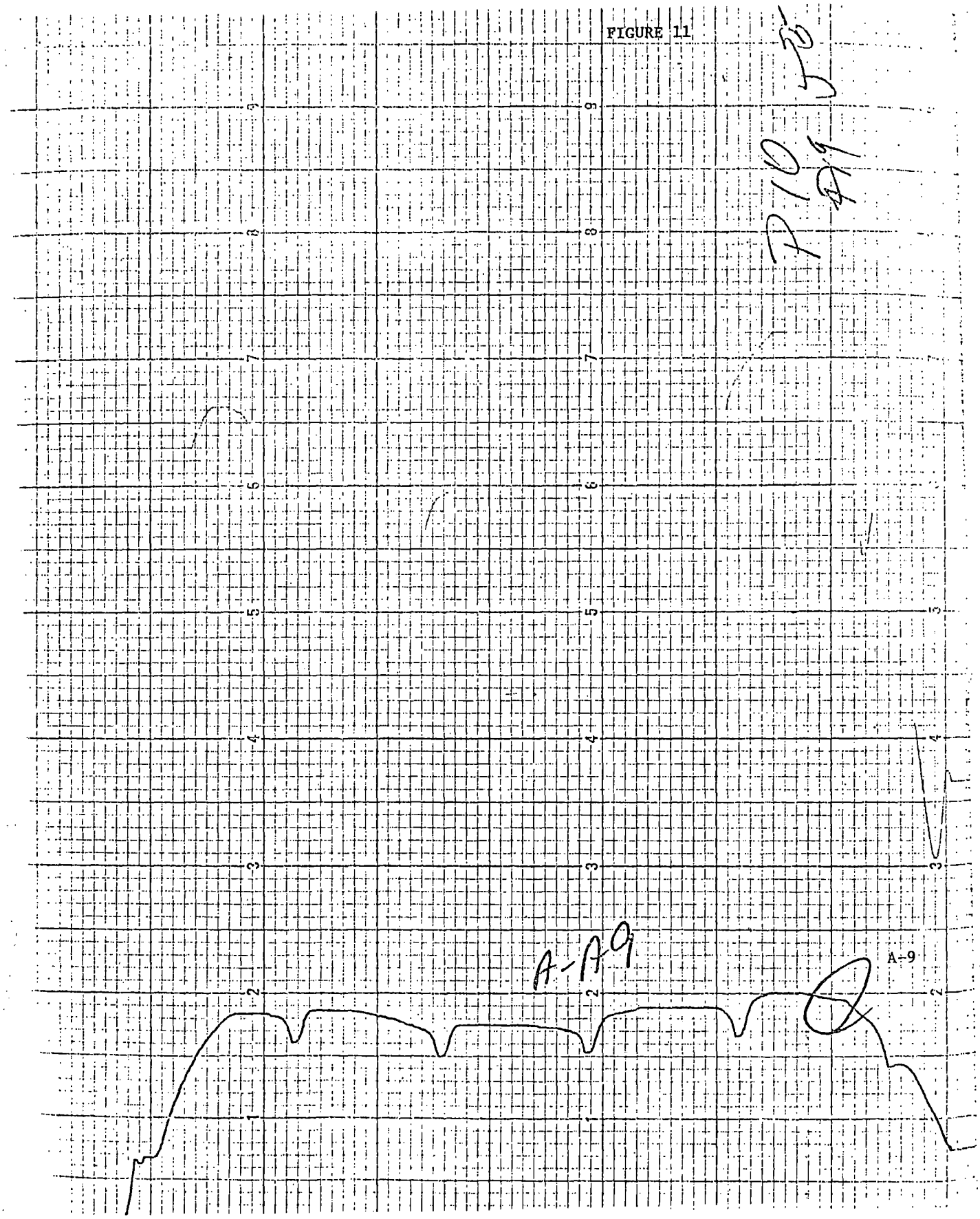

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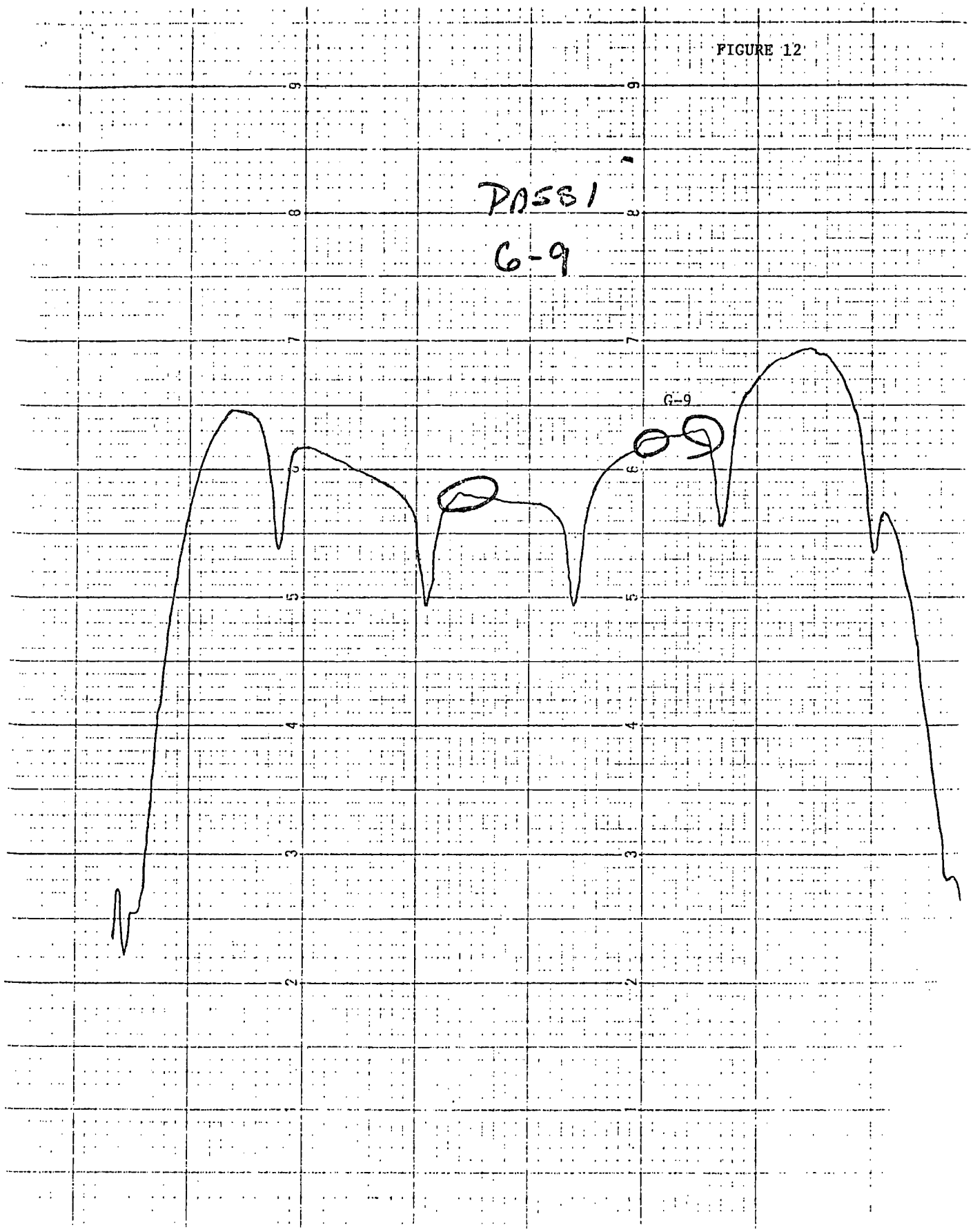


FIGURE 13

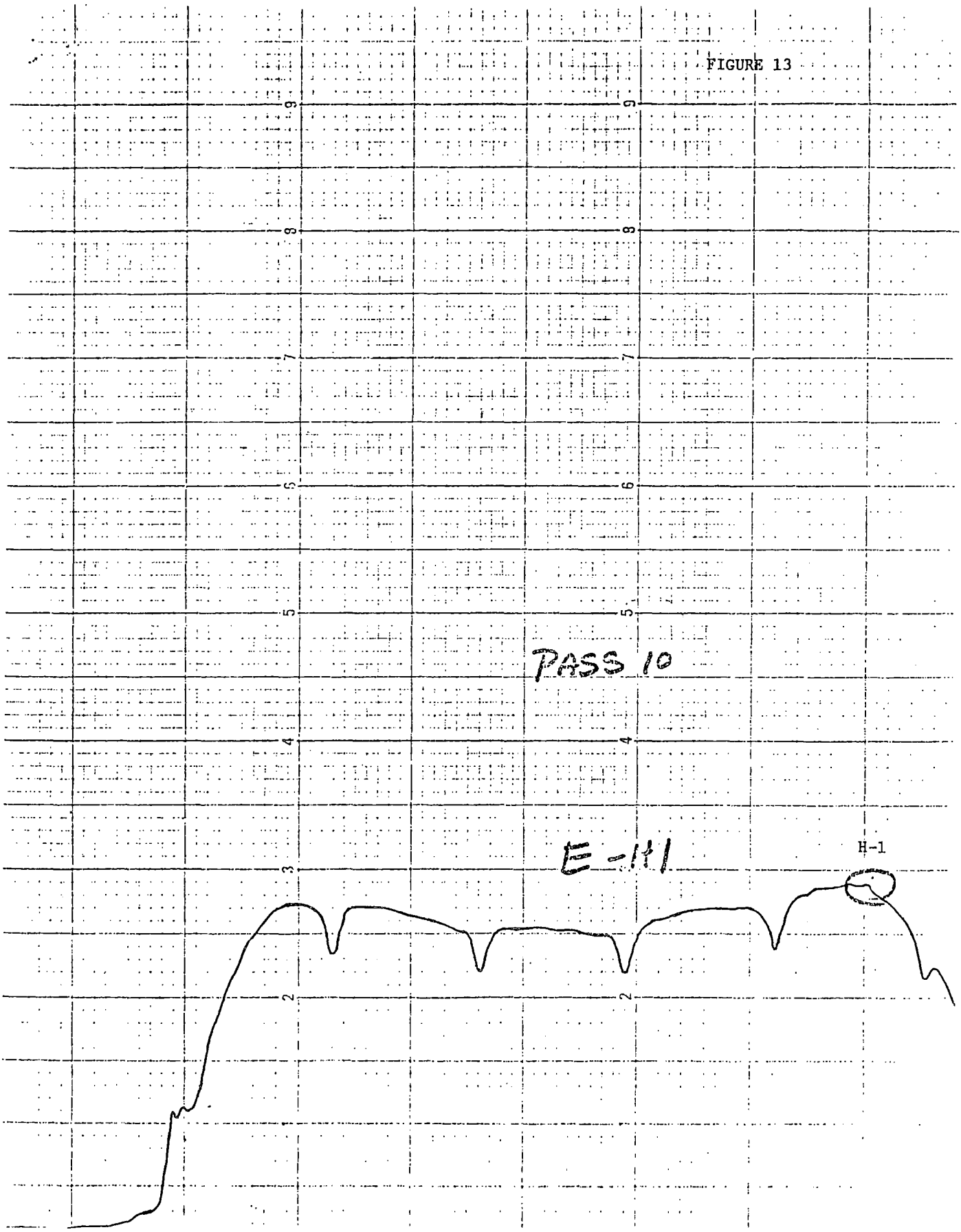
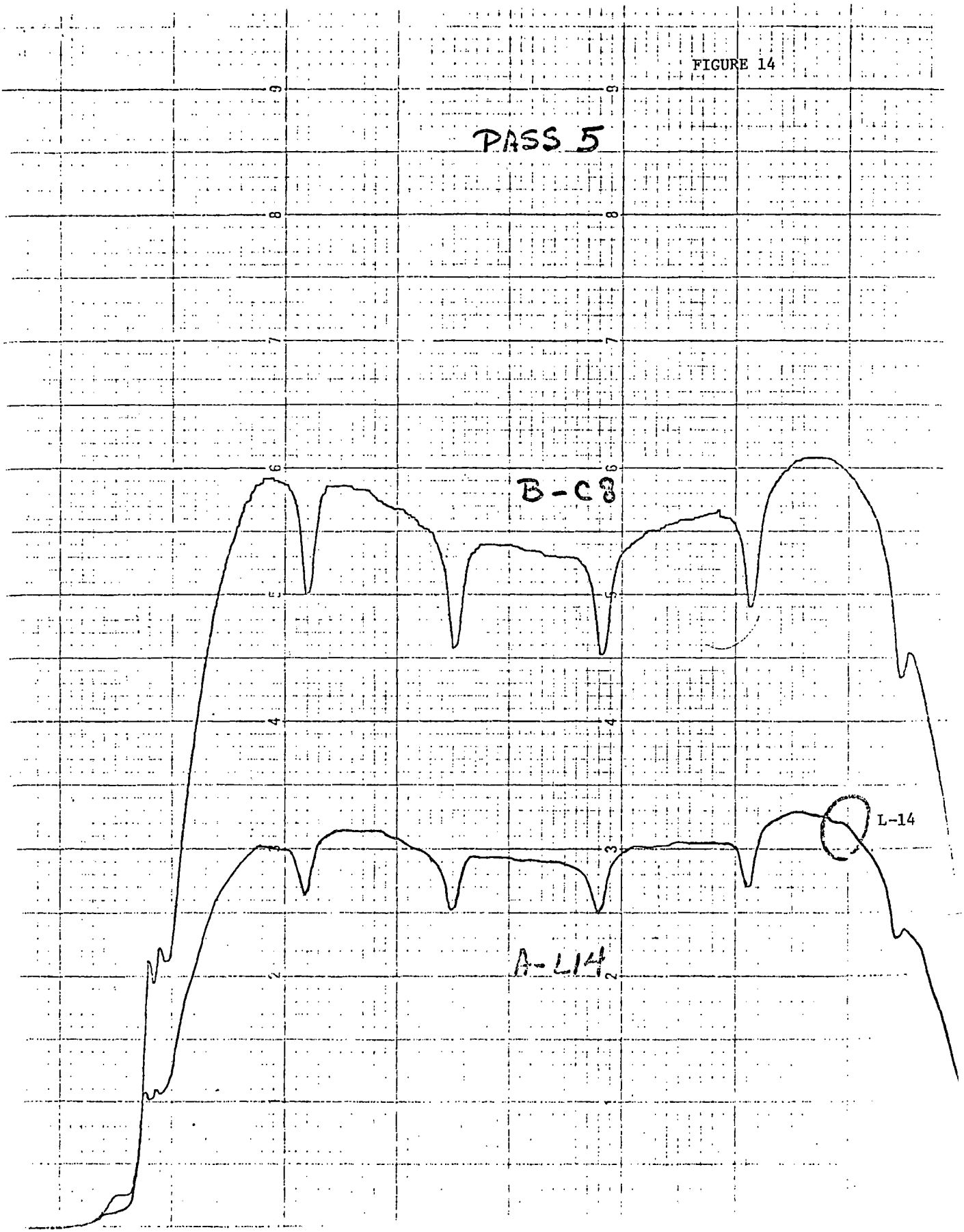


FIGURE 14



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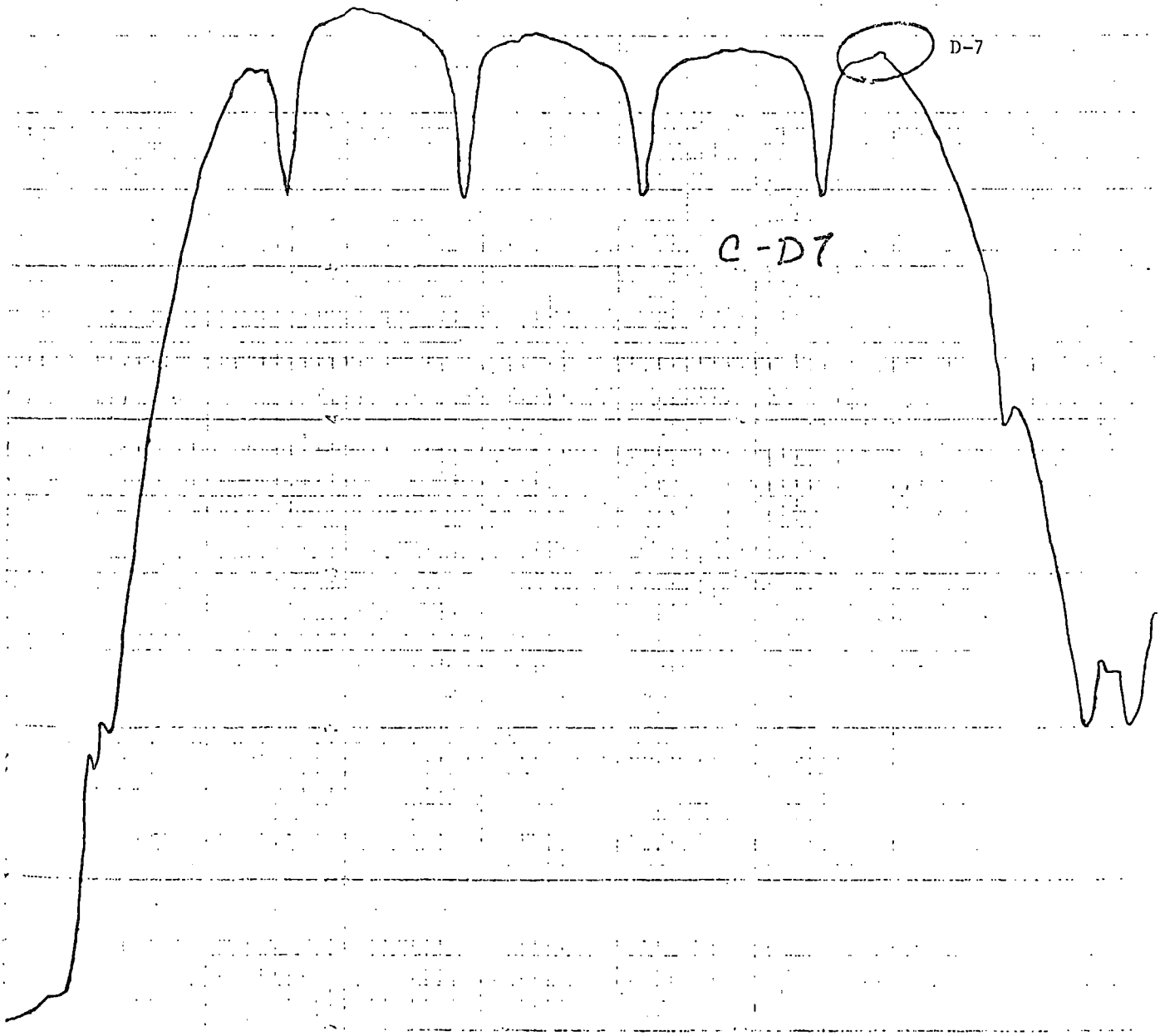


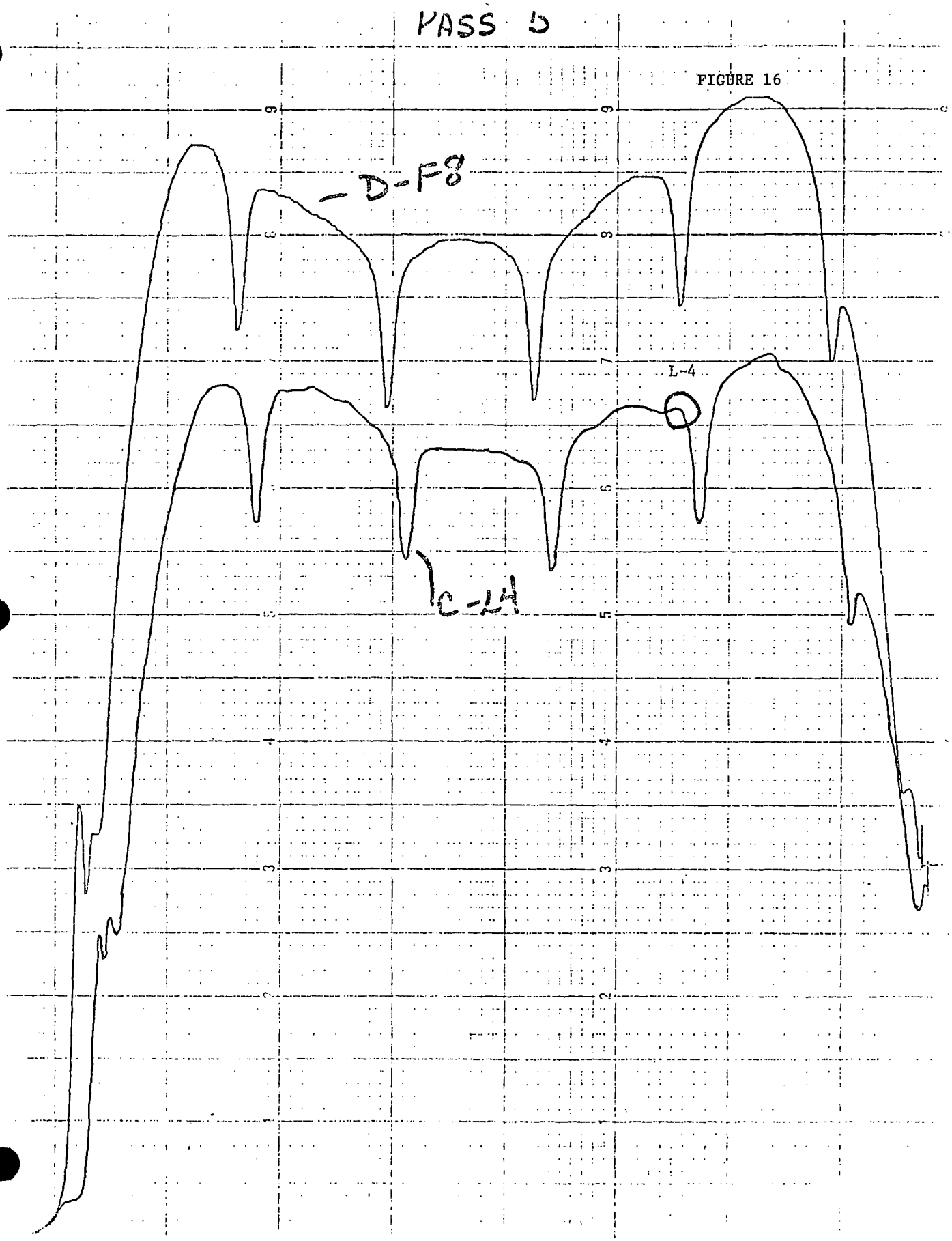

PASS 5
FIGURE 16
D-F8
L-4
C-L4

FIGURE 17

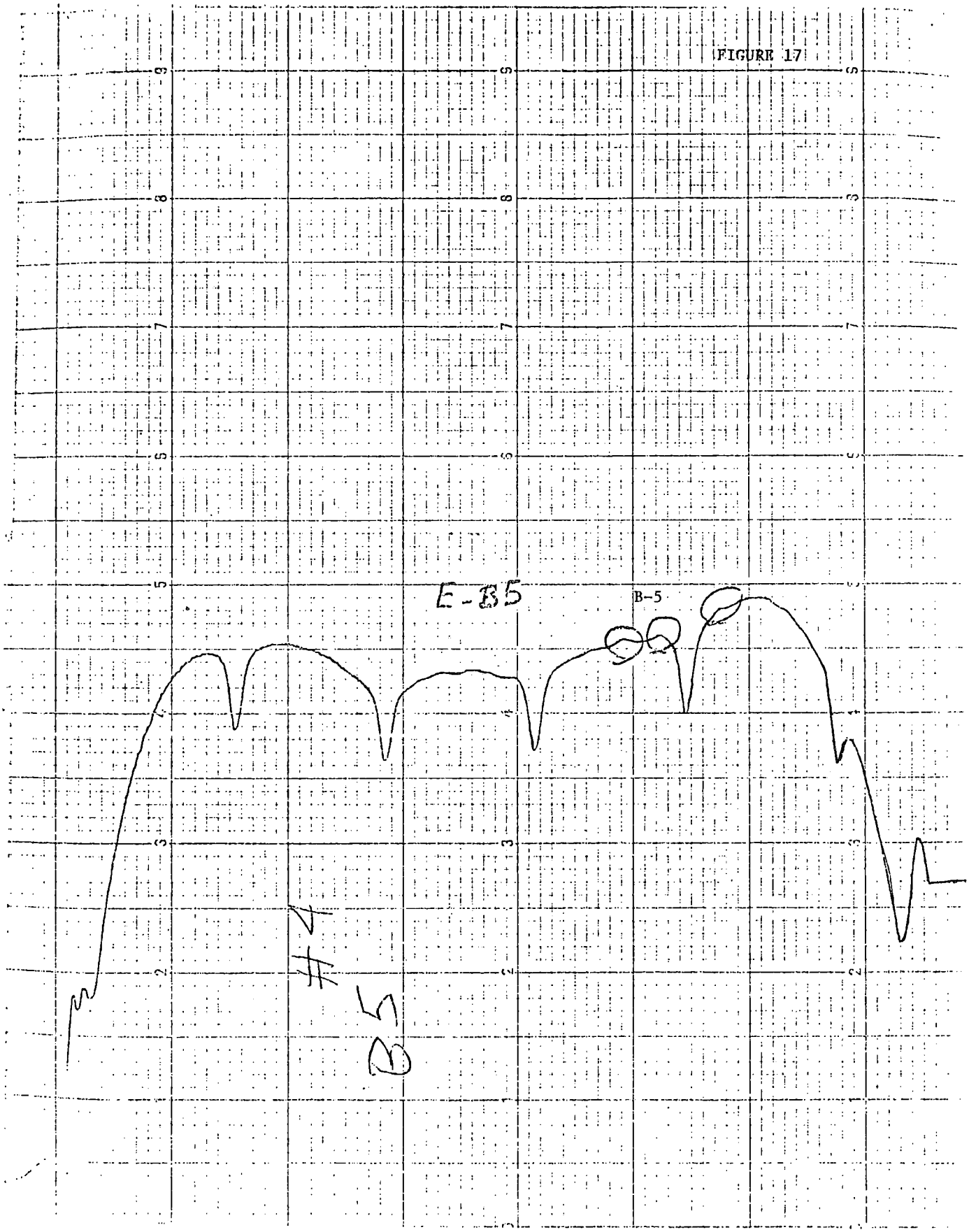


FIGURE 18

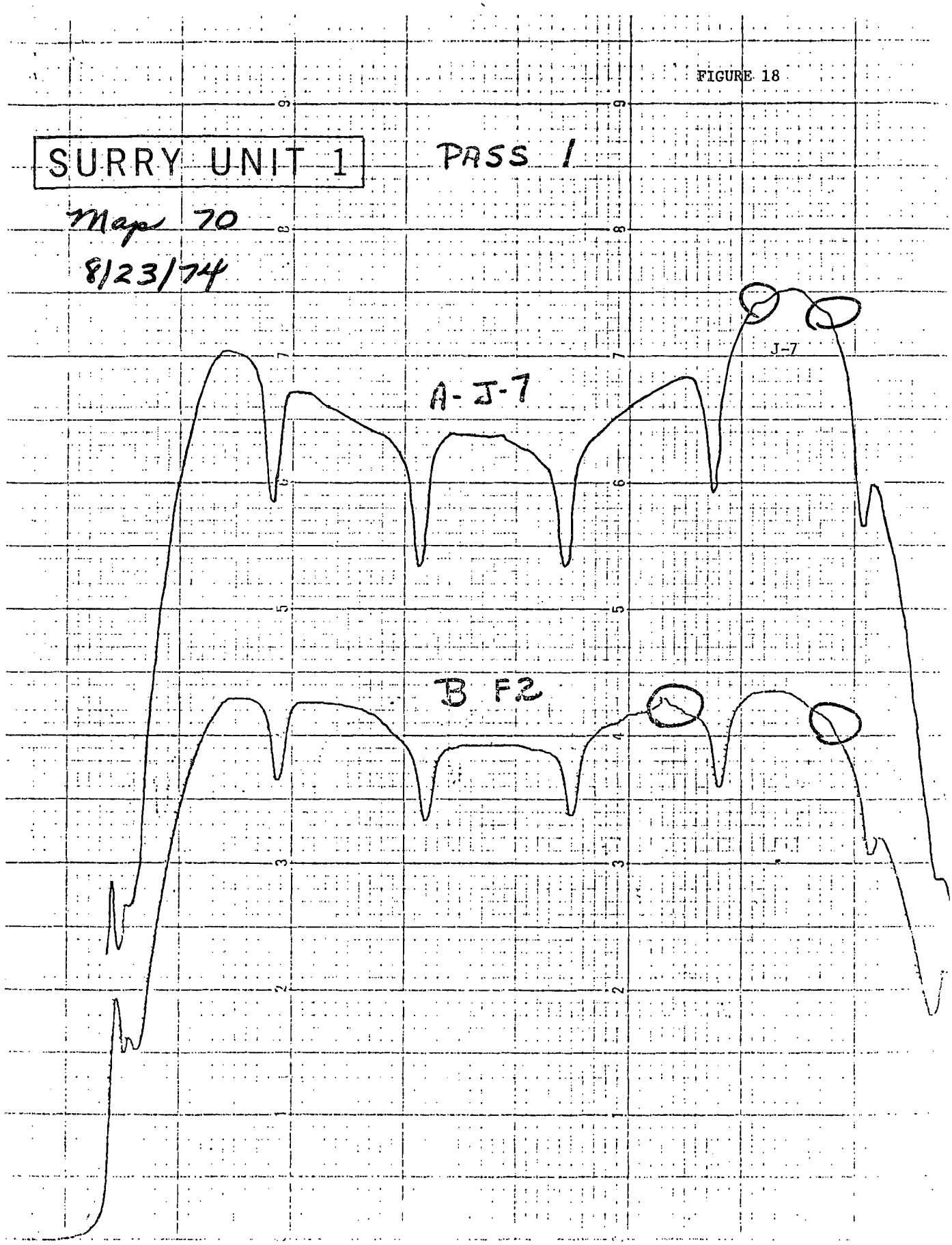


FIGURE 19

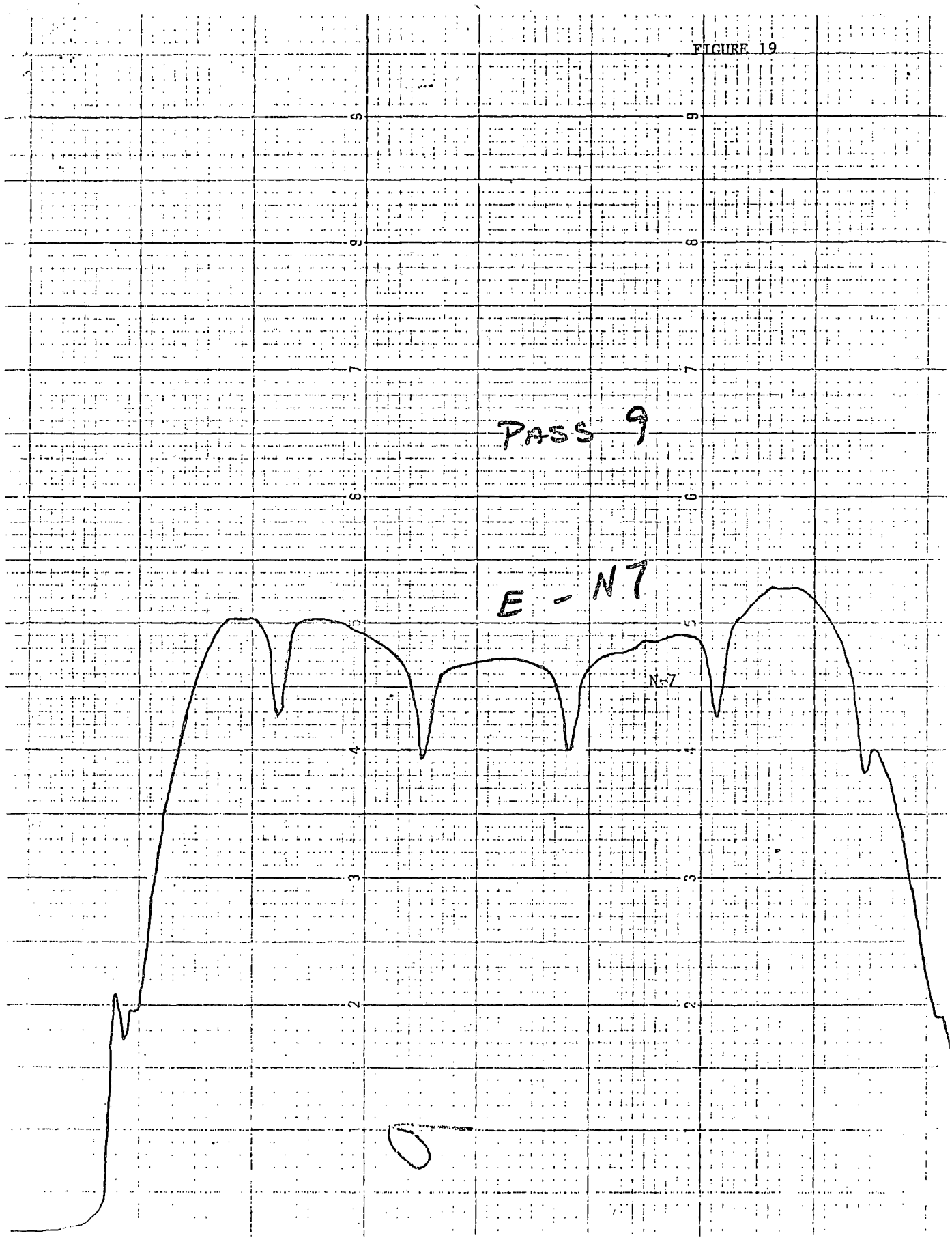


FIGURE 20

ACKNOWLEDGMENTS

The authors would like to acknowledge the cooperation of the staff at Surry Power Station in supplying the basic data for this report. Special thanks is due Messrs. D. Benson, K. Bowers, and W. Earl.

The authors want to express their appreciation to Mr. J. M. Huckabee for his assistance in preparing several of the figures and tables that went into this report.

10.5 CHANGES TO PROCEDURES

The following changes were made to the station procedures during the reporting period:

10.5.1 Administrative Procedures

A summary of the changes to Administrative Procedures made during the reporting period is presented in Table 10.5.1-1.

10.5.2 Abnormal Procedures

A summary of the changes to Abnormal Procedures made during the reporting period is presented in Table 10.5.2-1.

10.5.3 Annunciator Procedures

A summary of the changes to Annunciator Procedures made during the reporting period is presented in Table 10.5.3-1.

10.5.4 Chemistry and Health Physics Procedures

A summary of the changes to Chemistry and Health Physics Procedures made during the reporting period is presented in Table 10.5.4-1.

10.5.5 Emergency Procedures

A summary of the changes to Emergency Procedures made during the reporting period is presented in Table 10.5.5-1.

10.5.6 Maintenance Procedures

A summary of the changes to Maintenance Procedures made during the reporting period is presented in the following Tables:

10.5.6-1 Mechanical Maintenance Procedures

10.5.6-2 Electrical Maintenance Procedures

10.5.6-3 Instrument Maintenance Procedures

10.5.7 Operating Procedures

A summary of the changes to Operating Procedures made during the reporting period is presented in the following Tables:

10.5.7-1 Operating Procedures

10.5.7-2 Maintenance Operating Procedures

10.5.8 Periodic Test Procedures

A summary of the changes to Periodic Test Procedures made during the reporting period is presented in Table 10.5.8-1.

10.5.9 Quality Control Procedures

A summary of the changes to Quality Control Procedures made during teh reporting period is presented in Table 10.5.9-1.

10.5.10 Start-up Test Procedures

A summary of the changes to the Start-up Test Procedures made during the reporting period is presented in Table 10.5.10-1.

10.5.11 Special Test Procedures

A summary of the changes to the Special Test Procedures made during the reporting period is presented in Table 10.5.11-1.

SUMMARY OF
ADMINISTRATIVE PROCEDURE CHANGES
JULY THROUGH DECEMBER, 1974
SURRY POWER STATION

PROCEDURE NUMBER	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
ADM-2	Station Nuclear Safety and Operating Committee	7-18-74	Amended to reflect distribution change.
ADM-37	Use of Jumpers	8-21-74	Broadened scope of procedure and give Safety Committee greater responsibility in review of Jumpers.

Table 10.5.1-1

SUMMARY OF

ABNORMAL PROCEDURE CHANGES

JULY THROUGH DECEMBER 1974

SURRY POWER STATION

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	AP-3	Emergency Boration	7-03-74	Revised to concur with AP-1.1.2 and supply boron addition rates.
1,2	AP-3	Emergency Boration	8-07-74	Reworded note about injection of Boric Acid to Rx Coolant Pump Seals
1,2	AP-5	Radiation Monitoring System Index	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.0	Radiation Monitoring System	8-07-74	Update for clarity.
1,2	AP-5.1	Process Vent Particulate and Gaseous Monitors	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.1	Process Vent Particulate and Gaseous Monitors	7-25-74	Updated to allow deletion of EP-9.
1,2	AP-5.1	Process Vent Particulate and Gaseous Monitors	8-07-74	Update for clarity.
1,2	AP-5.2	Ventilation Vent Particulate and Gaseous Monitors	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.2	Ventilation Vent Particulate and Gaseous Monitors	7-25-74	Updated to allow deletion of EP-9.
1,2	AP-5.2	Ventilation Vent Particulate and Gaseous Monitors	8-07-74	Reword procedure for clarity.

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	AP-5.3	Liquid Waste Disposal Monitors	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.3	Liquid Waste Disposal Monitors	8-07-74	Reword procedure for clarity.
1,2	AP-5.4	Component Cooling Heat Exchanger Service Water Monitor	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.4	Component Cooling Heat Exchanger Service Water Monitor	8-07-74	Reword procedure for clarity.
1,2	AP-5.5	Component Cooling Water Monitors "A" and "B"	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.6	Decontamination Area, New Fuel Storage Area, Fuel Pit Bridge Area, Aux. Bldg. Control Area, Aux. Bldg. Drumming Area, Sample Rm. and Lab Area Monitor	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.6	Decontamination Area, New Fuel Storage Area, Fuel Pit Bridge Area, Aux. Bldg. Control Area, Aux. Bldg. Drumming Area, Sample Rm. and Lab Area Monitor	8-07-74	Reword procedure for clarity.
1,2	AP-5.7	Main Control Rm. Area Monitor	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.8	Containment Particulate and Gaseous Monitor Malfunction	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.9	Condenser Air Ejector Monitor	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.10	S/G Blowdown Sample Monitor	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.10	S/G Blowdown Sample Monitor	8-07-74	Reword procedure for clarity.
1,2	AP-5.11	Recirculation Spray Cooler Service Water Outlet Monitors	7-03-74	Revised and updated, placed in new format.

Table 10.5.2-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	AP-5.12	Reactor Coolant High and Low Range Monitors	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.13	Discharge Tunnel Monitor	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.13	Discharge Tunnel Monitor	8-07-74	Reword procedure for clarity.
1,2	AP-5.14	Containment High Range Area Monitor	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.15	Reactor Containment Area Monitor & Incore Instrument Area Monitor	7-03-74	Revised and updated, placed in new format.
1,2	AP-5.16	Process Vent Particulate and Gaseous Monitor Malfunction	7-03-74	New Abnormal Procedure.
1,2	AP-5.16	Process Vent Particulate and Gaseous Monitor Malfunction	8-07-74	Reword procedure for clarity.
1,2	AP-5.17	Ventilation Vent Particulate & Gaseous Monitor Malfunction	7-03-74	New Abnormal Procedure.
1,2	AP-5.17	Ventilation Vent Particulate & Gaseous Monitor Malfunction	8-07-74	Reword procedure for clarity.
1,2	AP-5.18	Containment Particulate and Gaseous Monitor Malfunction	7-03-74	New Abnormal Procedure.
1,2	AP-12	Loss of Service Water	7-03-74	New Abnormal Procedure.
1,2	AP-12.1	Loss of Charging Pump Service Water	7-03-74	New Abnormal Procedure.
1,2	AP-12.2	Loss of Charging Pump Service	7-03-74	New Abnormal Procedure.

Table 10.5.2-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	AP-12.3	Loss of Component Cooling Heat Exchanger Service Water	7-03-74	New Abnormal Procedure.
1,2	AP-12.4	Loss of Bearing Cooling Service Water	7-03-74	New Abnormal Procedure.
1,2	AP-12.5	Loss of Emergency Service Water Pump	7-03-74	New Abnormal Procedure.
1,2	AP-14	Low Condenser Vacuum	7-03-74	Updated and placed in new format.
1,2	AP-21	Loss of Feedwater Flow	7-18-74	Updated and placed in new format.
1,2	AP-23	Neutron Shield Tank Cooling System Malfunctions Abnormal Procedure Index	7-03-74	New Abnormal Procedure.
1,2	AP-23.1	Loss of Neutron Shield Tank Level	7-03-74	New Abnormal Procedure.
1,2	AP-23.2	High Neutron Shield Tank Surge Tank Level	7-03-74	New Abnormal Procedure.
1,2	AP-23.3	High Neutron Shield Tank Discharge Temperature	7-03-74	New Abnormal Procedure.
1,2	AP-26	Transmission System Restoration	7-03-74	Update and placed in new format.
1,2	AP-27	Electric Hydrogen Recombiner	7-18-74	Changed to Operating Procedure-24.
1,2	AP-28	Loss of Instrument Air	7-03-74	Update and place in new format.
1,2	AP-28	Loss of Instrument Air	8-07-74	Reword Procedure for clarity.
1,2	AP-29	Partial Loss of Station Service	7-18-74	New Abnormal Procedure.

Table 10.5.2-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	AP-29	Partial Loss of Station Service	7-25-74	Revised and updated.
1,2	AP-34	Steam Generator Blowdown High Flow Abnormal Procedure Index	7-03-74	New Abnormal Procedure.
1,2	AP-34.1	Steam Generator "A" Blowdown High Flow	7-03-74	New Abnormal Procedure.
1,2	AP-34.2	Steam Generator "B" Blowdown High Flow	7-03-74	New Abnormal Procedure.
1,2	AP-34.3	Steam Generator "C" Blowdown High Flow	7-03-74	New Abnormal Procedure.
1,2	AP-35	Oil Spill Control	9-18-74	New Abnormal Procedure.

Table 10.5.2-1

SUMMARY OF

ANNUNCIATOR PROCEDURE CHANGES

JULY THROUGH DECEMBER, 1974

SURRY POWER STATION

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
				There were no changes to Annunciator Procedures during this report period.

Table 10.5.3-1

SUMMARY OF

CHEMISTRY AND HEALTH PHYSICS PROCEDURE CHANGES

JULY THROUGH DECEMBER, 1974

SURRY POWER STATION

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	CP-51	Crud Analysis	10-17-74	Add appendix to procedure.
1,2	CP-52	Determination of Free Hydroxide	11-08-74	New procedure.
1,2	CP-53	Measurement of pH Under AVT Chemistry Control	11-29-74	New procedure.
1,2	HP-3.5-1	Radioactive Liquid Waste Discharges Contaminated Drains and Low Level Liquid Waste System	8-23-74	Modify procedure to reduce number of compositie sample bottles used.
1,2	HP-3.5-1	Radioactive Liquid Waste Discharge Contaminated Drains & Low Level Liquid Waste System	9-11-74	Determine Beta Gamma Activity weekly rather than monthly.
1,2	HP-3.5-2	Radioactive Liquid Waste Discharges (boron recovery test tanks)	8-23-74	Modify procedure to reduce number of composite sample bottles used.
1,2	HP-3.5-2	Radioactive Liquid Waste Discharge (boron recovery test tanks)	9-11-74	Determine Beta Gamma Activity weekly rather than monthly.
1,2	HP-3.5-3	Radioactive Liquid Waste Discharges Steam Generator Blowdown	8-23-74	Modify procedure to reduce number of composite sample bottles used.

Table 10.5.4-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	HP-3.5-3	Radioactive Liquid Waste Discharge Steam Generator Blowdown	9-11-74	Determine Beta Gamma Activity weekly rather than monthly.
1,2	HP-3.5-5	Gaseous Waste Discharges Containment Purging or Hogging Operation	8-23-74	Procedure clarified; amended to conform to HP 3.5-9.
1	HP-3.5-7	Process Vent - Iodine and Particulate Sample	10-03-74	Change calculations on form 3.5-7.1.
1	HP-3.5-8	Process Vent - Iodine and Particulate Sample	10-03-74	Change calculations on form 3.5-8.1
1,2	HP-3.5-9	Derivations of MPC's Used In Conjunction With Gas & Liquid Waste Discharges	8-23-74	Procedure clarified; MPC's added for air ejector discharges when primary to secondary leakage exists.

Table 10.5.4-1

SUMMARY OF

EMERGENCY PROCEDURE CHANGES

JULY THROUGH DECEMBER, 1974

SURRY POWER STATION

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	EP-1	Reactor Trip	7-03-74	Updated, Immediate action as per ROE-74-15.
1,2	EP-9	Accidental Release of Radio-active Gas	7-25-74	Deleted.

Table 10.5.5-1

SUMMARY OF

MECHANICAL MAINTENANCE PROCEDURE CHANGES

JULY THROUGH DECEMBER, 1974

SURRY POWER STATION

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	MMP-C-005	Corrective Maint. Procedure for Removal, Storage and Replacement of RC Letdown Filter Cartridge	7-31-74	Eliminate transfer of filter cask to Decon Building for decontamination.
1,2	MMP-C-002	Inspection of Main Steam Trip Valves	8-07-74	Change required torquing specifications.
1,2	MMP-S-021	Special Maint. Procedure for Freeze Seal of Stainless Steel Piping	8-20-74	New procedure.
1	MMP-S-RF-022	Special Maint. Procedure for Removal, Storage & Reinstallation of Unit No. 1 CRD Missile Shields & Ventilation Ducts	9-04-74	New procedure.
1	MMP-S-RF-023	Special Maint. Procedure for Installatin, Inflation and Removal of Unit No. 1 Reactor Cavity Inner Seal Ring	9-04-74	New procedure.
1,2	MMP-CC-002	Preventative Maint. Procedure for Component Cooling Water Pumps (amended)	9-04-74	New procedure.

Table 10.5.6-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	MMP-P-004	Preventative Maintenance Procedure for Auxiliary Feed Pump Full and Half Size	9-23-74	Format change.
1,2	MMP-P-1A-001	Preventative Maintenance for Instrument and Service Air Compressor	9-23-74	Incorporate air dryers into same procedure as air compressor.
1,2	MMP-P-006	Emergency Service Water Diesel Engine Right Angle Gear Box Pump	9-25-74	Format change.
1,2	MMP-S-RC-024	Steam Generator Support Swivel Coupling	10-04-74	New procedure.
1,2	MMP-S-RC-024	Repair Instructions for Swivel End Couplings	10-15-74	Addendum 1
1,2	MMP-S-RC-024	Preventative Maintenance for Swivel End Couplings	10-15-74	Addendum 11
1	MMP-S-RC-022	Drive Rod Chamfer Modification	10-17-74	New procedure.
1	MMP-C-FH-023	Manipulator Crane Gripper Pin Modification	11-01-74	New procedure.
1	MMP-C-RC-027	Inspection of 1-RC-E-1B Secondary Side Internals	11-05-74	New procedure.
1	MMP-C-RC-025	#3 Seal Clamp Ring Modification VPS-74-134	11-05-74	New procedure.
2	MMP-C-RC-026	Installation of Safety Injection Anchors	11-05-74	New procedure.
1,2	MMP-C-RC-028	Fluxwire Thimble Retraction for Refueling	11-08-74	New procedure.

Table 10.5.6-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1	MMP-C-RC-026	Installation of Safety Injection Anchors	11-13-74	New procedure.
1	MMP-C-RC-029	Steam Generator Tube, Tubesheet Inspection & Repairs	11-13-74	New procedure.
2	MMP-C-S1-030	Corrective Maint. Procedure for Repair of Safety Injection Supports	11-15-74	New procedure.
1,2	MMP-C-RC-010	Procedure for Primary Manway Removal/Installation	11-20-74	Insert QA hold point. Add acceptance criteria.
1,2	MMP-C-RC-012	Procedure for Secondary Manway and/or Handhold Removal/Installation	11-20-74	Insert QA hold point. Add acceptance criteria.
1	MMP-C-S1-031	Procedure for Repairs of Safety Injection Supports	11-20-74	New procedure.
1,2	MMP-C-RS-012	Recirculation & Containment Spray Check Valves	12-12-74	New procedure.
1	MMP-P-RC-011	Pressurizer Safety Valve Setpoint Verification	12-04-73	New procedure.

Table 10.5.6-1

SUMMARY OF

ELECTRICAL MAINTENANCE PROCEDURE CHANGES

JULY THROUGH DECEMBER 1974

SURRY POWER STATION

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	EMP-C-CR-01	Maintenance Procedure for Rod Drive Power Supply, Motors, Generators, & Control Circuits	7-03-74	New procedure.
1,2	EMP-P-EPH-30	Reserve Station Service Transformer Maintenance	9-25-74	New procedure.
1,2	EMP-C-EE-05	Personnel Hatch Maintenance	11-27-74	New procedure.
1,2	EMP-P-EE-01	Emergency Diesel Generator Immersion Heaters & Auxiliary Motors	11-27-74	New procedure.
1,2	EMP-P-EE-02	Maintenance of Emergency Diesel Engine Control Cabinet	11-27-74	New procedure.
1,2	EMP-P-LR-02	Reactor Trip & Rod Drive Generator Circuit Breaker Type DB-50	11-27-74	New procedure.
1,2	EMP-P-LU-01	Greasing of Motors (Level 1)	11-27-74	New procedure.
1,2	EMP-P-PH-05	High Voltage Power Circuit Breaker Maintenance	11-27-74	New procedure.

Table 10.5.6-2

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	EMP-P-RC-01	Reactor Coolant Pump Motor Oil Change	11-27-74	New procedure.
1,2	EMP-C-SOV-36	Main Steam Trip Valve SOV-201C	11-27-74	New procedure.
1,2	EMP-C-SOV-39	Correcting Wiring Error of HCV-2200C	11-27-74	New procedure.

Table 10.5.6-2

SUMMARY OF

INSTRUMENT MAINTENANCE PROCEDURE CHANGES

JULY THROUGH DECEMBER, 1974

SURRY POWER STATION

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	IMP-C-FMI-1	Field Mounted Instrument Procedure	10-17-74	New procedure.
1,2	IMP-C-RMI-2	Replacing Incore Thermocouples	12-20-74	New procedure.

Table 10.5.6.3

SUMMARY OF

OPERATING PROCEDURE CHANGES

JULY THROUGH DECEMBER 1974

SURRY POWER STATION

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2		Curve Book	10-17-74	Approved official curve book.
1,2	OP-1	Unit Start-Up Operation	10-10-74	Update and new format.
1,2	OP-1.1	Unit Start-Up Operation RSD - 230^{0}F	10-10-74	New format.
1,2	OP-1.2	Unit Start-Up Operation 230^{0}F to 350^{0}F/450 psig	10-10-74	New format.
1,2	OP-1.3	Unit Start-Up Operation 350^{0}F/450 psig to HSD	10-10-74	New format.
1,2	OP-1.4	Unit Start-Up Operation HSD to 2%	10-10-74	New format.
1,2	OP-1C	Estimated Critical Position	10-10-74	As per updated curve book.
1,2	OP-1D	Reactor Shutdown and Trip Report	10-10-74	Incorporate start-up information.
1,2	OP-1E	Containment Integrity Check-list	10-10-74	New procedure.
1,2	OP-1E	Containment Integrity Check-list	11-01-74	Revision to valve numbers.
1,2	OP-1F	Shutdown Margin Calculations	10-10-74	New procedure.

Table 10.5.7-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	OP-1F	Shutdown Margin Calculation	11-20-74	Update.
1,2	OP-1F	Shutdown Margin Calculation	11-26-74	Clarify calculation.
1,2	OP-2.0	Unit Power Operation	9-06-74	Delete present OP, made OP-2.0 cover sheet.
1,2	OP-2.0	Unit Power Operation	9-06-74	Changed OP-2.0 to OP-2.1. Major rewrite & format change.
1,2	OP-2.1	Power Operation - Turbine	9-06-74	Changed OP-2.1 to OP-2.2. Major rewrite & format change.
1,2	OP-2.2	Power Operation - Turbine	9-12-74	Added section for using synchroscope switch in auto (sec.4.5)
1,2	OP-2.0 & 2.1	Unit Power Operation	9-12-74	Changed step numbers.
1,2	OP-3	Unit Shutdown	8-07-74	Step 4.13.1 Add "Place Reactor Coolant Stop Valves at Zero deflection prior to cooling below 500°F.
1,2	OP-4.4	Receipt & Storage of New Fuel	8-07-74	Update for new fuel and new format.
1,2	OP-5.4	Draining Reactor Coolant System	11-01-74	New format.
1	OP-5.7	Two Loop Operation	9-25-74	Updated ref. to T.S. New format - Add T.S. curve for insertion limits.
1	OP-5.7	Two Loop Operation	10-03-74	Update.
1	OP-5.7	Two Loop Operation	10-10-74	Amended to prevent Safety Injection while performing PT-9.
1,2	OP-6	Emergency Diesel Generator	11-01-74	Specify F.O. tank level in Sec. 2.0.
1,2	OP-6	Emergency Diesel Generator	11-13-74	Add section for start-up prior to maintenance.
1,2	OP-7	Engineered Safeguards	10-23-74	New format and updated.
1,2	OP-7.1	Safety Injection	10-23-74	New format and updated.

Table 10.5.7-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	OP-7.2	Containment Spray	10-23-74	New format and updated.
1,2	OP-7.3	Outside Recirculation Spray System	10-23-74	New format and updated.
1,2	OP-7.4	Inside Recirculation Spray System	10-23-74	New format and updated.
1,2	OP-7.5	RWST Chemical Addition Tank	10-23-74	New format and updated.
1,2	OP-7.6	RWST Temperature Control	10-23-74	New format and updated.
1,2	OP-7.7	Engineered Safeguards Tanks	10-23-74	New format and updated.
1,2	OP-7.8	Filling Boron Injection Tank	10-23-74	New format and updated.
1,2	OP-7.9	Leakage Monitoring	10-23-74	New format and updated.
1,2	OP-15	Reactor Cavity Purification	11-01-74	New format.
1	OP-16	Spent Fuel Pit Cooling and Purification	11-01-74	Add section for blender ΔP's to pit
1,2	OP-20	Spent Resin Discharge Index	7-15-74	Revised and updated, placed in new format.
1,2	OP-20.1	Ion Exchanger & Demineralizer Resin Discharge Operation	7-15-74	Revised and updated, placed in new format.
1,2	OP-20.2	Spent Resin Receiving	7-15-74	Revised and updated, placed in new format.
1,2	OP-20.3	Transfer of Resin From Catch Tank to the Resin Shipping Container	7-15-74	Revised and updated, placed in new format.
1	OP-23.2	Waste Gas Decay Tank Operation	10-23-74	Replace missing master - new format.
1	OP-23.2	Waste Gas Decay Tank Operation	11-13-74	Insert steps to assure collection of necessary HP data.

Table 10.5.7-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	OP-23.4	Post Accident Blower Operation	9-05-74	New procedure.
1,2	OP-24	Electric Hydrogen Recombiner	7-18-74	New Operating Procedure, was Abnormal Proc. #27.
1,2	OP-43	Generator Hydrogen System	7-03-74	Revised and updated, placed in new format.
1,2	OP-43.1	Purging Air From Generator with CO_2	7-03-74	Revised and updated, placed in new format.
1,2	OP-43.2	GHS - Purging CO_2 From the System with H_2	7-03-74	Revised and updated, placed in new format.
1,2	OP-43.3	GHS - Placing the System in Service for Normal Operation	7-03-74	Revised and updated, placed in new format.
1,2	OP-43.4	GHS - Purging H_2 From the System with CO_2	7-03-74	Revised and updated, placed in new format.
1,2	OP-43.5	Reactivating the Gas Dryer	7-03-74	Revised and updated, placed in new format.
1,2	OP-45	RWST Purification	11-01-74	New format.
1,2	OP-52.2	Fire Water Protection	7-25-74	New format.

Table 10.5.7-1

SUMMARY OF

MAINTENANCE OPERATING PROCEDURE CHANGES

JULY THROUGH DECEMBER, 1974

SURRY POWER STATION

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
2	MOP-5.6	Filling & Venting a Drained Isolated Loop	7-02-74	New procedure.
1	MOP-6.1	Removing of No. 1 Emergency Diesel for Maintenance	11-13-74	New procedure.
1	MOP-6.2	Return of No. 1 Emergency Diesel to Operation	11-13-74	New procedure.
2	MOP-6.1	Removing of No. 2 Emergency Diesel for Maintenance	11-13-74	New procedure.
2	MOP-6.2	Return of No. 2 Emergency Diesel to Operation	11-13-74	New procedure.
1,2	MOP-6.3	Removing of No. 3 Emergency Diesel for Maintenance	11-13-74	New procedure.
1,2	MOP-6.4	Return of No. 3 Emergency Diesel to Operation	11-13-74	New procedure.
1	MOP-22.3.3	Chemical Cleaning the Liquid Waste Evaporator	11-13-74	New procedure.
1	MOP-23.1	Removal of Catalytic Recombiner for Electrical Maintenance	10-23-74	New procedure.

Table 10.5.7-2

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1	MOP-23.2	Return of Catalytic Recombiner	10-23-74	New procedure.
2	MOP-28.7	840 PSIG Pressure Test of Steam Generator Shell Side (S/G B)	7-02-74	Change to allow for hydro of B S/G after maintenance.
2	MOP-28.7	840 PSIG Pressure Test of Steam Generator Shell Side (S/G B)	8-07-74	Addition of "Q.A. Hold Points".
1	MOP-28.7	840 PSIG Pressure Test of Steam Generator Shell Side Steam Generator A	12-31-74	New procedure.
1,2	MOP-38.1	Preparing Auxiliary Boilers for Hydro	8-07-74	New procedure.
1,2	MOP-38.2	Returning Auxiliary Boilers to Service Following Hydro	8-07-74	New procedure.
1	MOP-46.6	Containment Instrument Air System 1-1A-C-2A Remove Compressor From Service	9-18-74	Changed number from 46.6 to 46.4.1 and rewrite.
1	MOP-46.7	Containment Instrument Air System 1-1A-C-2A Return Compressor to Service	9-18-74	Changed number from 46.7 to 46.4.2 and rewrite.
1	MOP-46.8	Containment Instrument Air System 1-1A-C-2B Remove Compressor From Service	9-18-74	Changed number from 46.8 to 46.4.3 and rewrite.
1	MOP-46.9	Containment Instrument Air System 1-1A-C-2B Return Compressor to Service	9-18-74	Changed number form 46.9 to 46.4.4 and rewrite.

Table 10.5.7-2

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
2	MOP-48.1	Removal of "A" Condenser Waterbox From Service	10-23-74	Replace missing master and update.
2	MOP-48.2	Return of "A" Condenser Waterbox To Service	10-23-74	Replace missing master and update.
2	MOP-48.3	Removal of "B" Condenser Waterbox From Service	10-23-74	Replace missing master and update.
2	MOP-48.4	Return of "B" Condenser Waterbox To Service	10-23-74	Replace missing master and update.
2	MOP-48.5	Removal of "C" Condenser Waterbox From Service	10-23-74	Replace missing master and update.
2	MOP-48.6	Return of "C" Condenser Waterbox To Service	10-23-74	Replace missing master and update.
2	MOP-48.7	Removal of "D" Condenser Waterbox From Service	10-23-74	Replace missing master and update.
2	MOP-48.8	Return of "D" Condenser Waterbox To Service	10-23-74	Replace missing master and update.
1	MOP-53.1	Removal of No. 1 Emergency Diesel Fuel Oil System for Maintenance	11-13-74	New procedure.
1	MOP-53.2	Return of No. 1 Emergency Diesel Fuel Oil System To Operation	11-13-74	New procedure.
2	MOP-53.3	Removal of No. 2 Emergency Diesel Fuel Oil System for Maintenance	11-13-74	New procedure.

Table 10.5.7-2

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
2	MOP-53.4	Return of No. 2 Emergency Diesel Fuel Oil System to Operation	11-13-74	New procedure.
1,2	MOP-53.5	Removal of No. 3 Emergency Diesel Fuel Oil System for Maintenance	11-13-74	New procedure.
1,2	MOP-53.6	Return of No. 3 Emergency Diesel Fuel Oil System to Operation	11-13-74	New procedure.

Table 10.5.7-2

SUMMARY OF

PERIODIC TEST PROCEDURE CHANGES

JULY THROUGH DECEMBER, 1974

SURRY POWER STATION

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	PT-1.1	NIS Trip Channel Test Prior Prior to Start-Up	8-23-74	Addition of Acceptance Criteria and rewording for clarity.
1,2	PT-1.2	NIS Trip Channel Test During Power Operation	8-23-74	Addition of Acceptance Criteria and changes to facilitate testing at high power levels with large axial offsets.
1,2	PT-1.3	NIS Trip Channel Test Prior to Shutdown	9-25-74	Addition of Acceptance Criteria.
1,2	PT-1.4	NIS Trip Channel Test At Power	7-19-74	New procedure to test source and intermediate range instrumentation at power.
1,2	PT-1.4	NIS Trip Channel Test At Power	8-04-74	Rewording for clarity and addition of steps to temporarily disable computer alarms which would be actuated by performance of test.
1,2	PT-1.4	NIS Trip Channel Test At Power	9-25-74	Addition of Acceptance Criteria.
1,2	PT-2.2	Reactor Coolant Flow	10-17-74	Setpoint change.
1,2	PT-2.3	Pressurizer Level	10-17-74	Setpoint change.
1,2	PT-2.4	Pressurizer Pressure	7-30-74	Reorganization and syntax changes for clarity and greater efficiency in performance of test.
1,2	PT-2.4	Pressurizer Pressure	10-17-74	Setpoint change.

Table 10.5.8-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	PT-2.6	Steam Line Pressure	7-10-74	Reorganization and syntax changes for clarity and greater efficiency in performance of test.
1,2	PT-2.6	Steam Line Pressure	10-17-74	Setpoint change.
1,2	PT-2.8	First Stage Pressure	7-30-74	Reorganization and syntax changes for clarity and greater efficiency in performance of test.
1,2	PT-2.9	Steam Flow	7-30-74	Reorganization and syntax changed for clarity and greater efficiency in performance of test.
1,2	PT-2.10	Feedwater Flow	7-30-74	Reorganization and syntax changed for clarity and greater efficiency in performance of test.
1,2	PT-2.11	Containment Pressure	10-17-74	Setpoint change.
1,2	PT-3	Incore TC and RTD Cross Calibration	9-25-74	Addition of Acceptance Criteria.
1,2	PT-4	Updating of Upper Pressurization Limits for Heatup and Cooldown.	9-25-74	Addition of Acceptance Criteria.
1,2	PT-5	Analog Rod Position Bottom Bistable Action	9-25-74	Addition of Acceptance Criteria.
1,2	PT-7.0	Full Length Control Rod Assembly Drop Time	7-23-74	Addition of Acceptance Criteria.
1,2	PT-8.1	Reactor Protection Logic (Normal Operating Conditions)	7-23-74	Addition of Acceptance Criteria. Reorganization and syntax changes for clarity and greater efficiency in performance of test.
1,2	PT-8.2	Reactor Protection Logic (Refueling)	7-19-74	Addition of Acceptance Criteria.

Table 10.5.8-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	PT-8.3A	Safety Injection System Logic (Normal Operation)	7-19-74	Addition of Acceptance Criteria. Reorganization and syntax changes for clarity and greater efficiency in performance of test.
1,2	PT-8.3B	Safety Injection System Logic (Refueling Shutdown Conditions)	7-22-74	Addition of Acceptance Criteria. Change of annunciator location designations to new system.
1,2	PT-8.4	Consequence Limiting Safeguards Logic (Hi Train)	7-22-74	Addition of Acceptance Criteria.
1,2	PT-8.5	Consequence Limiting Safeguards Logic (Hi-Hi Train)	7-22-74	Addition of Acceptance Criteria.
1,2	PT-8.5A	Consequence Limiting Safeguards Functional Test (Hi-Hi)	7-22-74	Addition of Acceptance Criteria.
1,2	PT-9	Reactor Coolant Loop Isolation Valve Logic Test	9-25-74	Addition of Acceptance Criteria.
1,2	PT-9	Reactor Coolant Loop Isolation Valve Logic Test	10-10-74	Addition of initial conditions to procedure.
1,2	PT-11	Reactor Coolant Integrity Test Following Opening	9-25-73	Addition of Acceptance Criteria.
1,2	PT-12	Pressurizer Safety Valve Setpoint	9-25-74	Addition of Acceptance Criteria.
1,2	PT-13	Main Steam Safety Valve Setpoint	9-25-74	Addition of Acceptance Criteria.
1,2	PT-14.1	Main Steam Line Trip Valves	9-18-74	Separation of monthly and refueling tests, addition of Acceptance Criteria.
1,2	PT-14.1	Main Steam Line Trip Valves	10-10-74	Ammended to reflect T.S. change.
1,2	PT-14.2	Main Steam Line Trip Valves - Refueling	9-18-74	Separation of monthly and refueling tests, addition of Acceptance Criteria

Table 10.5.8-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	PT-14.2	Main Steam Line Trip Valves	10-10-74	Change frequency of testing to conform with T.S. change.
1,2	PT-15	Steam Generator Auxiliary Feedwater Pumps	9-02-74	Addition of Acceptance Criteria and increase in conservatism of allowable discharge pressure band.
1,2	PT-15	Steam Generator Auxiliary Feedwater Pumps	12-26-74	Modified to reflect Design Change 73-108 and 73-122.
1,2	PT-16.1	Containment Leakage Monitoring System	9-25-74	Addition of Acceptance Criteria.
1,2	PT-16.2	Containment Penetration Local Leakage	9-25-74	Addition of Acceptance Criteria.
1,2	PT-16.2	Containment Penetration Local Leakage	12-04-74	Modified to eliminate portion consolidated as PT-16.6.
1,2	PT-16.3	Containment Leakage Rate (Class A at 39.2 psig)	9-25-74	Addition of Acceptance Criteria.
2	PT-16.4	Containment Isolation Valve Leakage	9-18-74	New procedure.
1,2	PT-16.4	Containment Isolation Valve Leakage	9-25-74	Addition of Acceptance Criteria.
1,2	PT-16.5	Containment Personnel Air Lock Test	9-25-74	Addition of Acceptance Criteria.
1,2	PT-16.6	Equipment Hatch Leak Test	12-04-74	New procedure.
1,2	PT-17.1	Containment Spray System	8-02-74	Addition of Acceptance Criteria and clarification of purpose of test.
1,2	PT-17.2	Containment Inside Recirculating Spray Pump	8-02-74	Addition of Acceptance Criteria.

Table 10.5.8-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	PT-17.3	Containment Outside Recirulation Spray Pumps	8-02-74	Addition of Acceptance Criteria and deletion of unnecessary water sampling requirements.
1,2	PT-17.4	Containment Spray and Recirculation Spray Check Valves	8-02-74	Addition of Acceptance Criteria.
1,2	PT-18.1	Lo Head Safety Injection Test & Flushing of Stainless Steel Piping	8-02-74	Addition of Acceptance Criteria and clarification of purpose of test.
1,2	PT-18.2	Safety Injection System Test	8-02-74	Addition of Acceptance Criteria and clarification of purpose of test.
1,2	PT-18.3	Accumulator Check Valve Operability Test	9-02-74	Addition of Acceptance Criteria and clarification of purpose of test.
1,2	PT-18.4	Boron Injection Tank	8-02-74	Addition of Acceptance Criteria and clarification of purpose of test.
1,2	PT-18.5	Hi Head SI Test & Flushing of Stainless Steel Piping	7-31-74	Addition of Acceptance Criteria.
1,2	PT-19.2	RWST Chemical Addition Tank Performance - Refueling	7-22-74	Addition of Acceptance Criteria.
1,2	PT-20.1	Fuel Handling Systems	9-18-74	Addition of Acceptance Criteria.
1	PT-20.2	Spent Fuel Pit Cooling System	9-25-74	Addition of Acceptance Criteria.
1,2	PT-21	4kv Voltage and Frequency	9-25-74	Addition of Acceptance Criteria.
1,2	PT-22.1	Diesel Generator Test During Refueling Shutdown	9-11-74	Addition of Acceptance Criteria.
1	PT-22.2A	Diesel No. 1 Fuel Supply	9-11-74	Addition of Acceptance Criteria.
2	PT-22.2B	Diesel No. 2 Fuel Supply	9-11-74	Addition of Acceptance Criteria.

Table 10.5.8-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	PT-22.2C	Diesel No. 3 Fuel Supply	9-11-74	Addition of Acceptance Criteria.
1,2	PT-23.1	Station Batteries - Monthly	9-11-74	Test amended to include emergency diesel batteries.
1,2	PT-23.2	Station Batteries - Quarterly	9-11-74	Test amended to include emergency diesel batteries.
1,2	PT-23.3	Station Batteries - Annual	9-11-74	Test amended to include emergency diesel batteries.
2	PT-23.3	Station Batteries 2A and 2B	9-25-74	Addition of Acceptance Criteria.
1,2	PT-23.5	Station Batteries 2A and 2B	9-25-74	Addition of Acceptance Criteria.
1	PT-24.1	Fire Protection Water Pump	9-11-74	Addition of Acceptance Criteria.
1	PT-24.2	High Pressure CO_2 System	9-11-74	Addition of Acceptance Criteria.
1	PT-24.3	Low Pressure CO_2 System	9-11-74	Addition of Acceptance Criteria.
1	PT-24.3	Low Pressure CO_2 System	12-12-74	Provide more efficient check of CO_2 System low pressure alarm.
1	PT-24.4	Fire Protection System	9-18-74	Addition of Acceptance Criteria.
1,2	PT-25.1	Service Water System	9-18-74	Addition of Acceptance Criteria.
1,2	PT-25.2	Main Condenser Valve Functional Test	9-18-74	Addition of Acceptance Criteria.
1	PT-25.3	Emergency Service Water Pumps	9-18-74	Addition of Acceptance Criteria.
1,2	PT-26.1	Radiation Monitoring Equipment Check	7-22-74	Addition of Acceptance Criteria.
1,2	PT-26.2	Radiation Monitoring Equipment Test	7-22-74	Rewording of Acceptance Criteria to standard format.
1,2	PT-26.3	Radiation Monitoring Equipment Calibration	7-22-74	Addition of Acceptance Criteria.

Table 10.5.8-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	PT-26.4	Radiation Monitoring Equipment Test During Purging	7-22-74	Rewording of Acceptance Criteria to standard format.
1	PT-26.5	Radiation Monitoring Equipment Calibration	11-27-74	New procedure.
1,2	PT-27	Heat Tracing System (modified)	9-18-74	Addition of Acceptance Criteria.
1,2	PT-28.1	Reactivity Anamolies	9-18-74	Addition of Acceptance Criteria.
1,2	PT-28.2	Reactor Core Flux	9-18-74	Addition of Acceptance Criteria.
1,2	PT-28.3	Core Exposure	9-18-74	Addition of Acceptance Criteria.
1,2	PT-28.4	F_z Surveillance	9-06-74	New procedure.
1,2	PT-28.5	Computor Updating	9-18-74	Addition of Acceptance Criteria.
1,2	PT-28.6	Core Quadrant Power Balance	9-18-74	Addition of Acceptance Criteria.
1,2	PT-28.7	Rapid Check of Core Packing Factors	9-18-74	Addition of Acceptance Criteria.
1,2	PT-28.8	Excore Calibration Curves	9-18-74	Addition of Acceptance Criteria.
1,2	PT-28.9	Incore-Excore NI Calibration	9-18-74	Addition of Acceptance Criteria.
1,2	PT-28.11	Nuclear Design Check Tests	11-20-74	New procedure.
1	PT-28.11	Nuclear Design Check Tests	12-12-74	Addition of calibration checks on reactivity computer and determination of zero power testing range.
1,2	PT-29.3	Turbine Trip Setpoint	9-25-74	Addition of Acceptance Criteria.
1,2	PT-29.4	Turbine Overspeed Protection Controller Channel (Electrical)	12-23-74	New procedure.

Table 10.5.8-1

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	PT-30	Feedwater Control Isolation Logic	7-19-74	Procedure deleted. Testing requirements met by revised PT-8.3A.
1	PT-31.1	Seismic Instrumentation Test	9-25-74	Addition of Acceptance Criteria.
1	PT-31.2	Seismic Instrumentation Calibration	9-25-74	Addition of Acceptance Criteria.
1	PT-32	HEPA and Charcoad Filter Test	9-25-74	New procedure.
1	PT-33	Control Room Leakage	9-25-74	Addition of Acceptance Criteria.
1,2	PT-34	Electrical Penetration Leakage Test	9-25-74	Addition of Acceptance Criteria.
1,2	PT-35	Reactor Power Calibration	9-25-74	Addition of Acceptance Criteria.
1,2	PT-37.1	Electric Hydrogen Recombiners	9-25-74	Addition of Acceptance Criteria.
1,2	PT-37.2	Electric Hydrogen Recombiners, Refueling	9-25-74	Addition of Acceptance Criteria.
1,2	PT-38.6	Chemistry Sampling - Ventilation Vent	7-22-74	Correction of typographical error.
1,2	PT-38.7	Chemistry Sampling - Process Vent	7-23-74	Correction of typographical error.
1,2	PT-38.15	Health Physics Source Leak Test	11-27-74	Provide additional sources.
1,2	PT-40	Instrument Calibration	12-04-74	Addition of calibration requirements for newly installed gauges.
1,2	PT-42	Maximum Load Test	9-08-74	Addition of computer point designations to facilitate date gathering.
1,2	PT-43	Pipe Hanger Inspection	8-28-74	New procedure.

Table 10.5.8-1

SUMMARY OF

QUALITY CONTROL PROCEDURE CHANGES

JULY THROUGH DECEMBER, 1974

SURRY POWER STATION

PROCEDURE NUMBER	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
	Nuclear Power Station Quality Assurance Manual	9-01-74	Initial issue of manual.
	Nuclear Power Station Quality Control Manual	9-18-74	Cancelled.

Table 10.5.9-1

SUMMARY OF

START-UP TEST PROCEDURE CHANGES

JULY THROUGH DECEMBER, 1974

SURRY POWER STATION

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	SU-80	Steam Generator Auxiliary Feedwater Booster Pumps	11-06-74	New procedure.
1,2	SU-81	Auxiliary Feedwater Cross-Connect From Unit #1 Auxiliary Feedwater Pump to Unit #2 Steam Generator	11-06-74	New procedure.
1	SU-80	Steam Generator Auxiliary Feedwater Booster Pumps	12-12-74	Reorganization and syntax changes for clarity and greater efficiency in performance of test.
1	SU-81	Auxiliary F.W. Cross-Connect from Unit No. 1 Auxiliary FW Pumps to Unit No. 2 Steam Generators	12-12-74	Reorganization and syntax changes for clarity and greater efficiency in performance of test.

Table 10.5.10-1

SUMMARY OF

SPECIAL TEST PROCEDURE CHANGES

JULY THROUGH DECEMBER, 1974

SURRY POWER STATION

UNIT	PROCEDURE NO.	TITLE	EFFECTIVE DATE OF CHANGE	DESCRIPTION OF CHANGE
1,2	ST-21	Investigation of Erosion of Charging Pump Miniflow Line & Orifice	7-24-74	New procedure.
1,2	ST-22	Investigation of Flow Required to Allow PCV-CN-100 (200)D,E,F to Function Properly	7-31-74	New procedure.
1,2	ST-23	Evaluation of Steam Gen. Narrow Range Level Recorder System	8-05-74	New procedure.
1,2	ST-25	Measurement of Steam Generator Parameters	8-14-74	New procedure.
2	ST-26	Auxiliary Feedwater Stop Valve Performance Unit 2	10-17-74	New procedure.
1,2	ST-27	Special Test of Containment Instrument Air System & Compressor Capacity	11-13-74	New procedure.
1,2	ST-28	Emergency Diesel Generator Fuel Oil Supply System	11-06-74	New procedure.
1	ST-29	Component Cooling Heat Exchanger Flow Determination	11-20-74	New procedure.

Table 10.5.11-1

10.6 UNIT 1 MAINTENANCE

The following is a summary of the maintenance performed during the report period.

10.6.1 Unit 1 Mechanical Maintenance

A summary of Unit 1 mechanical maintenance is tabulated in Table 10.6.1-1.

10.6.2 Unit 1 Electrical Maintenance

A summary of Unit 1 electrical maintenance is tabulated in Table 10.6.2-1.

10.6.3 Unit 1 Instrument Maintenance

A summary of Unit 1 instrument maintenance is tabulated in Table 10.6.3-1.

SURRY POWER STATION
UNIT NO. 1
MECHANICAL MAINTENANCE
JULY THROUGH DECEMBER, 1974

Table 10.6.1-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
7-01-74	Boron Evaporator Re-boiler BR-E-5B	Suspected tube leakage	None	Plugged (2) tubes and inspected reflux nozzle, MR-S1-1899.	N/A	80 Hrs.
7-05-74	Gaseous Drains Valve 1-DG-14	Ruptured diaphragm.	None	Renewed diaphragm, MR-S1-1980.	N/A	2 Hrs.
7-06-74	Boron Evaporator Re-boiler BR-E-5B	Pipe nipple cracked.	None	Renewed drain line nipple, MR-S1-1990.	N/A	2 Hrs.
7-10-74	Main Steam Non-Return Valves	None, inspection of valves due to failure of Unit 2 non-return valves.	None	Renewed all (3) NRV's piston and disc assy's, MR-S1-1977	Reactor at cold shutdown.	5 Days
7-15-74	Hydraulic Restraints on RC Pumps 1-RC-P-1A,B,C	None, upgrading of seal parts on Bergen-Patterson hydraulic snubbers HSSA-30-6.	None	Renewed all O-rings with ethylene propylene material, inspected and polished pistons & cylinders, 12 total, (4) each pump, MR-S1-2027.	Reactor at cold shutdown. MMP-C-RC-019	40 Hrs.
7-16-74	Containment Inst. Air Compressor	Valves.	None	Replaced with rebuilt compressor MR-S1-2058	N/A	4 Hrs.
7-17-74	Containment Vacuum Pump 1-CV-P-1B	Normal wear reduced capacity.	None	Replaced with rebuilt pump, MR-S1-2073.	N/A	½ Hr.
7-31-74	Boron Recovery Pump BR-P-3B	Normal wear reduced capacity.	None	Rebuilt pump; new shaft, impeller bearing housing & shaft retaining rings bearing housing and impeller O-rings, MR-S1-1744.	N/A	8 Hrs.
8-16-74	Boric Acid Transfer Pump 1-CH-P-2B	Normal seal wear.	None	Renewed mechanical seal, MR-S1-2087.	N/A	3 Hrs.

Table 10.6.1-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint
8-20-74	Boric Acid Transfer Pump 1-CH-P-2C	Normal seal wear.	None	Renewed mechanical seal, MR-S1-2260	N/A	3 Hrs.
9-03-74	Containment Instrument Air Compressor 1-IA-C-2A	Normal wear, Compressor would not load.	None	Replaced with rebuilt compressor, MMP-C-006, MR-S1-2355.	N/A	8-3/4Hrs
9-06-74	Residual Heat Removal Valve MOV-1700	None, normal packing wear.	None	Backseated valve and repacked. MR-S1-2373.	Hot shutdown.	24 Hrs.
9-11-74	Containment Instrument Air Compressor 1-IA-C-2B	Ruptured diaphragm in unloader.	None	Renewed diaphragm, MR-S1-2387.	N/A	1 Hr.
9-11-74	Containment Instrument Air Compressor 1-IA-C-2A	Discharge valve closed.	None	Renewed head & valve assy., piston rings & expanders, MR-S1-2388	N/A	6½ Hrs.
9-13-74	Emergency Diesel Generator No. 1	None. Annual PMP.	None	Performed annual PMP as per MMP-P-007, MR-S1-2405.	N/A	7½ Hrs.
10-03-74	Service Air Compressor 1-SA-C-1	Worn valve.	None	Rebuilt unloader valves. MR-S1-2548 & 2509.	N/A	16 Hrs.
10-17-74	Spent Fuel Handling Tool	None - W ECR-102	None	Reworked tool as per design change 74-101, MR-S1-2471.	N/A	48 Hrs.
10-20-74	Service Air Compressor	Unloader line leaking.	None	Tightened lines and reworked discharge valves. MR-S1-2662.	N/A	3½ Hrs.
10-23-74	Charging Pump Component Cooling Water Pump 1-CC-P-2B	None - normal mechanical seal wear.	None	Renewed mechanical seal. MR-S1-2644.	N/A	8 Hrs.
10-27-74	Radiation Monitor RI-LW-108	None - design change.	None	Modified as per design change 73-38 MR-S1-2691.	N/A	2 Days
11-01-74	Unit #1 Instrument Air to Fuel Transfer Upender	None - design change.	None	Installed SOV as per design change 74-49 MR-S1-2769	N/A	8 Hrs

Table 10.6.1-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint
11-01-74	Fuel Manipulator Crane Gripper Pins	None - design change.	None	Modified gripper pins as per design change 74-107 MR-S1-2743.	N/A	20 Hrs.
11-04-74	Reactor Coolant Loop Stop Valves MOV-1594 and 1595	None - Packing, normal wear.	None	Repacked with Grafoil packing. MR-S1-2754 & 2753.	Reactor at cold shutdown.	44 Hrs.
11-06-74	Fuel Manipulator Crane	None.	None	Reworked plastic knobs as per Westinghouse letter. VPA-74-028 MR-S1-1220	N/A	1 Hr.
11-06-74	Liquid Waste Pump 1-LW-P-6A, B	Strainers plugged.	None	Cleaned strainers and installed new mechanical seals MR-S1-2746.	N/A	48 Hrs.
11-08-74	Component Cooling Pump 1-CC-P-1B	None - mechanical seal leaking.	None	Renewed mechanical seals. MR-S1-2704.	N/A	24 Hrs.
11-15-74	Instrument Air Compressor 1-1A-C-1	None - normal wear.	None	Overhauled Compressor. MR-S1-2651.	N/A	48 Hrs.
11-30-74	Penetration Valve 1-VP-12	Valve would not pass leak rate test PT-16.4.	None	Lapped seat and disc. MR-S1-2767.	Reactor at cold shutdown.	12 Hrs.
11-30-74	Containment Vacuum Check Valve 1-CV-3	Valve would not pass leak rate test PT-16.4.	None	Lapped seat and disc. MR-S1-2845.	Reactor at cold shutdown.	8 Hrs.
12-06-74	Component Cooling Heat Exchangers 1-CC-E-C & D	Unknown - leaking tubes	None	Plugged (2) tubes 1-CC-E-1C, plugged (1) tube 1-CC-E-1D MR-S1-2839 & 3090.	Refueling outage.	24 Hrs.
12-10-74	Charging Pump Service Water Pump 1-SW-P-108	Pump shaft worn.	None	Replaced pump with rebuilt pump. MR-S1-3082.	Refueling outage.	5½ Hrs.
12-18-74	Radiation Monitoring System FG-SW-100A,B,C,D	None	None	Cleaned flow indicator, cleaned piping & valves. MR-S1-3122.	Refueling outage.	40 Hrs.

Table 10.6.1-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
12-18-74	Pressurizer Relief Valves MOV-1535 and 1536	Stud deterioration.	None	Renewed studs. MR-S1-3127.	Refueling outage.	20 Hrs.
12-19-74	Primary Grade Water TV-1519A	None - normal use.	None.	Renewed diaphragm.MR-S1-2818	Refueling outage.	4 Hrs

SURRY POWER STATION
UNIT NO. 1
ELECTRICAL MAINTENANCE
JULY THROUGH DECEMBER, 1974

Table 10.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
7-01-74	Unit #1 Loop Stop Valve	Maladjusted limit switches.	Repaired "closed-valve" indicating lights.	Adjusted limit switches. MR-S1-1916.	EMP-C-MOV-01.	2 Hrs.
7-01-74	Receiving High and Low Alarm Heat Tracing	Thermostat incorrectly set.	Corrected high and low temperature alarms.	Reset alarms to correct thermostat readings. MR-S1-1962	EMP-C-HT-01.	1 Hr.
7-01-74	Station Service Batteries 1A & 1B	Monthly PT.	Reactor at cold shutdown.	Completed PT-23.1 and cleaned both sets of batteries.	EMP-C-DC-01.	4 Hrs.
7-06-74	Unit #1 Blowdown Valves	Installation of jumpers.	Placing jumpers will allow blowdown valves to function as stated in tech. specifications.	Placed jumpers at SW-15J4, 15-1 & 4, and BD100A,B,C,D,E,F to permit blowdown function.	Reactor at cold shutdown. EMP-C-MOV-01.	4 Hrs.
7-09-74	MOV-MS-101C	Test readings.	Motor operated valve was tested in main steam system. Readings were positive.	Bridge T1-T2 .301Ω T1-T3 .299Ω T2-T3 .299Ω Meggered 50 MΩ	EMP-C-MOV-01. Reactor at cold shutdown.	½ Hr.
7-09-74	MOV-MS-101B	Test readings.	Motor operated valve was tested in main steam system. Careful connection of motor leads made the MOV functional.	Bridge T1-T2 .313Ω T2-T3 .306Ω T1-T3 .306Ω Meggered 100MΩ	EMP-C-MOV-01 Reactor at cold shutdown.	½ Hr.
7-09-74	MOV-MS-101A	Test readings.	Motor operated valve was tested in main steam system, readings were positive.	Bridge T1-T2 .241Ω T2-T3 .243Ω T1-T3 .241Ω Meggered 100 MΩ	EMP-C-MOV-01. Reactor at cold shutdown.	½ Hr.

Table 10.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
7-10-74	NRV-101B	Improperly set limit switches on NRV valves.	Satisfactory testing indicates that the NRV for steam control is operating correctly. Reactor at cold shutdown.	Set limit switches on non-return valves and test.	EMP-C-MOV-01. Reactor at cold shutdown.	1 Hr.
7-10-74	NRV-101A	Improperly set limit switches on non-return valves.	Positive testing results while reactor was at cold shutdown indicate correct operation.	Set limit switches on NRV-101A and tested satisfactorily.	EMP-C-MOV-01. Reactor at cold shutdown.	1 Hr.
7-10-74	NRV-101C	Unset limit switches on non-return valves.	Reactor at cold shutdown. Allowed positive testing to result on the NRV and insure proper operation.	Set limit switches on NRV-101C and tested satisfactorily.	EMP-C-MOV-01. Reactor at cold shutdown.	1 Hr.
7-11-74	Check Valves	Blown check valves BD-TV-101A,B,C,D,E & F	Safety pressure relief blowdown valves put back in operation.	Removed jumpers from 15A4 and 15J4 for blowdown valves.	Opened breakers, EMP-C-MOV-01.	1 Hr.
7-11-74	MOV-1590,1591,1593,1594, 1595, Loop Isolation Stop Valves	Needed to backseat valves electronically.	Motor control center was where the valves were set.	Went to MCC and set valves electronically as directed.	SEMP-MOV-01.	2 Hrs.
7-11-74	RCP Motors A,B & C	Checking oil levels, loop stop valve stress	No undue stress was observed on reactor coolant pumps A,B, or C, and the oil levels were nearly normal.	Added oil to A & B motors and checked stress levels of loop stop valves.	EMP-P-LU-01, SW-P-3.	2½ Hrs.
7-15-74	Boric Acid Batch Tank Agitator CH-BL-2	Loose shaft.	Reactor at cold shutdown during maintenance.	Shaft 5A drawn tight, bridge and megger readings taken.	EMP-C-CH-01	½ Hr.
7-15-74	Boric Acid Tank Agitator	Disconnect motor for Mech. Dept.	None.	Motor disconnected for Mech.Dept.	EMP-C-CH-01	1½ Hrs.
7-17-74	Containment Instrument Air	PS-1A need calibration.	None	Found PS-1A 1012B1 & B2 to need calibrating by Instrument Shop.	N/A	1 Hr.
7-18-74	1-CW-P-2B	Overload assemble loop loose and over-heating	Positive load check & testing indicates that circulating water pump motor now normal.	Bridge and megger tested, then replaced circuit breaker & overload assemble. MR-S1-2082	EMP-CW-P-01.	2½ Hrs.

Table 10.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
7-16-74	Units #1 & 2 Electrical Penetrations	Low pressures.	Nitrogen restored to correct levels.	Filled all low pressures to normal pressure.	PT-34.	½ Hr.
7-16-74	1A Station Service Batteries	Low voltage batteries checked on alarm.	Reactor at cold shutdown.	Low voltage alarm reset and batteries checked.	EMP-C-DC-01.	1 Hr.
7-22-74	Boron Recovery	Wrong size bulb on indicating light.	Dim, blinking symbol corrected by installing correct bulb.	Bulb in system replaced with correct size of bulb. MR-S1-2103.	None.	½ Hr.
7-22-74	Heat Tracing Panel #12	Open breaker on "H" terminal & center terminal corroded.		Closed breaker & cleaned center terminal. MR-S1-2105	EMP-C-HT-01.	1 Hr.
7-23-74	1A1 & 1A2 Battery Chargers	Faulty high & low voltage alarm relay card.	Relay card will be installed to make low voltage alarm operable.	Checked voltages on 1A1 & 1A2 battery chargers & located defective relay card.	Opened breaker.	1 Hr.
7-24-74	Station Batteries	Periodic testing 23.1 and 23.2	Station battery tests indicate power capacity of station service.	Took all required readings and entered them on operating forms.	None, EMP-C-DC-01.	8 Hrs.
7-25-74	1-BR-P-5B	Bridge, megger and load readings on motor	Satisfactory testing on boron recovery system motor indicates proper operation.	Normal bridge, megger and ampere readings on 1-BR-P-5B motor. MR-S1-2117	EMP-C-CH-01.	½ Hr.
7-25-74	1-BR-P-5B	T5, T8 motor leads open T3 shorted in connection box.	Boron recovery motor 5B now effectively operational. Positive testing insure proper results.	Pulled motor, cleaned bearings, reinstalled, bridge & megger tested. MR-S1-2117	Radiation Work Permit #1. EMP-C-CH-01/	2½ Hrs
7-30-74	Emergency Diesel Batteries	Clean batteries in normal maintenance	Normal battery maint. resulted in proper upkeep of batteries.	Batteries thoroughly cleaned on #1,2, & 3 emergency diesels.	EMP-C-DC-02.	4 Hrs.
7-30-74	Boric Acid Tank Agitator	Broken shaft.	Repair of boric acid tank agitator allows acid to be maintained in proper condition.	Shaft disconnected from motor for Mech. Dept., then bridge and megger tested.	EMP-C-CH-01.	1½ Hrs
7-30-74	Emergency Diesels 1,2, and 3	Monthly battery check.	Emergency diesel batteries tested with normal results insuring proper operation.	Batteries checked on 1,2,3 emergency diesel batteries.	EMP-C-DC-02.	2 Hrs.

Table 10.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
8-01-74	Unit #1 Penetration	E-16 at one pound pressure.	Corrected low pressure in Unit 1 Nitrogen penetration.	Added nitrogen to penetration 7 P.S.I. MR-S1-2179	PT-34	1 Hr.
8-06-74	1-BR-P-4	Boric Acid transfer pump motor installation.	Pump motor tested while running with a load check of 4 amps indicating positive results.	Installed the repaired motor on the acid pump and meggered at 500-M2.	All other Boric acid pumps were operating, therefore no precautions required.	3 Hrs.
8-09-74	1-BR-P-8	Motor tripped when started.	Thoroughly inspecting motor 1-BR-P-8 and testing it resulted in normal findings, with no indication of reason for trip.	Motor disconnected from pump, test run, and reconnected to pump.	EMP-C-PL-02	2 Hrs.
8-12-74	1-BR-P-6A	Heat tape needed replacement.	Heat indicating tape is needed to have proper control over actions in the functions of 1-BR-P-6A.	Retaped the heat tape on the line for suction side of pump.	EMP-C-HT-01.	3 Hrs.
8-15-74	Boric Acid Batch Tank Agitator	Overload had tripped causing it not to run.	Effective operation insured by thoroughly testing the Agitator after resetting the switch.	Megger and bridge tests performed, and overload breaker was reset. MR-S2-2194	Opened breaker.	½ Hr.
8-19-74	1-CH-P-2B	Motor turning in wrong direction.	Reversed motor leads will correct problems of motor turning in wrong direction.	Switched T_2 & T_3 motor leads. Testing postponed due to Mechanical tag.	EMP-C-HT-01	1 Hr.
8-21-74	"A" Station Battery Chargers	High voltage alarm adjusted too low.	High-low voltage alarm relay on 1A1 charger readjusted to insure correct control room monitoring.	Readjusted high alarm and checked low setting also. MR-S1-2067.	EMP-C-DC-01	½ Hr.
8-22-74	Unit #1 Penetrations	Low Pressures on Penetrations B-18, C-18, E-17, A-1.	Corrected low pressures on Unit #1 penetrations.	Pressurized to normal pressure levels. MR-S1-2299.	PT-34	½ Hr.
9-03-74	Emergency Diesel Generators	Monthly battery check.	Check specific gravity and voltage	All tests satisfactory.	EMP-C-DC-02.	3 Hrs.
9-04-74	1-VS-F-1A, B, C	Containment recirculate fans.	High containment temperature.	Checked load current on fan motors - all motors below nameplate.	EMP-S-PL-02	1 Hr.

Table 10.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
9-10-74	1-VS-E-4A	Oil pressure reset switch broken.	Compressor motor would not start.	Replaced switch.	Opened circuit.	1 Hr.
9-16-74	1-1AC-2A	Overload relay bad.	Overload relay will not reset.	Replaced overload relay and checked load - all test satisfactory.	Opened breaker.	2 Hrs.
9-19-74	Charging Pump, Service Water Cooling Pump Low Pressure Annunciator	PS-SW-104 failed.	Alternate pump operated.	Replaced pressure switch. MR-S1-2447	MR-S1-2447	3 Hrs.
9-20-74	Unit #1 Penetrations 18C, 17E, 17C, 17D,16C, 16D, 16E, 15B, 15C,2B	Low pressures.	None.	Filled to normal pressure levels. MR-S1-2454.	PT-34	1½ Hrs.
9-22-74	1-1A-C-1	Coil for auto start open.	Auto start alarm failed.	Reconnected alarm and transferred card to new drop.	Opened circuit.	1 Hr.
10-03-74	1-RCP-1A	Trip during instrument P.T.	None.	Bridge & megger - all tests normal.	Reactor at cold shutdown.	1 Hr.
10-3-74	1-MG-2	Bearing failed.	None.	Disconnected motor & removed flywheel. Removed & replaced bearing. Installed flywheel & motor.	Reactor at cold shutdown.	10½ Hrs.

Table 10.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
10-28-74	1-RCP-1A, 1C	Testing.	Refueling Unit 1.	Disconnect Motor & auxiliaries.	Reactor at Hot Shutdown.	8½ Hrs.
10-30-74	Reactor Head Plugs	Disconnect.	Refueling Unit 1.	Disconnected as necessary.	Reactor at Hot Shutdown.	2 Hrs.
11-01-74	RCP-1B	Remove for pump modification - Mech. Dept.	None.	Disconnected motor and auxiliaries; performed swing check.	Reactor at Cold Shutdown.	30 Hrs.
11-02-74	1-BR-P-3A	Trips on overload.	None.	No problems found.	Reactor at Cold Shutdown.	½ Hr.
11-03-74	1-RCP-1C	Remove North Anna motor.	None.	Disconnected and removed to Turbine Building.	Reactor at Cold Shutdown.	15 Hrs.
11-09-74	1-RCP-1A	Inspection.	None.	Swing check - all test satisfactory.	Reactor at Cold Shutdown.	9 Hrs.
12-01-74	MOV-CS-101 A,B,C,D	Disconnect.	None.	Disconnected leads, remove cable & tape leads MR-S1-3033	MR-S1-2033	6 Hrs.
12-02-74	#1 Emergency Diesel	Fast start light on while diesel is running	None.	Researched prints - normal for light to be on. MR-S1-3091	Reactor at Cold Shutdown.	2 Hrs.
12-02-74	1-WT-P-2B	Preventive maintenance	None.	Disconnect.	Reactor at Cold Shutdown.	3 Hrs.
12-02-74	1-FW-P-1A1, 1A2	Preventive maintenance	None.	Clean motor, found wedges loose, repaired at W Service Shop - Reassembled motor & tested.	Reactor at Cold Shutdown.	5 Hrs.
12-02-74	#1 Emergency Diesel Generator	P.T.	None.	Complete PT, all test normal.	Reactor at Cold Shutdown	½ Hr.
12-04-74	Personnel Hatch Control Panel	Fire damage.	None.	Cleaned panel and ordered necessary replacement parts.	Reactor at Cold Shutdown	4 Hrs.
12-04-74	1-VS-F-39	Freeze relay tripped.	None.	Reset relay. MR-S1-3051.	Reactor at Cold Shutdown.	½ Hr.
12-04-74	1-SV-S-1C	Mechanical department request.	None.	Connected high speed for reverse operation. Return to normal service.	Reactor at Cold Shutdown.	1½ Hrs.

Table 10.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint
12-04-74	RS-156A, B	Mechanical department request.	None.	Disconnected.	Reactor at Cold Shutdown.	1 Hr.
12-06-74	Reactor Coolant Pump Motor A 1-RC-P-1A	Preventive maintenance.	N/A	Reconnect & tape motor leads, connect auxiliaries.	Reactor at Cold Shutdown.	26½ Hrs.
12-08-74	Part Length Control Rod Coils	Refueling maintenance.	N/A	Megger & bridge - readings normal. FP-VPA-RI.	Reactor at Cold Shutdown.	8 Hrs.
12-08-74	1-RCP-1C	Reassambly and reinstallation.	None.	Install coolers.	Reactor at Cold Shutdown.	30 Hrs.
12-10-74	1-PG-P-1B	Pump frozen.	Overload tripped.	Refered to Mechanical Dept.	Reactor at Cold Shutdown.	2½ Hrs.
12-13-74	1-BR-P-7A	Motor overloaded.	Overloads tripped.	Conditions normal at time of check.	Reactor at Cold Shutdown.	1 Hr.
12-13-74	Feed Water Heater	Thermo-couple shorted.	N/A	Replaced thermo-couple.	Reactor at Cold Shutdown.	1 Hr.

SURRY POWER STATION
UNIT NO. 1
INSTRUMENTATION & CONTROLS
JULY THROUGH DECEMBER, 1974

Table 10.6.3-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
7-05-74	Channel 3 Steam Line Pressure P Header Minus P Line Comparator PC-1-485B Out P	Electronic drift of trip setpoint.	Comparator was tripping 10MV in the non-conservative direction at 96.5 psi rather than 100 psi differential.	Recalibrated comparator, returned to service.	Used approved procedures, placed channel in test.	½ Hr.
7-05-74	Channel 3 Steam Line Pressure Steam Line Flow Pressure Trip Comparator PC-1-485A	Electronic drift of trip setpoint.	Comparator was tripping 6 MV in the non-conservative direction at 498.7 psi rather than 500 psi.	Recalibrated comparator, returned to service.	Used approved procedures, placed channel in test.	½ Hr.
7-05-74	Pressurizer Level Channel 3 High Level Trip Setpoint	Electronic drift of trip setpoint.	Comparator was tripping .014 mills in the non-conservative direction at 92.27% rather than 92%.	Recalibrated comparator, returned to service.	Used approved procedures, placed channel in test.	½ Hr.
8-04-74	Feed Flow Protection Channel 4, FC-1-498D Feedwater Minus steam flow alarm comparator	Electronic component failure, comparator would not trip.	No control room alarm if feed flow signal would have exceeded steam flow signal by .709 x 10^6 lb/hr.	Replaced module with spare unit, calibrated, completed PT-2.10.	Channel in test, redundant instruments in service & normal, used approved procedure.	1 Hr.
8-04-74	Steam Line Pressure Low Pressure Trip Channel 3 Protection Comparator PC-1-485A	Electronic component failure, comparator tripped but would not reset.	The trip signal would have been generated if required, but comparator would not have reset.	Replaced module with spare, calibrated, performed PT-2.6 to assure proper operation.	Channel in test, redundant instruments in service & normal, Used approved procedures.	1 Hr.
8-04-74	Steam Generator Low Level Pressure Trip Comparator LC-1-485B Output No. 1	Electronic component failure. Comparator tripped but would not reset within the proper band and could not be adjusted.	The trip signal would have been generated if required, but would have reset on increasing level 1MV after trip.	Replaced module with spare unit. Calibrated, performed PT-2.5 to insure proper operation.	Channel in test, redundant instruments in service and normal. Used approved procedures.	1 Hr.

Table 10.6.3-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
11-19-74	Intake Canal Level Circulating Water Magnetic Amplifier Switch LS-CW-201C Setpoint Drift	Electronic component drift resulted in a setpoint change.	This switch in series with a redundant switch on Unit 1 will shutdown the reactor on low canal level via a turbine trip due to the magnitude of the drift a turbine trip could not be initiated.	Recalibrated the magnetic switch to the proper setpoint. Increase surveillance to insure no further malfunction. Reported as Abnormal Occurrence.	Both units at cold shutdown. Used approved procedures.	1 Hr.
12-16-74	PC-2-455A Pressurizer Pressure Protection Channel 1 Comparator Tripped Low and would not reset.	Electronic component failure.	The High Pressure Reactor trip would have occurred at 2096 PSI instead of normal 2135 PSI in the conservative direction.	Removed module, replaced bad components, calibrated and checked for proper operation via PT-2.4 returned to service.	Channel in test. Reactor at cold shutdown. Redundant channels in service. Used approved procedures.	2 Hrs.
12-19-74	PC-2-456A Pressurizer Pressure Protection Channel 2 Comparator Failed To Trip.	Electronic component failure.	The High Pressure Reactor trip would have failed to occur on channel 2.	Removed module, replaced bad components, calibrated and checked for proper operation via PT-2.4 returned to service.	Channel in test. Reactor at cold shutdown. Redundant channels in service and normal. Used approved procedure.	2 Hrs.
12-20-74	FC-2-4980 FW-SF Alarm Comparator. 4MV out of spec in the conservative direction.	Electronic drift.	FW-SF alarm would have occurred at $.687 \times 10^6$ lb/hr., rather than $.709 \times 10^6$ lb/hr.	Recalibrated comparator set 15 mills conservative, checked for proper operation, via PT-2.10, returned to service.	Reactor at cold shutdown. Channel in test. Redundant channels in service and normal. Used approved procedures.	1 Hr.
12-20-74	FM-2-496 Feedwater Flow Multiplier Divider 10 MV out of spec.	Electronic drift.	All comparators down stream of the multiplier would have performed their function ¼% earlier than expected.	Recalibrated multiplier divider, checked for proper operations, via PT-2.10 returned to service.	Channel in test, Reactor at cold shutdown, redundant channels in service. Used approved procedures.	2 Hrs.
12-20-74	PM-2-446B First Stage Pressure Summator Set-Point 1% High	Electronic drift.	All comparator setpoints for high steam flow would have operated 1% in the non-conservative direction.	Recalibrated summator, checked for proper operation via PT-2.8. Returned to service.	Channel in test, Reactor at cold shutdown, redundant channels in service. Used approved procedures.	2 Hrs.

10.7 RESULTS OF SURVEILLANCE TESTS

The majority of periodic test results for July were satisfactory; however, the following problems were noted:

a) PT-2.3 - Pressurizer Level, 7-5-74

Level comparator, LC-1-461A, Reactor Hi Level Trip, drifted out of specification in the non-conservative direction. The required number of channels per Technical Specifications remained operable at all times. Channel was realigned.

b) PT-2.6 - Steam Line Pressure, 7-5-74

Pressure comparator, PC-1-485B, Low Steam Line Pressure Trip, drifted out of specification in the non-conservative direction. The required number of channels per Technical Specification remained operable at all times. Channel was realigned.

c) PT-26.1 - Radiation Monitoring Equipment Check, 7-19-74

Ventilation Vent Particulate Monitor, RM-VG-109, failed to respond in either the normal operation or check source position. Failure was due to a faulty high voltage connection. Following repairs, monitor performed satisfactorily.

d) PT-34 - Electrical Penetration Leakage Test

Several electrical penetrations indicated a loss of pressure. In each case the penetrations were recharged to the correct pressure.

The majority of periodic test results for August were satisfactory; however, the following were noted:

a) PT-1.2 - NIS Trip Channel Test During Power Operation, 8-11-74.

The control power fuse blew on channel N-42 during performance of test. Fuse was replaced and the channel performed satisfactorily.

b) PT-2.3 - Pressurizer Level, 8-25-74

Level Comparator, LC-1-461A Reactor Trip Hi Level, drifted out of specification in the non-conservative direction. The required number of channels per Technical Specifications remained operable at all times. Channel was realigned.

c) PT-2.5 - Steam Generator Level, 8-4-74

Level comparator LC-1-485B had no deadband. Alarm and trip settings were within specifications. Comparator was replaced. New comparator was calibrated and performed satisfactorily.

d) PT-2.6 - Steam Line Pressure, 8-4-74

Pressure comparator PC-1-485A had excess deadband and could not be adjusted. Trip setting was within specifications. Comparator was replaced. New comparator was calibrated and performed satisfactorily.

e) PT-2.10 - Feedwater Flow, 8-4-74

Flow comparator, FC-1-498D, would not alarm. Trip setting was within specifications. Comparator was replaced. New comparator was calibrated and performed satisfactorily.

f) PT-18.5 - Hi Head S.I. Test and Flushing of Stainless Steel Piping, 8-12-74

Valve, HCV-1850C, would not indicate "closed" in the Main Control Room. Following adjustment of limit switch, control room indicator performed satisfactorily.

g) PT-29.1a - Turbine Main Steam Stop and Governor Valve Test, 8-20-74

Stop valves #1 and #3 would not close. Following repeated cycling, valves closed properly.

h) PT-34 - Electrical Penetration Leakage Test

Several electrical penetrations indicated a loss of pressure. In each case, the penetrations were recharged to the correct pressure.

i) PT-36 - Instrument Surveillance, 8-12-74

Containment Total Pressure indicators PI-CV-101A and PI-CV-101B were not within the acceptable range of agreement. Indicators were recalibrated.

The majority of periodic test results for September were satisfactory; however, the following were noted:

a) PT-2.1 - Reactor Coolant Temperature, 9-16-74

Overpower ΔT setpoint summator, TM-1-422G was found slightly out of alignment. Summator was recalibrated and returned to service.

b) PT-2.3 - Pressurizer Level, 9-23-74

Level comparator, LC-1-459, would not trip. Level comparator, LC-1-461, was found slightly out of alignment in the non-conservative direction. Both comparators were replaced. The Unsatisfactory performance of these instruments was reported

to the Atomic Energy Commission as an abnormal occurrence.

c) PT-8.1 - Reactor Protection Logic, 9-7-74

Valve TV-BD-100D failed to indicate "closed" despite local verification of valve closing. Following adjustment of valve position limit switch, indication was satisfactory.

d) PT-15 - Steam Generator Auxiliary Feedwater Pumps, 9-2-74

The discharge pressure of the turbine driven auxiliary feedwater pump was apparently in excess of specification. The erroneous discharge pressure reading was due to a faulty pressure gage. Following calibration and installation of a new gage, pump performance was determined to be satisfactory. MOV-FW-151D failed to close during the performance of test. Inspection revealed that the motor clutch had stuck in the disengaged position. Following maintenance, valve performed satisfactorily.

e) PT-34 - Electrical Penetration Leakage Test

Several electrical penetrations indicated a loss of pressure. In each case, the penetrations were recharged to the correct pressure.

The majority of periodic test results for October were satisfactory; however, the following were noted:

a) PT-17.3 - Containment Outside Recirculation Spray Pumps, 10-2-74

During the performance of this test, valve MOV-RS-155B failed in the closed position. The valve motor overloaded when the torque switch failed to open as the valve seated. Setting of torque switch was decreased from 2.5 to 2.0 amps. Valve then performed satisfactorily.

b) PT-26.1 - Radiation Monitoring Equipment Check, 10-6-74

RI-SS-113 failed to respond to check source. Test button internals were stuck in the test position. Following repairs of push button, meter performed satisfactorily.

10-20-74, RM-RMS-155 failed to respond to check source. Further testing revealed a failure in the high range amplifier board. Monitor performed satisfactorily following replacement of defective circuit board.

The majority of periodic test results for November were satisfactory; however, the following was noted:

a) PT-34 - Electrical Penetration Leakage Test

Several electrical penetrations indicated a loss of pressure. In each case, the penetrations were recharged to the correct pressure.

The majority of periodic test results for December were satisfactory; however, the following was noted:

a) PT-34 - Electrical Penetration Leakage Test

Several electrical penetrations indicated a loss of pressure. In each case, penetrations were recharged to the correct pressure.

10.8 PERIODIC CONTAINMENT LEAKAGE RATE TEST

Periodic Test 16.5 Containment Personnel Airlock Test, was performed quarterly during the reporting period. No significant leakage was detected.

10.9 CHANGES, TESTS AND EXPERIMENTS REQUIRING AUTHORIZATION FROM THE ATOMIC ENERGY COMMISSION

10.9.1 Technical Specification Changes

Changes made to the Technical Specifications, Units Nos. 1 and 2, Surry Power Station during the reporting period are summarized in Table 10.9.1-1. These changes were issued by the U.S. Atomic Energy Commission pursuant to Section 50.59, Title 10, Code of Federal Regulations.

10.9.2 Test or Experiments

There were no tests or experiments conducted on Unit No. 1 during the reporting period which required approval of the U.S. Atomic Energy Commission.

10.9.3 Facility Design Changes

There were no facility design changes implemented during the reporting period which required authorization from the U.S. Atomic Energy Commission.

SUMMARY OF
TECHNICAL SPECIFICATION CHANGES
SURRY POWER STATION
UNIT NOS. 1 & 2
JULY THROUGH DECEMBER, 1974

CHANGE NO.	T.S. NO.	DATE ISSUED	DESCRIPTION OF CHANGE
16	3.19	10-02-74	Changes prescribing remedial action to be taken in the event of a loss of bottled air in the main control room ventilation system and modification of surveillance requirements for the main steam line trip valves.
17	4.16 6.5	10-31-74	Delineation of leakage testing requirements for miscellaneous radioactive materials sources and specification of required retention time for various station records and documents.

Table 10.9.1-1

10.10 TESTS AND EXPERIMENTS NOT REQUIRING AUTHORIZATION FROM THE ATOMIC ENERGY COMMISSION

Special Test ST-21 - "Investigate errosion of the charging pump miniflow line and orifice", was conducted to determine the cause of errosion induced leaks in the charging pump miniflow lines.

Start-Up Test SU-64 - "Load swing test", was conducted to satisfy requirements of the initial start-up test program. This test was not performed during the initial start-up test program due to power level restrictions imposed as a result of fuel densification.

Special Test ST-28 - "Verification of level setpoints and proper operation of the emergency diesel generator fuel oil supply system", was performed to verify that previous fuel oil supply and storage problems had been corrected.

Special Test ST-29 - "Component cooling heat exchanger flow measurement, was performed to verify that heat exchanger flow limits were not being exceeded during normal component cooling system operation.

11.0 UNIT NO. 2 OPERATING SUMMARY

11.1 POWER GENERATION

11.1.1 A summary of power generated during each month of the reporting period, the total for the reporting period, and the accumulative total since commercial operations commenced is tabulated in Table 11.1.1-1.

11.1.2 A histogram of thermal power versus time for the reporting period is given in Figure 11.1.2-1.

11.1.3 Operating statistics during the period from initial criticality until the date Unit No. 2 was declared commercial (March 7, 1973 to May 1, 1973) are tabulated in Table 11.1.3-1.

POWER GENERATION SUMMARY
SURRY POWER STATION

UNIT NO.2

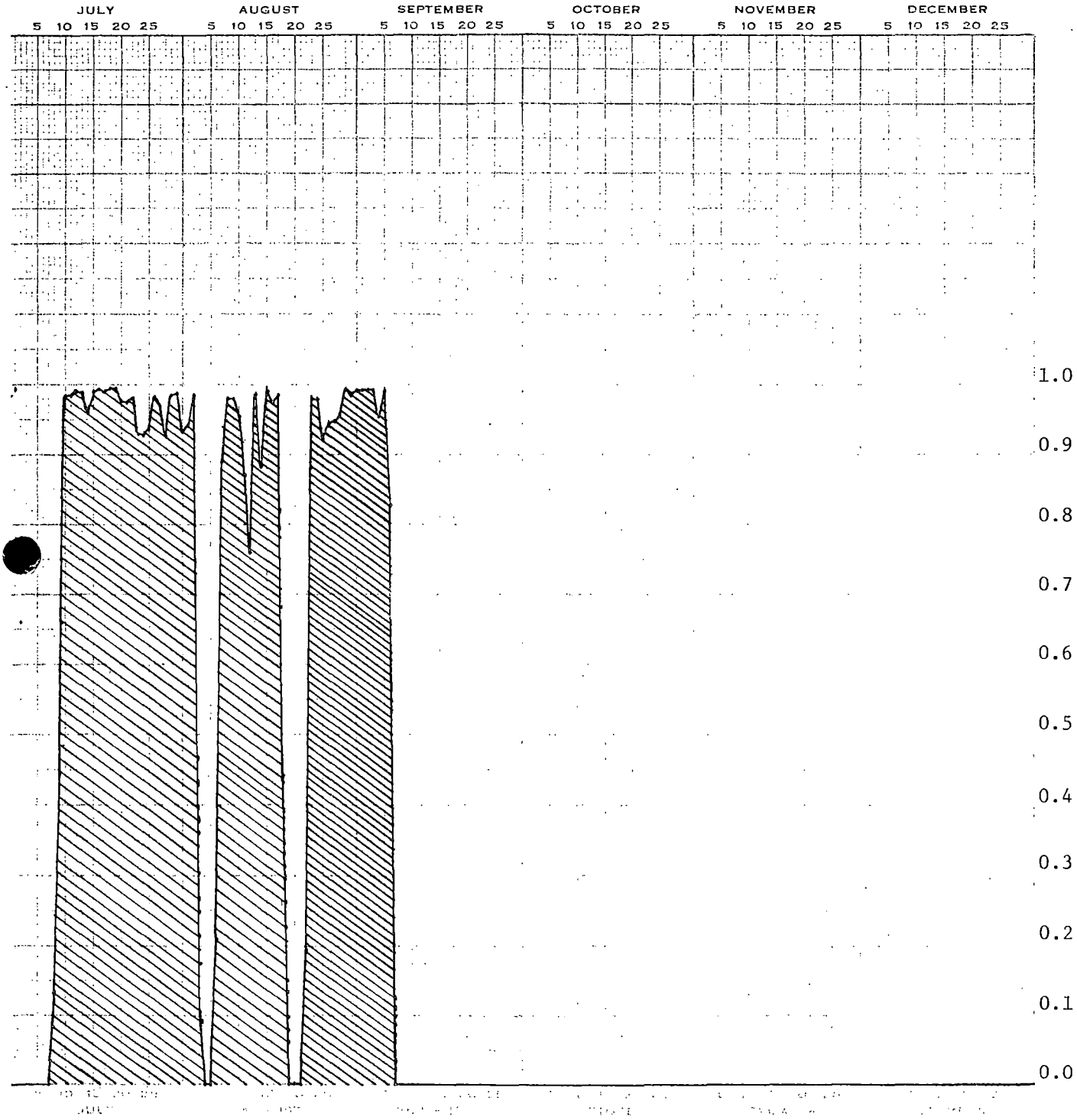
JULY THROUGH DECEMBER, 1974

DESCRIPTION	JULY	AUGUST	SEPT.	OCTOBER	NOV.	DEC.	TOTAL FOR PERIOD	* CUMULATIVE TOTAL
1. Gross Thermal Power Generated (MWH)	1,346,055	1,281,396	377,146	0	0	0	2,964,597	18,224,789
2. Gross Electrical Power Generated (MWH)	423,191	422,750	110,545	0	0	0	956,486	6,022,467
3. Station Service (MWH)	21,912	22,128	5,601	0	0	0	49,641	323,168
4. Net Electrical Power Generated (MWH)	401,279	400,622	104,944	0	0	0	906,845	5,699,299
5. Number of Hours Reactor Critical (HRS)	565.3	572.2	140.7	0	0	0	1,278.2	8,509
6. Number of Hours Generator On Line (HRS)	549.7	565.2	140.7	0	0	0	1,255.6	8,384.2

* Since Commercial Operation

Figure 11.1.2-1

POWER GENERATION HISTOGRAM
UNIT NO. 2
SURRY POWER STATION
JULY THROUGH DECEMBER 1974



YEAR 1974

PRE-COMMERCIAL OPERATION STATISTICS
SURRY POWER STATION
UNIT NO. 2

Gross Thermal Power Generated (MWH):	1,076,017
Gross Electrical Power Generated (MWH):	343,931
Net Electrical Power Generated (MWH):	312,841
Hours Reactor Was Critical	991.4
Hours Generator On-Line	787.7

11.2 OUTAGES

The outages occurring during the reporting period are tabulated in Table 11.2-1.

OUTAGE REPORT
UNIT NO.2
SURRY POWER STATION
JULY THROUGH DECEMBER, 1974

OUT OF SERVICE		RETURN TO SERVICE		NO. HRS. OUT		UNIT STATUS	METHOD OF SHUTDOWN	CAUSE	CORRECTIVE ACTION
TIME	DATE	TIME	DATE	HRS	MIN				
1220	6/25/74	0834	7/08/74	176	34	CSD	Scheduled	Maintenance on main steam non-return valves.	Repaired NRV's in main steam lines.
1752	7/08/74	1855	7/08/74	1	03	HSD	Reactor trip	SOV failed on main steam trip valve actuator allowing the valve to trip close.	Replaced failed SOV and verified operability of similar SOV's in trip circuitry.
0602	7/09/74	0705	7/09/74	1	03	HSD	Reactor trip	Operator failed to reset P-10 when unit loads exceeded 10% unit trip at 25% (hi-flux lo-setpoint.	Reinstructed operator to insure all procedures are followed and discussed the importance of same.
0349	8/03/74	1624	8/06/74	81	16	CSD	Reactor trip	"B" MS trip valve closed during PTs. Reactor tripped on lo lo level B steam gen.	Modification made on main steam trip valve rock shaft bearings.
0631	8/12/74	0758	8/12/74		34	HSD	Over power ΔT Reactor trip	OPΔT runback did not operate but caused trip.	Hi Flux as a result of load following caused reduction in OPΔT trip setpoint.
1947	8/18/74	1500	8/22/74	90	57	HSD	Scheduled	Excessive RC leakage PCV-2455A packing.	Maintenance performed on PCV-2455A (PRZ spray valve) repacked.
2045	9/06/74	Still Out		2,785	-15	CSD	Reactor trip by Turbine trip	High turbine vibration.	Renewing turbine blades. LP turbine L-4 row replaced and/or modified. Inspections and repair of steam generator supports as required.

Table 11.2-1

11.3 CHANGES IN FACILITY DESIGN

The following changes were implemented on Unit No. 2 during the reporting period:

1. Design Change 73-108 - Auxiliary Feedwater Booster Pump Addition

Description

The Unit 2 portion of this design change was completed in October. This design change to the auxiliary feed system is one of several modifications proposed as a result of a study made on the effects of piping system breaks outside containment, FSAR, Appendix D. One of these proposed changes, #73-133, is the cross connecting of auxiliary feed discharges. This means that the unaffected unit is required to supply both unit's steam generators, and hence, the residual heat removal capacity from the existing 110,000 gallon condensate storage tank is halved. To supply the additional emergency feedwater, the following modification was implemented:

The unused 100,000 gallon condensate storage tank was used to supply added feedwater makeup. Two (2) booster pumps were added to supply the suction of the auxiliary feedwater pumps.

Summary of Safety Evaluation

a. The probability of an accident or malfunction of equipment important to safety is not increased with this modification. Sufficient feedwater makeup will be supplied

to the steam generators to prevent a loss of main feedwater accident from resulting in adverse conditions (i.e., water relief from pressurizer safety valves or uncovering of steam generator tube sheets).

b. The possibility of an accident or malfunction other than that already evaluated by the FSAR is not created. The physical location of the booster pumps and lines is such that it would not be affected by high-pressure feed line or steam line breaks. The possibility of serious damage to related equipment due to low water level (steam generators) is decreased.

c. The margin of safety of the auxiliary feed system is not reduced by this design change. Adding an alternate source of makeup feedwater and two booster pumps to each unit assures safe shutdown reliability under all possible conditions.

Conclusion

This design change does not constitute an unreviewed safety question.

2. Design Change 73-113 - Modify Low Pressure Heater Drain Pump Miniflow Line

Description

This modification was completed in October. The purpose of the change was to prevent flashing of steam in the line downstream of the orifice and subsequent erosion of the line. A flash chamber was added downstream of the orifice to preclude aforementioned problems.

Summary of Safety Evaluation

a. The probability of an accident or malfunction of equipment important to safety previously evaluated is not increased. The operation of the L.P. Heater Drain Pump is not safety related.

b. The possibility for an accident or malfunction of a different type than any previously evaluated in the FSAR is not created. A failure of the L.P. Heater Drain Pump would cause the drains to be diverted to the condenser with a resulting loss of secondary efficiency.

c. The margin of safety as defined in the basis for any technical specification is not reduced. The operation of the L.P. Heater Drain Pump is not a limiting condition for operation.

Conclusion

An unreviewed safety question does not exist as the change is to the miniflow line of the L.P. Heater Drain Pump which is not a safety system.

3. Design Change 73-116 - Neutron Shield Tank Component Cooling Isolation Valve Switch Arrangement Modification

Description

This change was implemented in October. This change consisted of rearranging switch positions on neutron shield tank component cooling isolation valves to agree with the arrangement on Unit No. 1. This was completed in order to avoid operator confusion.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report is not increased by this change. The subject switch arrangement is not specified in the safety analysis report.

b. The possibility of an accident or malfunction of a different type than any evaluated previously in the safety analysis report is not created. The proposed switch arrangement will lessen the present confusion.

c. The margin of safety as defined in the basis for any technical specification is not reduced. This modification will not affect the operation of the neutron shield tank cooling water subsystem.

Conclusion

This design change does not constitute an unreviewed safety question.

4. Design Change 73-120 - Excess Flow Instrumentation for Steam Generator Blowdown (This change not reported on June,1974 Six Month Operating Report.)

Description

This modification was completed in June as a part of the high energy line modifications. This change consisted of installing a flow orifice in each steam generator blowdown line

with associated vent solenoids to shut off the inside containment isolation valves. An alarm shared by each blowdown line indicates high flow in the steam generator blowdown lines. Upon high flow indication, 350 gpm, the associated solenoid vents and closes the inside containment isolation valve.

Summary of Safety Evaluation

a. The probability of an accident or malfunction of equipment important to safety, previously evaluated, is not increased. The design change allows another method of closing the blowdown lines without impairing the system as it is at present.

b. The possibility for an accident or malfunction of a different type than any previously evaluated in the FSAR is not created. The design change does not alter the fail safe closed condition of the present system and adds a high blowdown flow rate closure to the system.

c. The margin of safety as defined in the basis for any technical specification is not reduced, as another parameter is added to close the blowdown lines without affecting the existing systems margin of safety.

Conclusion

An unreviewed safety question does not exist. The solenoid valve and control circuit to be added will not be between the existing solenoid valve and the trip valve. Therefore,

the present system's ability to vent air and fail safe closed will not be altered. The addition of the flow orifices upstream from the trip valves does not alter the closing of the system.

5. Design Change 73-121 - Refueling Water Storage Tank Cross Connect

Description

The modification was completed in July. The purpose of this change is to provide the safety injection system of each unit with emergency water from both refueling water storage tanks (RWST). This modification was designed to insure the integrity of the safety injection system in the event of a missile penetrating one of the RWST's. The change consisted of installing a cross connecting pipe between the suction side of the charging pumps of Units 1 and 2 and four trip valves also being added, with two in parallel on each side of the cross connect. One trip valve in each side is opened automatically by an "A" train steam line break (SLB) input from either unit. The other trip valve on each side is opened automatically by a "B" train (SLB) input from either unit.

Summary of Safety Evaluation

a. The probability of an accident or malfunction of equipment important to safety previously evaluated is not increased. The design change allows another source of borated water to the charging pumps.

b. The possibility for an accident or malfunction of a different type than any previously evaluated in the

FSAR is not created. The cross connect system is closed during normal operation. Single failure analysis does not affect the present system operation.

c. The margin of safety as defined in the basis for any technical specification is not reduced, as another source of borated water is added to the suction of the charging pumps in case of a steam line break (SLB) accident.

Conclusion

This design change does not constitute an unreviewed safety question.

6. Design Change 73-122 - Auxiliary Feedwater Discharge Cross Connect

Description

This change was completed in December. The modification consisted of cross connecting the discharge piping of the auxiliary feedwater systems. In the event of a postulated break in either units main steam line or main feed lines the other unit's auxiliary feed system will be capable of maintaining both units in a shutdown condition.

Summary of Safety Evaluation

a. The probability of an accident or malfunction of equipment is not increased. The cross connection of feed systems provides for redundancy of emergency feedwater supply in the event of a main steam line or feedwater line break. Since this modification provides for

maximum separation of feedwater systems from postulated break points, the probability of accident or malfunction is reduced.

b. The possibility of an accident or malfunction occurring other than those previously evaluated, is not created. The cross connect modification to the auxiliary feed system precludes the possibility of any additional accident or malfunction by providing a necessary source of feedwater in the event of a steam or feed line break.

c. The margin of safety of the system is not reduced by the addition of the auxiliary feed line cross connects. By adding a cross connect feed line, additional assurance is provided that the ultimate requirement for a safe shutdown (i.e., feedwater to the steam generators) will be met.

Conclusion

This design change does not constitute an unreviewed safety question.

7. Design Change 73-124 - Reactor Coolant Pump Seal Water Bypass Low Flow Alarm Modification

Description

This design change was implemented in September. The change consisted of adding a set of contacts to the hand control valve in the RCP seal water bypass line to override the low flow alarm when the valve is closed. The bypass flow which provides cooling to the RCP lower bearing and No. 1 seal is not needed during normal operation, so it is desirable to

have the annunciator bypassed when the valve is closed in order to maintain the "blackboard concept".

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the safety analysis report is not increased by this change. RCP seal water bypass flow is not evaluated in the safety analysis report.

b. The possibility of an accident or malfunction of a different type than any evaluated previously in the safety analysis report is not created. When HCV-1307 (2307) is closed the subject alarms are meaningless; this modification simply clears them from the annunciator board under this condition.

c. The margin of safety as defined in the basis for any technical specification is not reduced. This modification will not affect the operation of the Chemical and Volume Control System.

Conclusion

This design change does not constitute an unreviewed safety question.

8. Design Change 74-1 - Refueling Water Storage Tank (RWST) Overflow

Description

This change was completed in November. The modification consisted of installing an eight (8) inch overflow pipe from the RWST to the safeguards sump which flows to the liquid

waste system. The purpose of the change was to prevent RWST water from overflowing from the vent and possible release of contaminated water to the yard area.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of this equipment with regard to the safety evaluation given in the safety analysis report is not increased. No portion of the system referred to in the FSAR is changed.

b. The possibility for an accident or malfunction of a different type than any previously evaluated is not created since no safety system function is affected.

c. The margin of safety as defined in the basis for any technical specification is not reduced by this design change since the systems referenced in these specifications are not changed.

Conclusion

This design change does not constitute an unreviewed safety question.

9. Design Change 73-71 - Installation of Modified Piston/Disc Assemblies in Main Steam Non-Return Valves

Description

This change was completed in September. This modification was implemented as a result of piston/disc assembly failures on Unit No. 2 main steam non-return valves. The details of the

failures are enumerated in AO-S2-74-04. The change consisted of installing modified piston/disc assemblies as provided by the valve manufacturer. The modification to the piston/disc assembly involved increasing the thickness of the transition between the piston and disc and addition of a generous radius at the joint between the transition piece and valve disc. The aforementioned failure of the old assembly occurred at the joint of the transition piece and the valve disc. The new piston/disc assembly should improve resistance to fatigue failure.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of equipment important to safety and previously evaluated in the safety analysis report is not increased. This design change is a modification of the structure of the main steam non-return valve (NRV) disc and piston assembly. This modification improves the fatigue strength of the disc to piston weld joint which would reduce the probability of inservice failure.

b. The possibility for an accident or malfunction of a different type than any evaluated previously in the safety analysis report is not created. No new components have been added to the NRV's, nor has any existing component been functionally modified. Therefore, the NRV's will function exactly as before, but will be able to withstand more fatigue cycles.

c. The margin of safety as defined in the basis for any technical specification is not reduced. The margin

of safety for a steam line break between any main steam trip valve and its NRV should actually be increased since the likelihood for NRV failure is now reduced.

Conclusion

This design change does not constitute an unreviewed safety question.

10. Design Change 74-82 - Increase Range of Condenser Hotwell Conductivity Readout

Description

This change was implemented in October. The change consisted of installing conductivity cells having a higher constant. The previous low constant conductivity cells became saturated and thus made surveillance of an increase in salinity impossible. Cells of ten times higher range were installed in the condenser outlets.

Summary of Safety Analysis

a. The probability of an accident or malfunction of equipment important to safety previously evaluated is not created. The condenser salinity cells have not been evaluated.

b. The possibility for an accident or malfunction of a different type than any evaluated in the FSAR is not created. Increase in the conductivity rating of the conductivity cell in the condenser poses no new accident possibilities.

c. The margin of safety as defined in the basis for any technical specification is not reduced. The conductivity

of the condenser is not a limiting factor.

Conclusion

This design change does not constitute an unreviewed safety question.

11. Design Change 74-92 - Installation of Vortex Breakers to Intake Canal

Description

This design change was implemented in October. The modification consisted of adding a structure to the intake screens to prevent air from being drawn in at the traveling screens. The structure breaks the air flow thus preventing the formation of the vortex at the screens. This is accomplished by effectively "sealing" the surface of the water with the vortex breaker thus eliminating the flow path of air which forms the vortex.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of equipment important to safety previously evaluated in the FSAR is not increased by this change. This change does not change the accident analysis because the modification does not change the function of any safety system.

b. The probability for an accident or malfunction of a different type than previously evaluated in the FSAR is not created. No new accident situation is created.

c. The margin of safety as defined in the technical speci-

fication is not reduced since the operation of the service water system is not affected.

Conclusion

This change does not constitute an unreviewed safety question.

12. Design Change 74-94 - Charging Pump Service Water Strainer Valve Removal

Description

This design change was implemented in August. The change was to remove the strainer blowdown piping and valves and place a 1/2 inch pipe plug in the strainer cap. This will allow the cap to be removed more readily for the bi-weekly cleaning. The bi-weekly blowdown of these strainers through these valves was not adequate for strainer cleaning.

Summary of Safety Evaluation

a. The probability of occurrence or the consequences of an accident or malfunction of the charging pump service water pumps with regard to the safety evaluation given in the safety analysis report is not increased. Operation of the system remains the same.

b. The possibility for an accident or malfunction of a different type than any previously evaluated is not created. The new pipe plug would be subject to the same failures as the closed valve.

c. The margin of safety as defined in the basis for any technical specification is not reduced by this design change, since service water system requirements will

remain unchanged.

Conclusion

This change does not constitute an unreviewed safety question.

11.4 PERFORMANCE CHARACTERISTICS

11.4.1 Abnormal Occurrences

A tabulation of the Abnormal Occurrences as defined by Technical Specification 1.0.I which occurred during the reporting period is contained in Table 11.4.1-1. These reports have been previously submitted to the U.S. Atomic Energy Commission.

11.4.2 Unusual Safety Related Events

A tabulation of the Unusual Safety Related Events which occurred during the reporting period is contained in Table 11.4.2-1.

11.4.3 Equipment Performance

Section 11.6 of this report summarizes the important maintenance which was performed on unit equipment and is indicative of equipment performance.

Equipment problems experienced in the performance of surveillance tests are summarized in section 11.7.

The abnormal occurrences and unusual safety related events enumerated above also provide information on equipment performance.

ABNORMAL OCCURRENCE REPORTS
UNIT NO. 2
SURRY POWER STATION

JULY THROUGH DECEMBER, 1974

NUMBER	TITLE	OCCURRENCE DATE
AO-S2-74-05	Steam Generator Primary to Secondary Leakage	7-01-74
AO-S2-74-06	Main Steam Trip Valve Failure	8-03-74
AO-S2-74-07	Failure of Overpower Setpoint Summator TM-2-412G	8-10-74
AO-S2-74-08	Failure of Fuel Oil Flow Paths to an Emergency Diesel Generator	9-12-74
AO-S2-74-09	Steam Generator No. 2 Seismic Report - Steam Generator Coupling Supports	10-17-74

UNUSUAL SAFETY RELATED EVENTS
UNIT NO. 2
SURRY POWER STATION

JULY THROUGH DECEMBER, 1974

NUMBER	TITLE
USRE-S2-01	Containment Vacuum System

11.4.4 Fuel Performance

A summary of fuel performance is contained in the attached report.

VEP-FRD-10

SURRY UNIT 2
CORE PERFORMANCE REPORT
Cycle 1 Through December 31, 1974

By

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S. P. Keck
J. T. Rhodes

Nuclear Fuel Design and
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January, 1975

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Section 1

INTRODUCTION AND SUMMARY

Surry Unit 2 has completed twenty months of commercial operation. Since its initial criticality on March 7, 1973, the reactor core has produced some 65×10^6 MBTU (11380 Megawatt days per metric ton of contained uranium) which has resulted in the generation of over 6.4×10^9 kwhr of electrical energy. The purpose of this report is to present an analysis of the core performance for routine operation during this period. Non-routine operation was covered in the Surry 2 startup physics test report[1] and, therefore, will not be included here.

Routine core follow involves the analysis of four principal performance indicators. These are burnup distribution, reactivity depletion, power distribution, and primary coolant activity. The core burnup distribution is followed to verify both burnup symmetry and proper batch burnup sharing, thereby ensuring that the fuel held over for the next cycle will be compatible with the new fuel inserted. Reactivity depletion is monitored to: detect the existence of any abnormal reactivity behavior, determine if the core is depleting as designed, and indicate at what burnup level refueling will be required. Core power distribution follow includes the monitoring of nuclear hot channel factors to verify that they are within the Technical Specifications limits, thereby ensuring that adequate margins to linear density and critical heat flux thermal limits are maintained. Lastly, as part of normal core follow, the primary coolant activity is monitored to assess the integrity of the fuel.

---

(1) Gardner, D. A., and Keck, S. P., Surry Unit 2 Startup Physics Test Report, VEP-FRD-2, Richmond, Virginia, June, 1973

In addition to the above, the effects of fuel densification were monitored. Although not normally part of routine core follow, this phenomenon is treated here because of its impact on core performance.

Each of the four performance indicators, as well as the status of observed fuel densification effects, is discussed in detail for the Surry 2 core in the body of this report.[2] The results are summarized below:

1. Burnup Follow - The burnup tilt (deviation from quadrant symmetry) on the core is less than $\pm 0.2\%$ with the burnup accumulation in each batch deviating from design prediction by less than 3%.
2. Reactivity Depletion Follow - The critical boron concentration, used to monitor reactivity depletion, has consistently been within $\pm 0.4\%$ $\Delta K/K$ of the design prediction which is well within the $\pm 1\%$ $\Delta K/K$ margin allowed by the Technical Specifications.
3. Power Distribution Follow - Maps taken during each month indicate that the radial power distributions were generally within $\pm 3\%$ of the design predictions with all hot channel factors meeting Technical Specifications limits.
4. Primary Coolant Activity Follow - The iodine-131 activity level in the primary coolant indicates that there is approximately one defect in the core. This corresponds to a 99.99% core integrity factor.
5. Fuel Densification Status - There are five confirmed and four suspected assembly locations with power spikes due to gap formation. However, all power spikes are very small, less than 1% in magnitude.

---

(2) See Appendix A for definition of terms used in this report.

Section 2

CORE PERFORMANCE ANALYSIS

2.1 Burnup Follow

The burnup history for the Surry Unit 2 core is graphically depicted in Figure 2.1.1. A chronology of the associated operating power level is given in Figure 2.1.2. The core has accumulated a burnup of 11380 MWD/MTU leaving approximately 2920 MWD/MTU to the normal reactivity end-of-life for Cycle 1. As shown in Figure 2.1.3, the average Surry 2 load factor for the cycle to date is 52.7% when referenced to maximum permitted power or 50.8% when referenced to rated power (2441 Mw (t)).

The burnup sharing on a batch basis is monitored to verify that the core is operating as designed and to enable accurate end-of-cycle batch burnup predictions to be made for use in reload fuel design studies. As seen in Figure 2.1.4, the batch burnup sharing for Surry 2 is following design predictions very closely with each batch deviating less than 3% from design; this is considered excellent agreement.

Radial (X-Y) burnup maps distribute the gross core burnup among the various assemblies and thereby allow a more detailed burnup distribution analysis. The TOTE computer code (see Appendix B) is used to calculate these assemblywise burnups. Figure 2.1.5 is a radial burnup map in which the core assemblywise burnup accumulation as of December 31, 1974 is given. For comparison purposes, the predicted values are also given. As can be seen from this figure, the accumulated assembly burnups are generally within $\pm 3\%$ of the predicted values. In addition, deviations from quadrant symmetry in the core, as indicated by the burnup tilt factors, is less than $\pm 0.2\%$. Therefore, symmetric burnup in conjunction with good agreement between actual and predicted assemblywise burnups, and batch burnup sharing, indicates that the core is depleting as designed.

2.2 Reactivity Depletion Follow

The primary coolant critical boron concentration is monitored for the purposes of following core reactivity and flagging any anomalous reactivity behavior. The FOLLOW computer code (see Appendix C) is used to normalize "actual" critical boron concentrations to design conditions taking into consideration off-normal rod positions, xenon and samarium concentrations, moderator temperatures, and power levels. The normalized critical boron concentration versus burnup curve for Surry 2 is shown in Figure 2.2.1. It can be seen that the measured data compare within $\sim\pm30$ ppm of the design prediction. This corresponds to $\pm0.4\%$ $\Delta K/K$ which is well within the $\pm1\%$ $\Delta K/K$ criteria for reactivity anomalies set forth in Section 4.10 of the Technical Specifications.

In conclusion, the trend indicated by the critical boron concentrations verifies that the core is depleting as expected with no reactivity anomalies, and thus far confirms the predicted end-of-cycle burnup of approximately 14,300 MWD/MTU.

2.3 Power Distribution Follow

Analysis of core power distributions on a routine basis is necessary to verify that the hot channel factors are within the Technical Specifications limits and to ensure that the reactor is operating with no abnormal conditions which could cause an "uneven" burnup distribution. Three-dimensional core power distributions are determined from movable detector flux map measurements using the INCORE computer program (see Appendix D). A summary of all flux maps taken since completion of startup physics testing for Surry 2 is given in Table 2.3.1. Power distribution maps are generally taken monthly with additional maps taken as needed.

Radial (X-Y) core power distributions for a representative series of maps are given in Figures 2.3.1 through 2.3.3. Figure 2.3.1 shows a map that was taken early in cycle life, Figure 2.3.2 shows one that was

taken near mid-cycle burnup, and Figure 2.3.3 shows a recent map. All of the radial maps shown were taken under equilibrium operating conditions with the Unit operating at 90% to 100% power. In each case the measured assembly powers are generally within 3% of the predicted values, which is considered good agreement. In addition, as indicated by the INCORE tilt factors, the power distributions are essentially symmetric for all cases.

Core average axial power distributions for a representative series of maps are given in Figure 2.3.4 through 2.3.6. One can observe from this sequence of figures the power-flattening effect caused by the preferential depletion in the high-power central core axial region. In Map 23 (Figure 2.3.4), taken at 365 MWD/MTU, the axial power distribution peaks very strongly just below core midplane and has a peaking factor ($\overline{F}_z$) of 1.39. In Map 49 (Figure 2.3.5), taken at 7310 MWD/MTU, the $\overline{F}_z$ has decreased to 1.17 and the central core axial power shape has flattened markedly as expected. Finally, due to central region burnup effects, a "double hump" forms in the axial power distribution as shown by Map 61 (Figure 2.3.6), taken at 11,025 MWD/MTU. With this "double hump" formation $\overline{F}_z$ levels off to a value of approximately 1.16. The gradual decrease and leveling off of $\overline{F}_z$ may also be noted in a plot of $\overline{F}_z$ versus burnup, Figure 2.3.7. In Figure 2.3.8, Surry 1 $\overline{F}_z$ values have been added to the graph; it is seen that these values are consistent with those of Surry 2.

The power flattening effect of increasing burnup can also be seen in the plot of axial offset[(4)] versus burnup, Figure 2.3.9. Axial offset shifts from approximately -5% at beginning-of-cycle to approximately 0% at 4000 MWD/MTU burnup. It then levels off and hovers around the 0% point. This expected axial offset shift is consistent with that of Surry 1, as shown by a comparison plot of axial offset versus burnup, Figure 2.3.10.

---

(4) Axial Offset = $\frac{Pt - Pb}{Pt + Pb} \times 100$ where Pt = power in core top and Pb = power in core bottom

Another important aspect of core power distribution follow is the monitoring of nuclear hot channel factors. Verification that these factors are within Technical Specifications limits ensures that linear power density and critical heat flux limits will not be violated, thereby providing adequate thermal margins and maintaining fuel cladding integrity.

The Technical Specifications limit on the heat flux hot channel factor, F_Q^N, is 2.39. (Prior to the acceptance of the new fuel densification model as described in WCAP-8219, this limit was 2.48.) As shown in Figure 2.3.11, the Surry 2 core has maintained an F_Q^N (with and without densification penalties) of at least 5% less than the applicable limit. In addition, Surry 2 heat flux hot channel factors compare well with the values obtained for Surry 1, as indicated in Figure 2.3.12.

Peak linear power density, which is determined directly from F_Q^N, is given in Figure 2.3.13. This is the limiting parameter from a loss-of-coolant accident-ECCS standpoint since it directly relates to the stored thermal energy in the core. As shown in Figure 2.3.13, the Surry 2 core has maintained a peak linear power density of at least 7% below the allowable limit. Figure 2.3.14 shows that Surry 1 and 2 peak linear power densities with burnup compare closely.

A radial hot channel factor routinely followed is $F_{\Delta H}^N$, the enthalpy rise hot channel factor. The Technical Specifications limit for this parameter is set such that the critical heat flux (DNB) limit is not violated. Figure 2.3.15 shows that at least a 4% margin to this limit has been maintained. Also, as indicated in Figure 2.3.16, the Surry 2 enthalpy rise hot channel factors compare closely with those of Surry 1.

Another radial hot channel factor routinely monitored is F_{xy}, the horizontal plane peaking factor. This peaking factor is a ratio of the peak to average power in a given horizontal plane. It is related to, but is not identical to, $F_{\Delta H}^N$ which is the ratio of the integral of power along the rod with the highest integrated power compared to that of the average rod.

As shown in Figure 2.3.17, the measured F_{xy} peaking factors, evaluated at core mid-plane, are as much as 3% higher than the nominal design prediction. However, this is well within the design uncertainty of 8%. In addition, as indicated in Figure 2.3.18, Surry 2 F_{xy} peaking factors compare well with values obtained for Surry 1.

In conclusion, the Surry 2 core has been performing very satisfactorily with power distribution analyses verifying that design predictions are accurate and that hot channel factors are meeting Technical Specifications limits. In addition, the Surry 2 core power distribution characteristics have been following the Surry 1 core characteristics closely, which was expected since startup test results of the two units compared well.[5]

2.4 Primary Coolant Activity Follow

Activity levels of iodine-131 and 133 are important in core performance follow analyses because they are used as indicators of defective fuel. These two isotopes leak into the primary coolant system through a breach in the cladding. I-131 activity is directly correlatable to the number of cladding defects; the ratio of I-131 to I-133 is used to determine if the iodine activity is originating from the inside of the fuel rod or if it is coming from "tramp"[6] uranium on the exterior of the fuel rod. Use of the ratio for this determination is feasible because I-133 has a short half-life (approximately 24 hours) compared to that of I-131 (approximately eight days) so that for small cladding defects where the diffusion time through the defect is on the order of days, the I-133 decays out leaving I-131 dominant in activity thereby causing the ratio to be 0.6 or more. For a pure "recoil" source such as "tramp" uranium, however, where there is little decay of I-133 before it enters into the primary coolant, the ratio will be 0.07 or less.

---

(5) Gardner and Keck, op. cit.

(6) "Tramp" uranium consist of small particles of uranium which adhere to the outside surface of the fuel during the manufacturing process.

Figure 2.4.1 shows the I-131 activity history for Surry 2 with FSAR value for one fuel defect[7] (which is equivalent to one defective rod) and five defects (an equivalent to five defective rods) delineated for comparison purposes. The data show considerable scatter but the trend indicates that on the order of one defective fuel rod exists in the core. This is also born out by the data in Figure 2.4.2 where the iodine ratio is trending in the mid range (0.4 or so) indicating that a slight amount of iodine is diffusing into the primary coolant. Periodically, large spikes in the ratio occur due to transient thermal effects on the fuel causing "burst" release of iodine.

Small quantities of fuel defects are not uncommon in operating reactors, and in fact, the reactor systems are normally designed to operate with up to approximately 1% failed fuel present. With only one defect present, Surry 2 has a core integrity factor of > 99.99% which is better than most operating reactors and is quite acceptable.

2.5 Fuel Densification Status

The total number of suspected and confirmed[8] densification-induced power spikes has increased from 8 to 9 since the last core performance report (June 30, 1974). However, the magnitudes of all power spikes are still very small, the largest being 0.8% for Assembly B-8. This can be seen in Table 2.5.1 which gives the assembly locations in which densification-induced power spikes have been observed.

---

(7) This is derived from FSAR Table 9.1-5 where cladding defects in 1% of the fuel rods gives an I-131 primary coolant activity concentration of 1.68 μCi/cc @ 560°F. Samples are analyzed at room temperature; hence, this value is 2.35 μCi/cc when a density correction is made.

(8) A confirmed power spike is one which has been in two or more recent maps. A suspect power spike is one which has been observed generally only in the most recent map.

Table 2.5.2 compares Surry 2 and Surry 1 densification-induced power spikes. It should be noted that power spike formation in Surry 2 fuel is reduced both in magnitude and number from that observed in Surry 1 fuel. This may be attributed, at least in part, to the fact that a less active powder (manufactured at Westinghouse Columbia plant) was used and the sintering temperatures were higher in Regions 2 and 3 of Surry 2 as compared with those of Surry 1.

Figures 1 through 9 Appendix E are the latest Surry 2 strip-chart traces for all of the confirmed and suspected assemblies with densification-induced gaps. In most all cases, the power spike is located above the midplane of the fuel which is where gap formation is most likely to occur. Unfortunately, the width of the power spike is not a direct indication of gap width since the detector is running down the center of the assembly and "sees" a composite effect of many fuel pins.

The first sign of gap formation in the Surry 2 fuel was observed in Map 34 taken at approximately 2100 MWD/MTU burnup, and since previous traces taken at 1850 MWD/MTU showed no sign of gap formation, the actual onset point is bounded by these two burnups. This is consistent with Surry 1 data, which indicated that gap formation occurred between 1900 and 2400 MWD/MTU burnup, as detailed in the July 1, 1973, core performance report.[9]

In conclusion, the number of densification-induced power spikes has increased slightly since the last report, however the magnitudes are still very small.

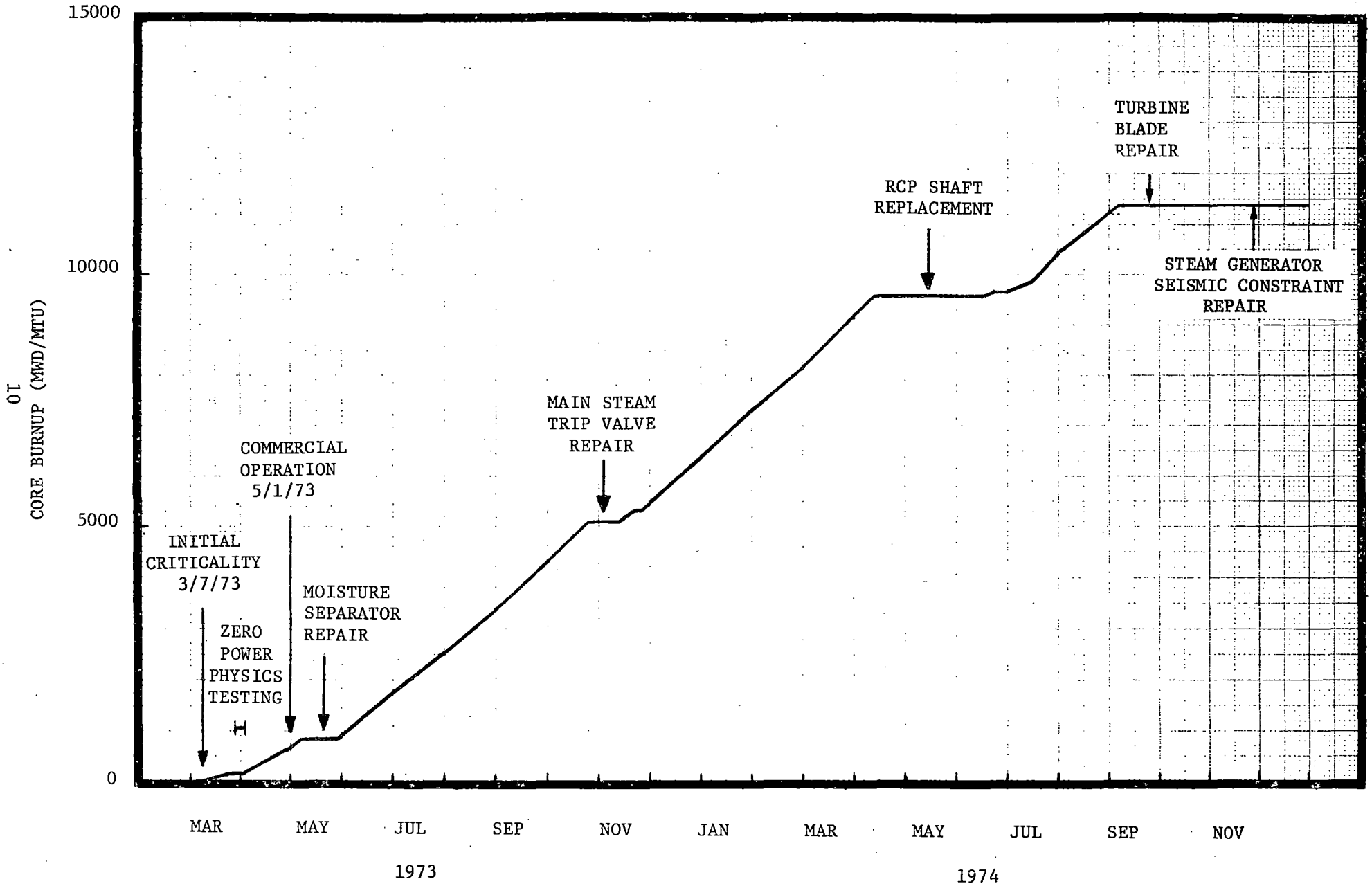
---

(9) Gardner, D. A., and Rhodes, J. T., Surry Unit 1 Core Performance Report - Cycle 1 through July 1, 1973-VEP-FRD, 3, Richmond, Virginia, July, 1973.

SURRY UNIT 2

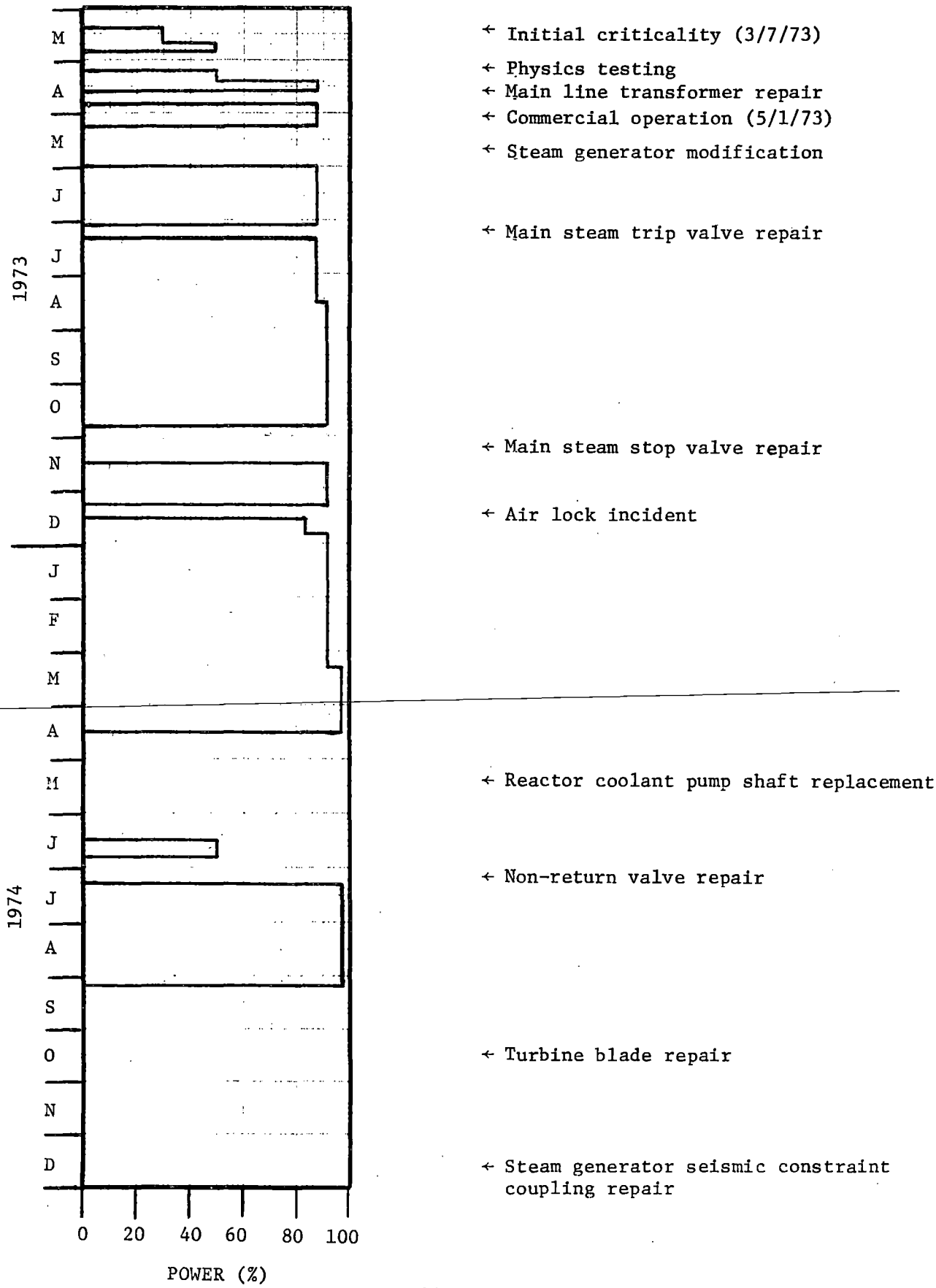
FIGURE 2.1.1

CORE BURNUP HISTORY



SURRY UNIT 2 FIGURE 2.1.2

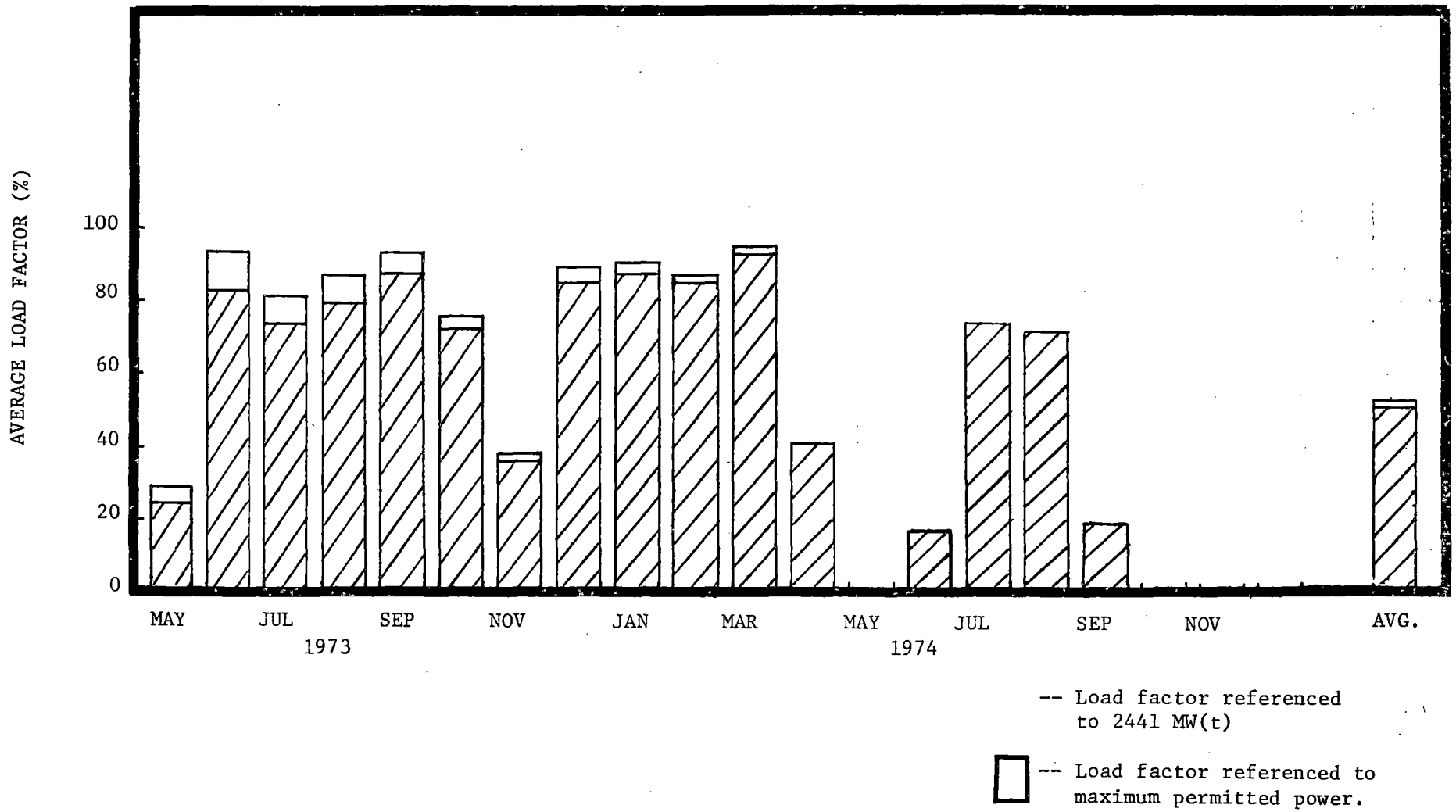
CHRONOLOGY OF OPERATING POWER LEVEL



SURRY UNIT 2

FIGURE 2.1.3

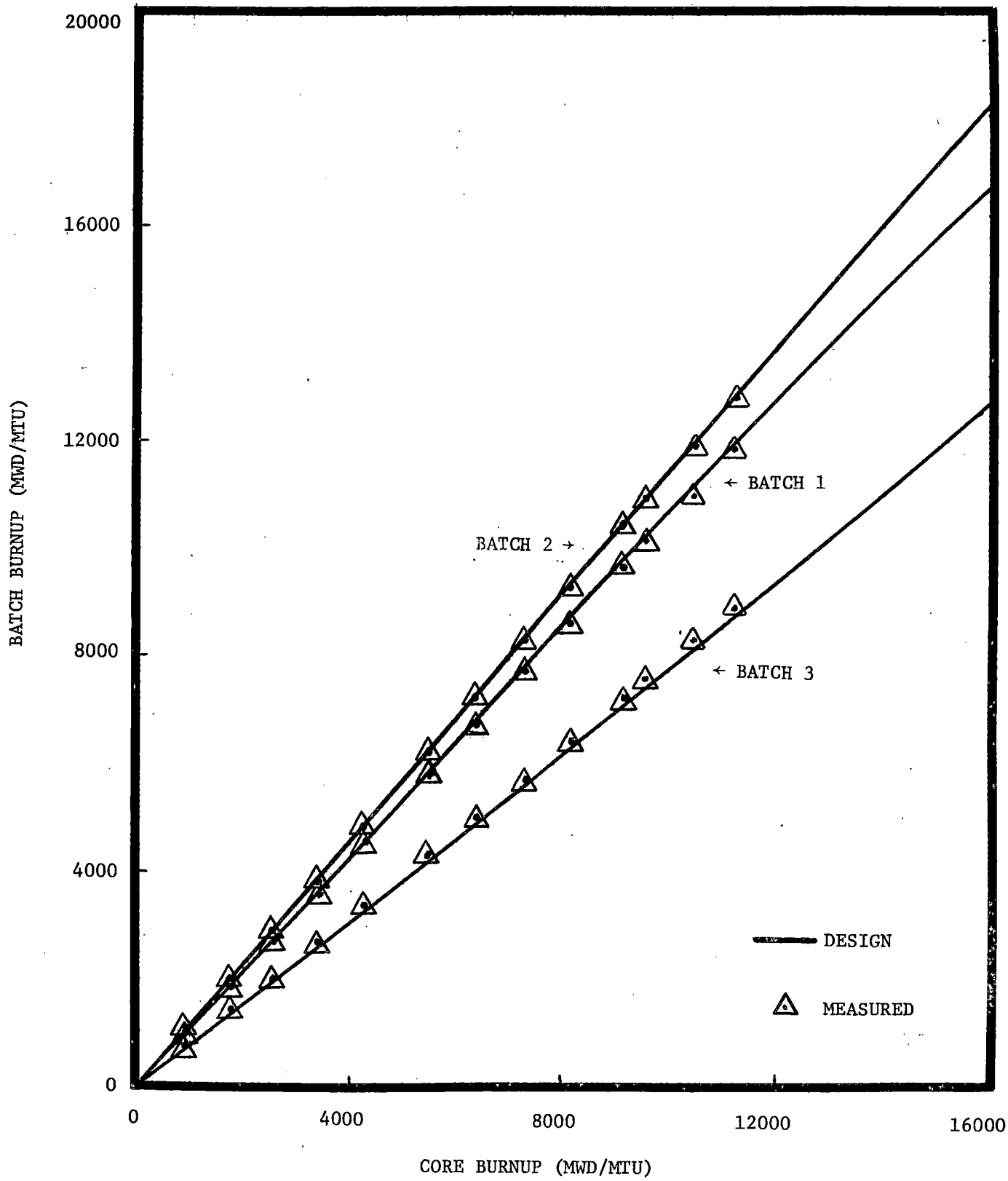
MONTHLY AVERAGE LOAD FACTORS



SURRY UNIT 2

FIGURE 2.1.4

BATCH BURNUP SHARING



SURRY UNIT 2

FIGURE 2.1.5

ASSEMBLYWISE ACCUMULATED BURNUP:
COMPARISON OF MEASURED WITH PREDICTED
10^3 MWD/MTU

	R	P	N	M	L	K	J	H	G	F	E	D	C	B	A
1							6.87 7.05 +2.6	8.64 8.78 +1.6	6.87 6.92 +0.7						
2					6.97 7.21 +3.4	10.12 10.30 +1.8	11.44 11.60 +1.4	10.72 10.38 -3.2	11.44 11.48 +0.4	10.12 10.17 +0.5	6.97 7.10 +1.9				
3				7.33 7.58 +3.4	10.72 10.94 +2.1	11.88 11.79 -0.8	11.84 11.60 -2.0	12.82 12.64 -1.4	11.84 11.55 -2.4	11.88 11.73 -1.3	10.72 10.95 +2.1	7.33 7.66 +4.5			
4			7.33 7.58 +3.4	9.50 9.36 -1.5	11.91 11.75 -1.3	12.10 11.81 -2.4	13.35 13.33 -0.2	12.57 12.46 -0.9	13.35 13.35 0.0	12.10 11.85 -2.1	11.91 11.99 +0.7	9.50 9.47 -0.3	7.33 7.60 +3.7		
5		6.97 7.18 +3.0	10.72 10.91 +1.8	11.91 11.81 -0.8	12.08 11.77 -2.6	13.47 13.29 -1.3	12.83 12.62 -1.6	13.83 13.93 +0.7	12.83 12.75 -0.6	13.47 13.42 -0.4	12.08 11.94 -1.2	11.91 11.92 +0.1	10.72 11.03 +2.9	6.97 7.19 +3.7	
6		10.12 10.47 +3.5	11.88 11.88 0.0	12.10 11.85 -2.1	13.47 13.35 -0.9	12.88 12.46 -3.3	13.98 13.95 -0.2	13.08 13.00 -0.6	13.98 14.03 +0.4	12.88 12.54 -2.6	13.47 13.43 -0.3	12.10 11.90 -1.7	11.88 11.83 -0.4	10.12 10.31 +1.9	
7	6.87 7.16 +4.2	11.44 11.76 +2.8	11.84 11.66 -1.5	13.35 13.37 +0.2	12.83 12.68 -1.2	13.98 13.95 -0.2	13.14 12.94 -1.5	14.14 14.21 +0.5	13.14 13.04 -0.8	13.98 14.08 +0.7	12.83 12.64 -1.5	13.35 13.23 -0.9	11.84 11.70 -1.2	11.44 11.59 +1.3	6.87 7.00 +1.9
8	8.64 8.97 +3.8	10.72 10.55 -1.6	12.82 12.83 +0.1	12.57 12.49 -0.6	13.83 14.00 +1.2	13.08 12.98 -0.8	14.14 14.12 -0.1	13.21 13.02 -1.4	14.14 14.21 +0.5	13.08 13.08 0.0	13.83 13.84 +0.1	12.57 12.43 -1.1	12.82 12.98 +1.3	10.72 10.64 -0.8	8.64 8.87 +2.7
9	6.87 7.18 +4.5	11.44 11.76 +2.8	11.84 11.67 -1.4	13.35 13.43 +0.6	12.83 12.72 -0.9	13.98 14.03 +0.4	13.14 12.94 -1.5	14.14 14.14 0.0	13.14 12.90 -1.8	13.98 13.85 -0.9	12.83 12.61 -1.7	13.35 13.33 -0.2	11.84 11.76 -0.7	11.44 11.80 +3.2	6.87 7.07 +2.9
10		10.12 10.33 +2.1	11.88 11.86 -0.2	12.10 11.93 -1.4	13.47 13.43 -0.3	12.88 12.52 -2.8	13.98 13.91 -0.5	13.08 12.91 -1.3	13.98 13.86 -0.9	12.88 12.43 -3.5	13.47 13.33 -1.0	12.10 11.80 -2.5	11.88 11.72 -1.4	10.12 10.33 +2.1	
11		6.97 7.18 +3.0	10.72 11.04 +3.0	11.91 11.95 +0.3	12.08 11.86 -1.8	13.47 13.34 -1.0	12.83 12.62 -1.6	13.83 13.90 +0.5	12.83 12.64 -1.5	13.47 13.38 -0.7	12.08 11.94 -1.2	11.91 12.07 +1.3	10.72 11.14 +3.9	6.97 7.24 +3.9	
12			7.33 7.63 +4.1	9.50 9.46 -0.4	11.91 11.91 0.0	12.10 11.79 -2.6	13.35 13.16 -1.4	12.57 12.29 -2.2	13.35 13.23 -0.9	12.10 11.83 -2.2	11.91 11.98 +0.6	9.50 9.68 +1.9	7.33 7.79 +6.3		
13				7.33 7.57 +3.3	10.72 10.95 +2.2	11.88 11.71 -1.4	11.84 11.44 -3.4	12.82 12.54 -2.2	11.84 11.44 -3.4	11.88 11.72 -1.4	10.72 11.00 +2.1	7.33 7.80 +6.4			
14					6.97 7.13 +2.3	10.12 10.27 +1.5	11.44 11.49 +0.4	10.72 10.22 -4.5	11.44 11.37 -0.6	10.12 10.16 +0.4	6.97 7.05 +1.2				
15							6.87 6.90 +0.4	8.64 8.63 -0.1	6.87 6.82 -0.7						

DATE December 31, 1975

CORE AVERAGE BURNUP 11,380 MWD/MTU

PREDICTED
MEASURED
% DIFFERENCE

BURNUP SHARING (10^3 MWD/MTU)

	ACTUAL	PREDICTED
BATCH 1	11.94	12.14
BATCH 2	13.04	13.07
BATCH 3	9.10	8.89

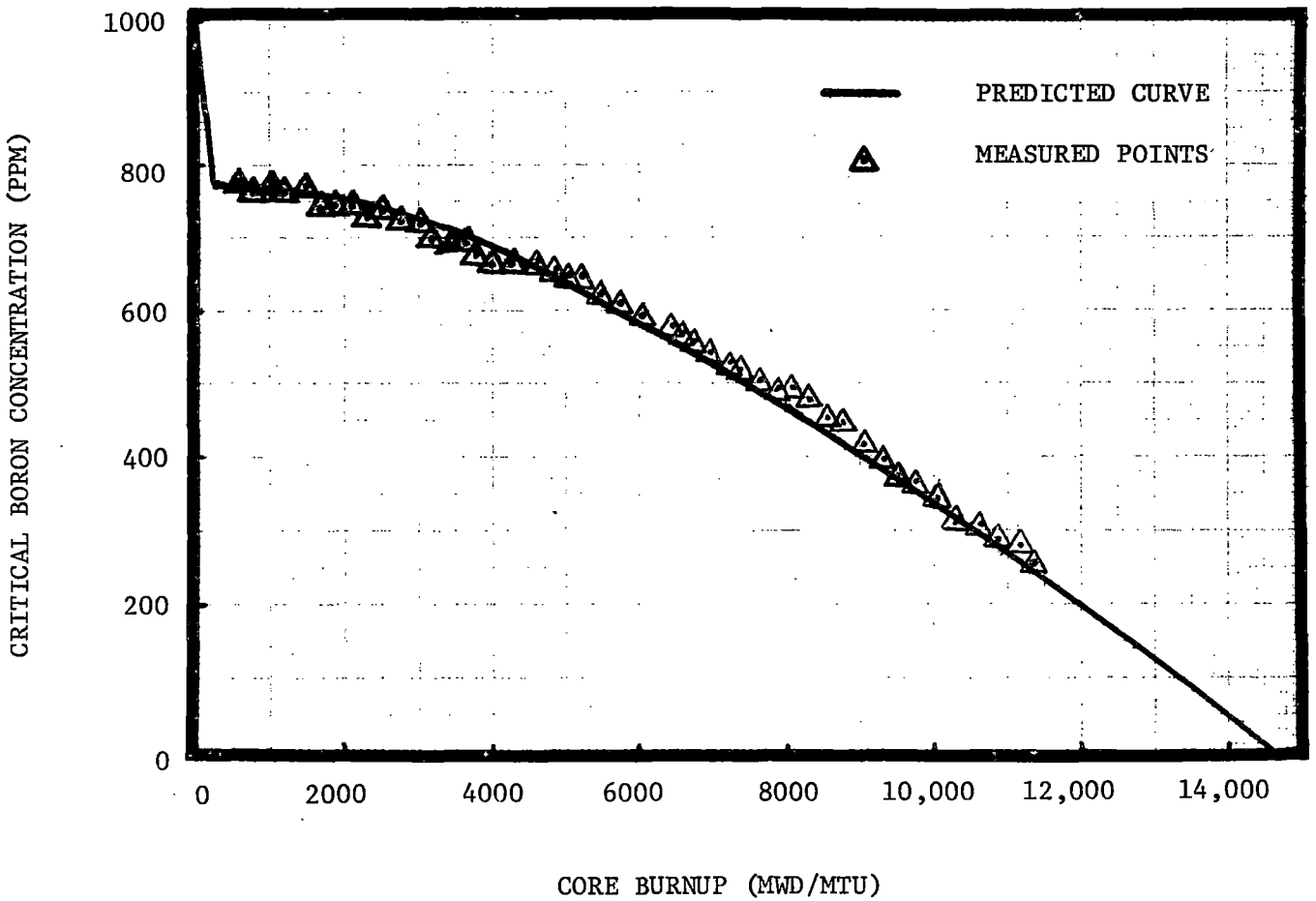
BURNUP TILT

NW - 1.000
NE - 1.001
SW - 0.999
SE - 1.000

FIGURE 2.2.1

SURRY UNIT 2

CRITICAL BORON CONCENTRATION
vs.
BURNUP



SURRY UNIT 2

TABLE 2.3.1

SUMMARY TABLE OF INCORE FLUX MAPS
FOR ROUTINE OPERATION

MAP NO.	DATE	% PWR	BANK D	BANK P/L	CORE $\overline{F}_z$	F_Q HOT CHANNEL FACTOR						$F_{\Delta H}$ HOT CHANNEL FACTOR			TILT		AVG AXIAL OFFSET	BURNUP (MWD/MTU)	NO. OF MONITORED THIMBLES
						ASSY.	PIN	AXIAL POINT	F_Q^N	S(Z)	$F_Q^{N'}$	ASSY	PIN	$F_{\Delta H}^N$	MAX	QUAD LOC			
22	4/12/73	75	195	228	1.42	J-8	HG	34	2.04	1.096	2.24	H-7	GH	1.42	1.003	NW	-2.8	280	46
23	4/15/73	90	204	228	1.39	F-7	GH	35	2.10	1.093	2.29	H-9	GH	1.45	1.004	SE	-5.5	365	34
27(1)	4/30/73	88	201	228	1.40	F-7	GH	35	2.10	1.093	2.30	F-7	GH	1.46	1.014	NE	-4.8	630	24
30(2)	6/6/73	90	200	228	1.40	J-10	HG	33	2.09	1.100	2.29	E-8	HG	1.46	1.005	SW	-4.6	1080	26
31	6/15/73	90	202	228	1.39	G-8	HG	34	2.06	1.096	2.25	H-7	GH	1.46	1.005	NE	-4.1	1300	43
33(2)	7/3/73	90	202	228	1.37	G-8	HG	34	2.01	1.096	2.20	H-7	GH	1.47	1.006	NW	-4.2	1850	29
34	7/13/73	88	203	228	1.36	J-8	HG	34	2.02	1.096	2.21	H-7	GH	1.48	1.003	NW	-4.4	2030	39
35	8/1/73	88	201	228	1.34	H-9	GH	33	1.96	1.100	2.16	G-8	HG	1.47	1.002	NE	-3.3	2560	24
37(2)	8/6/73	75	195	228	1.33	H-9	GH	33	1.95	1.100	2.15	H-5	GH	1.48	1.019	SE	-2.7	2705	30
38	8/17/73	92	202	228	1.31	H-9	GH	23	1.92	1.131	2.17	H-9	GH	1.47	1.004	NE	-2.3	2950	31
39	8/31/73	93	210	228	1.28	L-8	HG	24	1.89	1.128	2.07	L-8	HG	1.46	1.011	SW	-3.2	3380	17
40	9/13/73	92	213	228	1.25	G-8	HG	22	1.83	1.134	2.07	G-8	HG	1.42	1.004	NW	+1.3	3780	41
41	10/1/73	93	211	228	1.24	G-8	HG	23	1.81	1.131	2.04	G-8	HG	1.43	1.024	NE	-0.3	4320	30
42	10/12/73	94	214	228	1.22	H-9	GH	24	1.74	1.128	1.95	G-8	HG	1.41	1.001	SW	-1.1	4670	41
43	11/19/73	92	213	228	1.21	H-9	GH	24	1.73	1.128	1.95	H-7	GH	1.41	1.002	SW	-1.9	5240	47
44	12/3/73	94	213	228	1.22	L-8	HG	22	1.73	1.134	1.96	G-8	HG	1.39	1.002	NE	+1.8	5560	31
45	12/17/73	83	216	228	1.20	L-8	HG	22	1.68	1.134	1.90	H-7	GH	1.37	1.001	NE	+1.0	5940	49
46	12/31/73	91	194	228	1.23	L-8	HG	23	1.76	1.131	1.99	L-8	HG	1.40	1.014	SW	-1.6	6345	31
47	1/4/74	92	217	228	1.18	H-11	GH	21	1.63	1.137	1.86	H-11	GH	1.37	1.001	NW	+0.9	6460	23
48	1/15/74	91	218	228	1.22	H-11	GH	45	1.67	1.059	1.77	H-7	GH	1.36	1.001	NE	-4.2	6780	50
49	2/1/74	91	215	228	1.17	H-11	GH	23	1.62	1.131	1.80	H-7	GH	1.37	1.004	NE	-0.8	7310	45
50	2/15/74	91	216	228	1.18	H-11	GH	14	1.61	1.156	1.76	G-8	HG	1.36	1.003	SW	-1.6	7725	40
51	3/1/74	82	212	228	1.17	H-9	GH	13	1.60	1.158	1.86	H-9	GH	1.35	1.004	SW	+2.4	8135	24
52	3/15/74	98	214	228	1.15	H-11	GH	13	1.56	1.158	1.78	L-8	HG	1.34	1.003	SW	-0.1	8580	41
53	4/1/74	98	216	228	1.21	H-9	GH	46	1.67	1.056	1.77	H-9	GH	1.35	1.008	SW	-5.2	9135	25
54	4/6/74	98	218	228	1.17	L-8	DG	12	1.62	1.160	1.88	L-8	DG	1.34	1.005	NE	+2.1	9310	20
55	4/7/74	53	154	228	1.37	D-9	DI	45	1.81	1.059	1.92	D-9	IL	1.32	1.006	NE	-19.3	9340	15
56(3)	6/18/74	30	187	228	1.26	N-8	LG	20	1.70	1.053	1.79	L-8	DG	1.33	1.019	NW	+6.5	9557	28
58(2)	6/19/74	50	184	228	1.17	L-8	DG	21	1.61	1.052	1.69	L-8	DG	1.35	1.007	SW	-2.9	9575	48
59(2)	7/16/74	100	216	228	1.14	L-8	DG	13	1.53	1.060	1.62	L-8	DG	1.32	1.003	SE	-0.4	9890	47
61(4)	8/26/74	100	216	228	1.17	L-8	DG	12	1.59	1.061	1.69	L-8	DG	1.33	1.004	SW	+0.5	11025	45

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 O, 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.

All hot channel factor values include measurement uncertainty (1.05 on F_Q and 1.0365 on $F_{\Delta H}$).

The axial location of S(Z) is determined by locating the maximum value of $F_Q^N \times S(Z)$.

$$F_Q^N = \{F_Q^{N'}(Z) \times S(Z)\}_{MAX}$$

(1) Maps 24-26 were operational maps for F_Z monitoring only.
(2) Maps 28, 29, 32, 36, 57, and 60 were aborted due to M/D problems.
(3) New densification model WCAP-8219 accepted.
(4) No maps taken in September, October, November, and December 1974 since the Unit was down.

SURRY UNIT 2 FIGURE 2.3.1

ASSEMBLYWISE POWER DISTRIBUTION

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
						0.65	0.85	0.65							
						0.66	0.85	0.66							1
						0.3	0.3	0.9							
				0.62	0.93	1.03	0.99	1.03	0.93	0.62					
				0.61	0.86	1.00	0.96	1.02	0.95	0.64					2
				-1.9	-7.5	-3.5	-3.5	-1.2	1.7	2.7					
			0.63	0.89	1.00	1.06	1.11	1.06	1.00	0.89	0.63				
			0.62	0.88	0.98	0.98	1.03	1.03	1.01	0.91	0.66				3
			-1.9	-1.9	-1.9	-7.4	-7.4	-2.7	0.9	2.3	4.2				
		0.63	0.81	0.98	1.05	1.14	1.12	1.14	1.05	0.98	0.81	0.63			
		0.62	0.80	0.96	1.06	1.14	1.09	1.11	1.05	0.98	0.81	0.63			4
		-1.9	-1.2	-1.7	0.3	-0.4	-2.9	-2.9	0.1	0.1	0.2	0.2			
	0.62	0.89	0.98	1.04	1.14	1.15	1.20	1.15	1.14	1.04	0.98	0.89	0.62		
	0.62	0.89	0.98	1.04	1.15	1.19	1.24	1.18	1.18	1.04	0.94	0.86	0.58		5
	-0.3	-0.0	-1.3	-0.6	0.4	4.0	3.4	2.8	2.8	-0.1	-3.9	-3.9	-7.0		
	0.93	1.00	1.05	1.14	1.14	1.22	1.19	1.22	1.14	1.14	1.05	1.00	0.93		
	0.93	1.00	1.04	1.12	1.15	1.25	1.22	1.27	1.21	1.15	1.03	0.96	0.87		6
	-0.3	-0.3	-1.2	-2.2	0.6	3.0	2.7	4.0	5.6	0.9	-2.6	-4.0	-7.0		
0.65	1.03	1.06	1.14	1.15	1.22	1.20	1.25	1.20	1.22	1.15	1.14	1.06	1.03	0.65	
0.68	1.05	1.06	1.15	1.16	1.24	1.23	1.28	1.25	1.28	1.16	1.14	1.05	0.97	0.61	7
4.8	1.7	-0.3	0.5	1.1	1.7	2.4	2.5	4.1	5.5	1.4	-0.6	-1.1	-5.7	-6.9	
0.85	0.99	1.11	1.12	1.20	1.19	1.25	1.22	1.25	1.19	1.20	1.12	1.11	0.99	0.85	
0.89	1.02	1.11	1.15	1.25	1.22	1.28	1.25	1.27	1.21	1.19	1.15	1.15	0.98	0.81	8
4.9	2.8	-0.3	2.0	4.1	2.7	2.3	2.5	1.7	1.2	-0.5	1.8	3.2	-1.5	-4.2	
0.65	1.03	1.06	1.14	1.15	1.22	1.20	1.25	1.20	1.22	1.15	1.14	1.06	1.03	0.65	
0.68	1.05	1.05	1.16	1.15	1.24	1.23	1.28	1.23	1.22	1.17	1.19	1.11	1.04	0.64	9
4.8	2.0	-0.8	1.1	0.5	1.8	2.3	2.6	2.3	0.6	1.5	4.1	4.4	0.4	-2.5	
	0.93	1.00	1.05	1.14	1.14	1.22	1.19	1.22	1.14	1.14	1.05	1.00	0.93		
	0.93	1.00	1.05	1.14	1.14	1.19	1.19	1.22	1.14	1.15	1.08	1.04	0.91		10
	-0.8	-0.8	-0.6	-0.2	-0.4	-2.1	-0.2	0.2	-0.1	0.5	3.0	3.5	-2.5		
	0.62	0.89	0.98	1.04	1.14	1.15	1.20	1.15	1.14	1.04	0.98	0.89	0.62		
	0.61	0.89	0.97	1.04	1.09	1.11	1.17	1.13	1.13	1.04	0.99	0.92	0.60		11
	-0.9	-0.9	-0.9	-0.2	-4.3	-3.2	-2.3	-1.8	-1.4	-0.4	1.6	2.9	-2.5		
		0.63	0.81	0.98	1.05	1.14	1.12	1.14	1.05	0.98	0.81	0.63			
		0.63	0.84	1.02	1.01	1.10	1.10	1.13	1.05	0.98	0.82	0.65			12
		-0.9	4.0	4.0	-4.3	-3.9	-2.6	-1.0	-0.5	0.3	2.0	2.3			
			0.63	0.89	1.00	1.06	1.11	1.06	1.00	0.89	0.63				
			0.66	0.93	1.00	1.03	1.10	1.06	1.01	0.91	0.65				13
			4.0	4.0	-0.2	-2.8	-1.7	-0.3	0.8	1.4	2.3				
				0.62	0.93	1.03	0.99	1.03	0.93	0.62					
				0.64	0.95	1.02	0.98	1.03	0.94	0.62					14
				4.0	2.1	-1.1	-1.4	-0.3	0.8	0.8					
						0.65	0.85	0.65							
						0.65	0.84	0.65							15
						-0.8	-0.9	-0.8							

PREDICTED
MEASURED
P/C DIFFERENCE

MAP NO. 23 DATE 4/15/73 POWER ∿2200 MWT

CONTROL ROD POSITIONS

BANK C AT 228 STEPS

BANK D AT 204 STEPS

BANK P/L 228 STEPS

$F^N_{\Delta H}$ = 1.45 AT H9-GH *

F^N_Q = 2.10 AT F7-GH *

$\overline{F}_z$ = 1.39

A.O.= -5.5

BURNUP = ∿ 365 MWD/MTU

INCORE TILT

NW - 0.997

NE - 0.998

SW - 1.000

SE - 1.004

* Includes measurement uncertainty
Does not include densification penalties

SURRY UNIT 2

FIGURE 2.3.2

ASSEMBLYWISE POWER DISTRIBUTION

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
						0.59	0.74	0.59							
						0.59	0.74	0.55							1
						0.2	-0.3	-6.9							
				0.62	0.88	1.00	0.92	1.00	0.88	0.62					
				0.61	0.89	1.00	0.92	0.96	0.82	0.60					2
				-0.5	0.2	0.0	-0.1	-4.3	-6.9	-2.6					
			0.65	0.95	1.06	1.04	1.13	1.04	1.06	0.96	0.65				
			0.65	0.96	1.06	1.04	1.13	1.03	1.03	0.96	0.68				3
			-0.5	0.0	0.4	0.3	0.1	-0.8	-2.8	0.2	4.1				
		0.65	0.85	1.07	1.07	1.18	1.10	1.18	1.07	1.07	0.85	0.65			
		0.65	0.85	1.08	1.07	1.18	1.11	1.20	1.08	1.09	0.87	0.67			4
		-0.2	0.4	0.7	-0.1	-0.4	1.4	1.3	1.4	2.0	2.4	2.6			
	0.62	0.96	1.07	1.07	1.19	1.12	1.22	1.12	1.19	1.07	1.07	0.96	0.62		
	0.62	0.96	1.08	1.08	1.19	1.09	1.23	1.13	1.20	1.08	1.09	0.98	0.63		5
	0.2	0.2	0.8	1.5	-0.4	-2.5	0.7	1.5	0.6	1.3	1.3	1.9	2.5		
	0.88	1.06	1.07	1.19	1.11	1.23	1.13	1.23	1.11	1.19	1.07	1.06	0.88		
	0.89	1.06	1.07	1.20	1.11	1.23	1.16	1.24	1.10	1.20	1.08	1.07	0.89		6
	0.2	0.2	0.6	0.4	-0.3	0.1	2.5	1.1	-1.1	0.5	1.1	0.9	0.8		
0.59	1.00	1.04	1.18	1.12	1.23	1.13	1.23	1.13	1.23	1.12	1.18	1.04	1.00	0.59	
0.61	1.03	1.05	1.19	1.12	1.23	1.14	1.26	1.15	1.24	1.13	1.20	1.05	1.00	0.60	7
3.6	2.6	1.6	0.6	0.1	0.3	0.9	2.0	1.8	1.0	0.8	1.0	1.7	0.1	1.0	
0.74	0.92	1.13	1.10	1.22	1.13	1.23	1.13	1.23	1.13	1.22	1.10	1.13	0.92	0.74	
0.76	0.95	1.15	1.11	1.22	1.13	1.24	1.14	1.24	1.15	1.22	1.12	1.17	0.95	0.75	8
3.6	2.5	1.6	0.8	0.1	0.3	0.6	0.7	0.5	1.9	0.4	2.3	3.4	3.1	2.1	
0.59	1.00	1.04	1.18	1.12	1.23	1.13	1.23	1.13	1.23	1.12	1.18	1.04	1.00	0.59	
0.61	1.02	1.05	1.19	1.12	1.23	1.13	1.24	1.14	1.20	1.09	1.17	1.05	1.02	0.61	9
3.6	2.0	1.1	0.8	0.1	-0.0	-0.1	0.4	0.4	-2.3	-2.2	-1.6	1.1	2.4	2.2	
	0.88	1.06	1.07	1.19	1.11	1.23	1.13	1.23	1.11	1.19	1.07	1.06	0.88		
	0.89	1.07	1.05	1.13	1.09	1.23	1.15	1.23	1.11	1.17	1.02	1.03	0.89		10
	0.7	0.7	-1.7	-5.4	-2.2	0.2	1.3	0.5	-0.4	-1.8	-4.6	-2.7	0.1		
	0.62	0.96	1.07	1.07	1.19	1.12	1.22	1.12	1.19	1.07	1.07	0.96	0.62		
	0.63	0.98	1.06	1.01	1.15	1.13	1.25	1.14	1.21	1.07	1.08	0.97	0.62		11
	1.7	1.7	-1.4	-5.4	-3.3	1.5	2.8	2.3	1.5	0.6	0.3	0.7	1.2		
		0.65	0.85	1.07	1.07	1.18	1.10	1.18	1.07	1.07	0.85	0.65			
		0.67	0.85	1.01	1.01	1.20	1.12	1.19	1.07	1.08	0.88	0.68			12
		2.8	-0.5	-5.4	-5.4	1.5	1.5	0.6	-0.1	1.1	3.2	3.2			
			0.65	0.96	1.06	1.04	1.13	1.04	1.06	0.96	0.65				
			0.67	0.97	1.07	1.04	1.13	1.02	1.04	0.96	0.68				13
			1.6	0.5	0.5	-0.1	-0.3	-1.6	-2.4	-0.1	3.3				
				0.62	0.88	1.00	0.92	1.00	0.88	0.62					
				0.62	0.89	1.01	0.92	0.98	0.86	0.60					14
				0.5	1.0	0.9	-0.6	-2.2	-2.4	-2.4					
						0.59	0.74	0.59							
						0.60	0.74	0.58							15
						1.5	-0.1	-2.4							

PREDICTED	
MEASURED	
P/C DIFFERENCE	

MAP NO. 49 DATE 2/1/74 POWER ∿ 2230 MWT

CONTROL ROD POSITIONS

BANK C AT 228 STEPS

BANK D AT 215 STEPS

BANK P/L 228 STEPS

$F^N_{\Delta H}$ = 1.37 AT H7-GH *

F^N_Q = 1.62 AT H11-GH *

$\overline{F}_z$ = 1.17

A.O.= -0.8

BURNUP = ∿ 7310 MWD/MTU

INCORE TILT

NW - 1.002

NE - 1.004

SW - 0.996

SE - 0.998

* Includes measurement uncertainty
Does not include densification penalties

ASSEMBLYWISE POWER DISTRIBUTION FIGURE 2.3.3

SURRY UNIT 2

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
						0.61 0.65 6.7	0.75 0.80 6.7	0.61 0.65 6.7							1
				0.65 0.65 0.2	0.90 0.90 0.1	1.03 1.07 3.4	0.93 0.96 3.3	1.03 1.07 3.4	0.90 0.85 -5.9	0.65 0.61 -5.9					2
			0.69 0.69 0.2	1.03 1.03 0.2	1.10 1.11 0.3	1.04 1.03 -0.2	1.14 1.14 -0.0	1.04 1.02 -1.8	1.10 1.04 -5.9	1.03 0.96 -5.9	0.69 0.67 -2.6				3
		0.69 0.71 3.1	0.88 0.90 1.1	1.12 1.12 0.7	1.05 1.07 0.2	1.18 1.17 -0.4	1.07 1.06 -0.5	1.18 1.15 -2.4	1.06 1.01 -5.2	1.12 1.09 -2.5	0.88 0.87 -1.2	0.69 0.69 0.6			4
	0.65 0.65 5.0	1.03 1.08 5.0	1.12 1.13 1.3	1.06 1.06 -0.0	1.18 1.18 -0.2	1.07 1.07 0.3	1.18 1.18 0.3	1.07 1.05 -1.4	1.18 1.16 -1.8	1.06 1.06 -0.1	1.12 1.10 -2.0	1.03 1.03 0.6	0.65 0.67 3.7		5
	0.90 0.93 2.5	1.10 1.13 2.5	1.06 1.07 0.7	1.18 1.17 -1.1	1.06 1.05 -0.8	1.17 1.17 0.3	1.06 1.07 1.0	1.17 1.17 0.5	1.06 1.06 -0.3	1.18 1.17 -0.4	1.06 1.05 -1.2	1.10 1.11 0.1	0.90 0.92 1.4		6
0.61 0.61 -0.0	1.03 1.06 2.7	1.04 1.05 1.0	1.13 1.19 0.9	1.07 1.05 -1.4	1.17 1.15 -1.1	1.05 1.05 -0.5	1.16 1.16 0.4	1.05 1.06 0.5	1.17 1.17 0.4	1.07 1.07 0.4	1.18 1.18 0.6	1.04 1.05 1.3	1.02 1.02 0.0	0.61 0.62 1.6	7
0.75 0.90 7.0	0.93 0.97 4.2	1.14 1.21 6.0	1.07 1.09 2.1	1.18 1.16 -1.4	1.06 1.05 -1.1	1.16 1.15 -0.7	1.05 1.05 0.1	1.16 1.15 -0.2	1.06 1.06 0.3	1.18 1.16 -1.0	1.07 1.07 0.6	1.14 1.16 1.1	0.93 0.97 3.5	0.75 0.76 1.7	8
0.61 0.60 -1.0	1.03 1.04 3.0	1.04 1.07 2.0	1.13 1.19 1.5	1.07 1.05 -1.4	1.17 1.16 -0.4	1.05 1.06 0.6	1.16 1.15 0.5	1.05 1.05 -0.2	1.17 1.13 -3.0	1.07 1.05 -2.2	1.18 1.18 0.6	1.04 1.06 2.0	1.03 1.05 1.6	0.61 0.61 0.2	9
	0.90 0.89 -1.1	1.10 1.09 -1.1	1.06 1.06 -0.7	1.18 1.13 -0.2	1.06 1.06 0.3	1.17 1.17 0.4	1.06 1.05 -0.2	1.17 1.15 -1.4	1.06 1.03 -2.5	1.18 1.13 -4.2	1.06 1.07 0.2	1.10 1.11 0.2	0.90 0.90 0.2		10
	0.65 0.66 2.4	1.03 1.05 2.4	1.12 1.13 1.3	1.06 1.06 -0.2	1.18 1.18 -0.1	1.07 1.06 -0.5	1.18 1.16 -1.2	1.07 1.05 -1.4	1.18 1.16 -1.4	1.06 1.10 3.2	1.12 1.21 8.2	1.03 1.11 7.9	0.65 0.69 6.4		11
		0.69 0.73 6.0	0.88 0.92 3.5	1.12 1.12 -0.2	1.06 1.06 -0.4	1.18 1.16 -1.5	1.07 1.03 -3.8	1.18 1.13 -4.3	1.06 1.04 -2.0	1.12 1.13 1.1	0.88 0.93 5.0	0.69 0.79 14.0			12
			0.69 0.72 3.8	1.03 1.04 1.7	1.10 1.11 0.6	1.04 0.98 -5.0	1.14 1.06 -7.1	1.04 1.02 -1.3	1.10 1.09 -1.0	1.03 1.03 0.0	0.69 0.75 8.2				13
				0.65 0.66 1.7	0.90 0.93 3.0	1.03 1.02 -0.8	0.93 0.94 0.2	1.03 1.08 5.0	0.90 0.93 2.8	0.65 0.63 -2.0					14
						0.61 0.64 4.8	0.75 0.79 5.7	0.61 0.66 7.4				PREDICTED MEASURED P/C DIFFERENCE			15

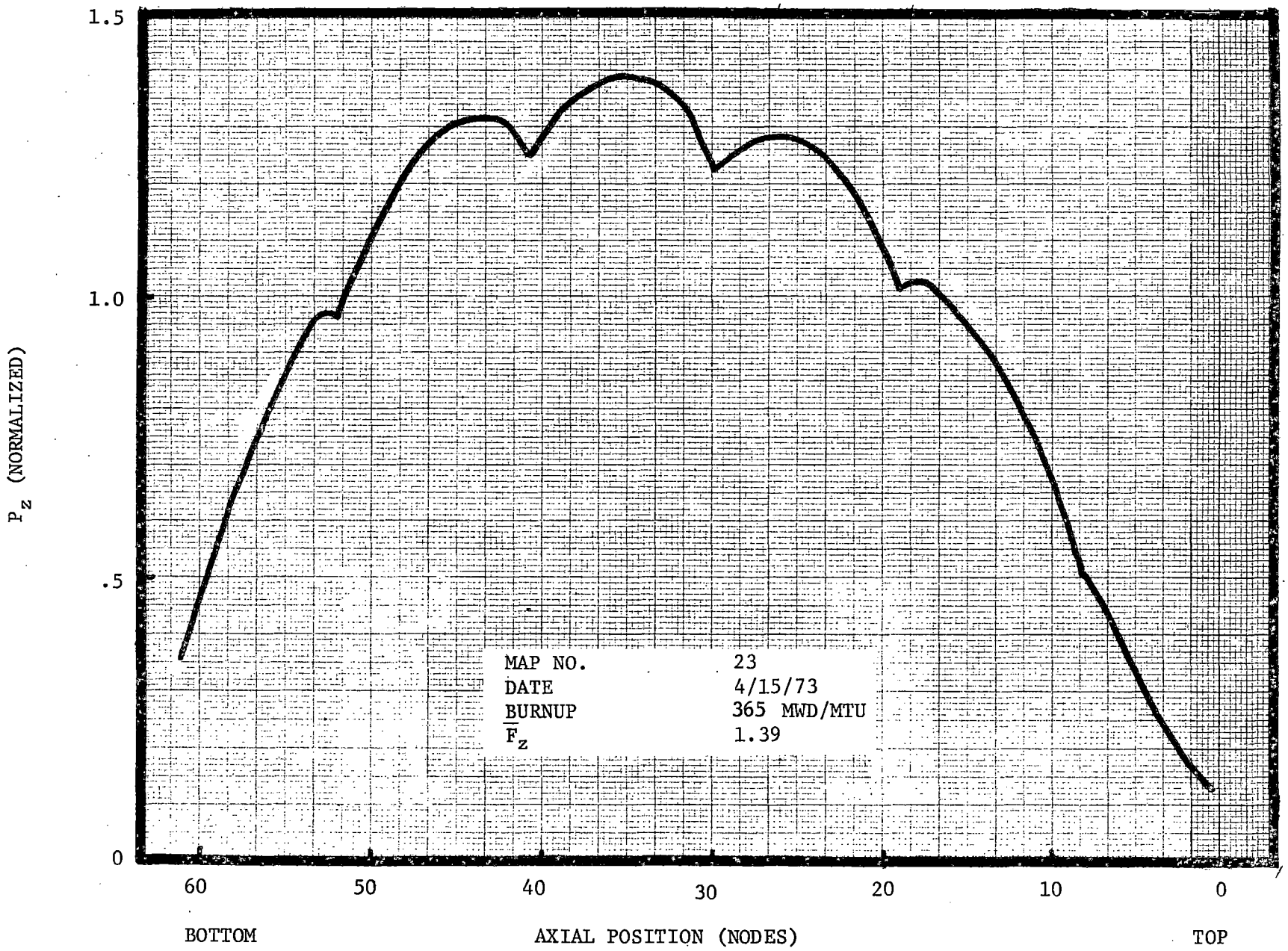
MAP NO. 61	DATE 8/26/74	POWER ∿ 2430 MWT
CONTROL ROD POSITIONS	$F^N_{\Delta H}$ = 1.33 AT L8-DG *	INCORE TILT
BANK C AT 228 STEPS	F^N_Q = 1.59 AT L8-DG *	NW - 0.995
BANK D AT 216 STEPS	$\overline{F}_z$ = 1.17	NE - 0.999
BANK P/L 228 STEPS	A.O.= +0.5%	SW - 1.004
	BURNUP = ∿ 11,025 MWD/MTU	SE - 1.003

* Includes measurement uncertainty
Does not include densification penalties

SURRY UNIT 2

FIGURE 2.3.4

CORE AVERAGE AXIAL POWER DISTRIBUTION



SURRY UNIT 2

FIGURE 2.3.5

CORE AVERAGE AXIAL POWER DISTRIBUTION

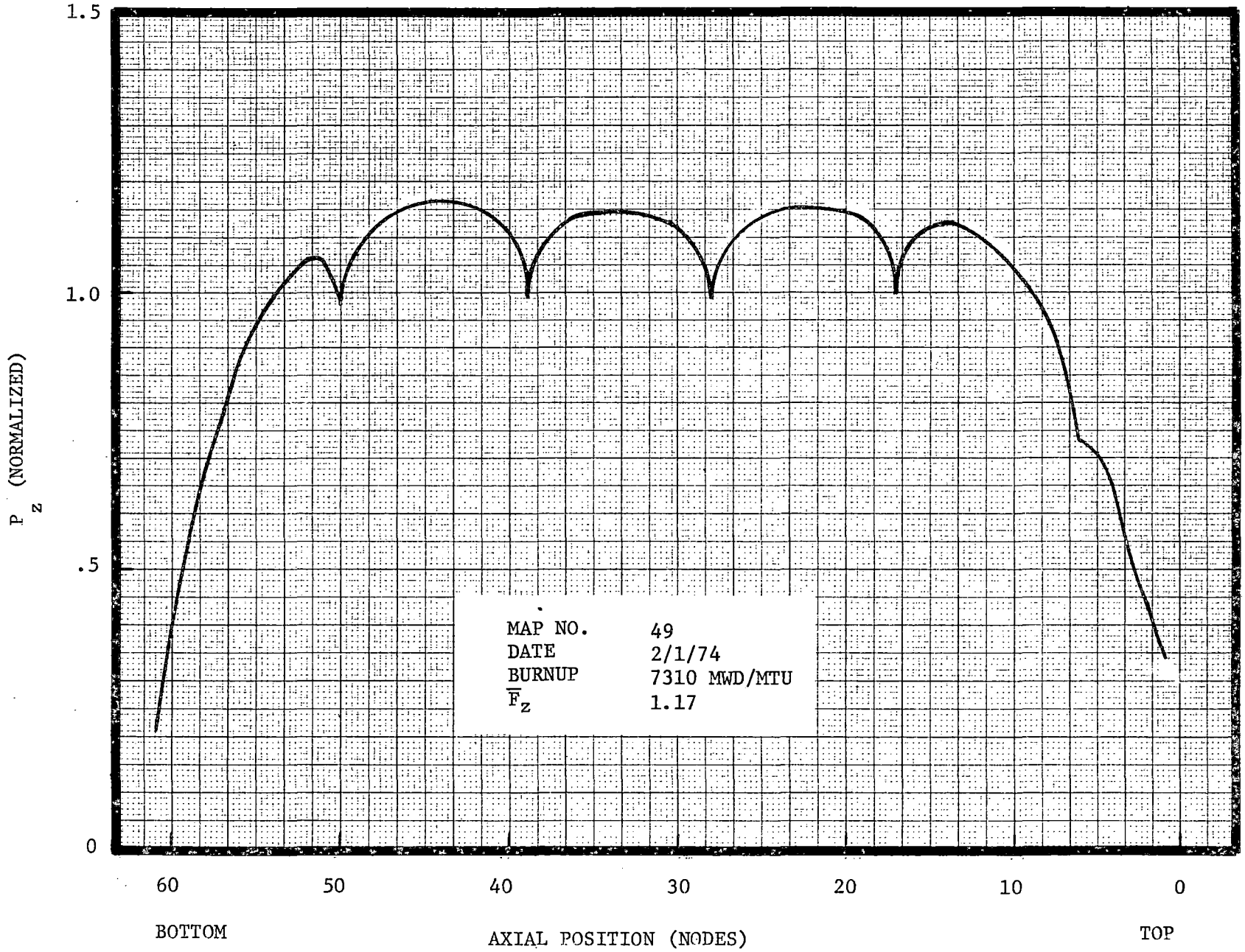
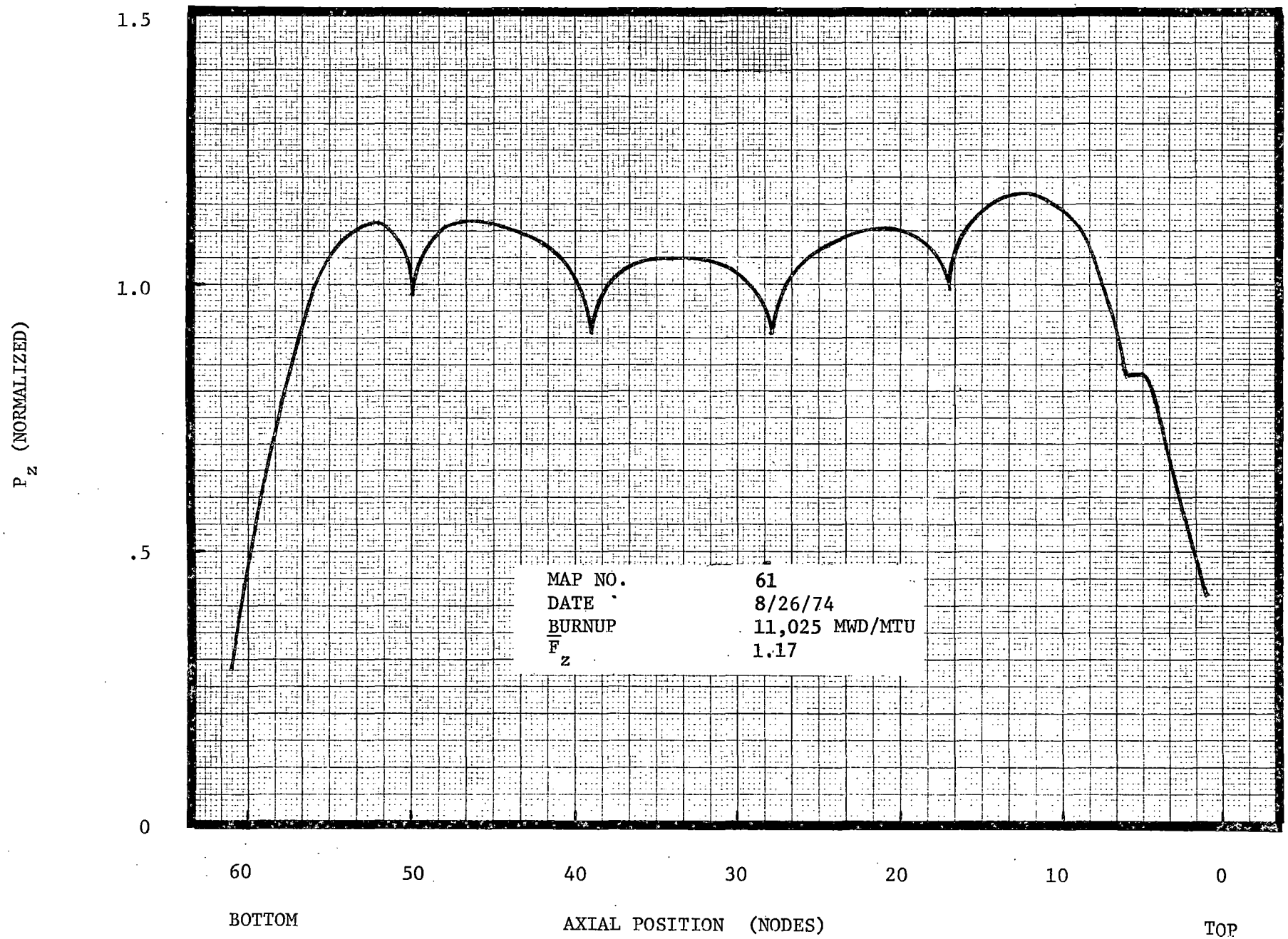


FIGURE 2.3.6

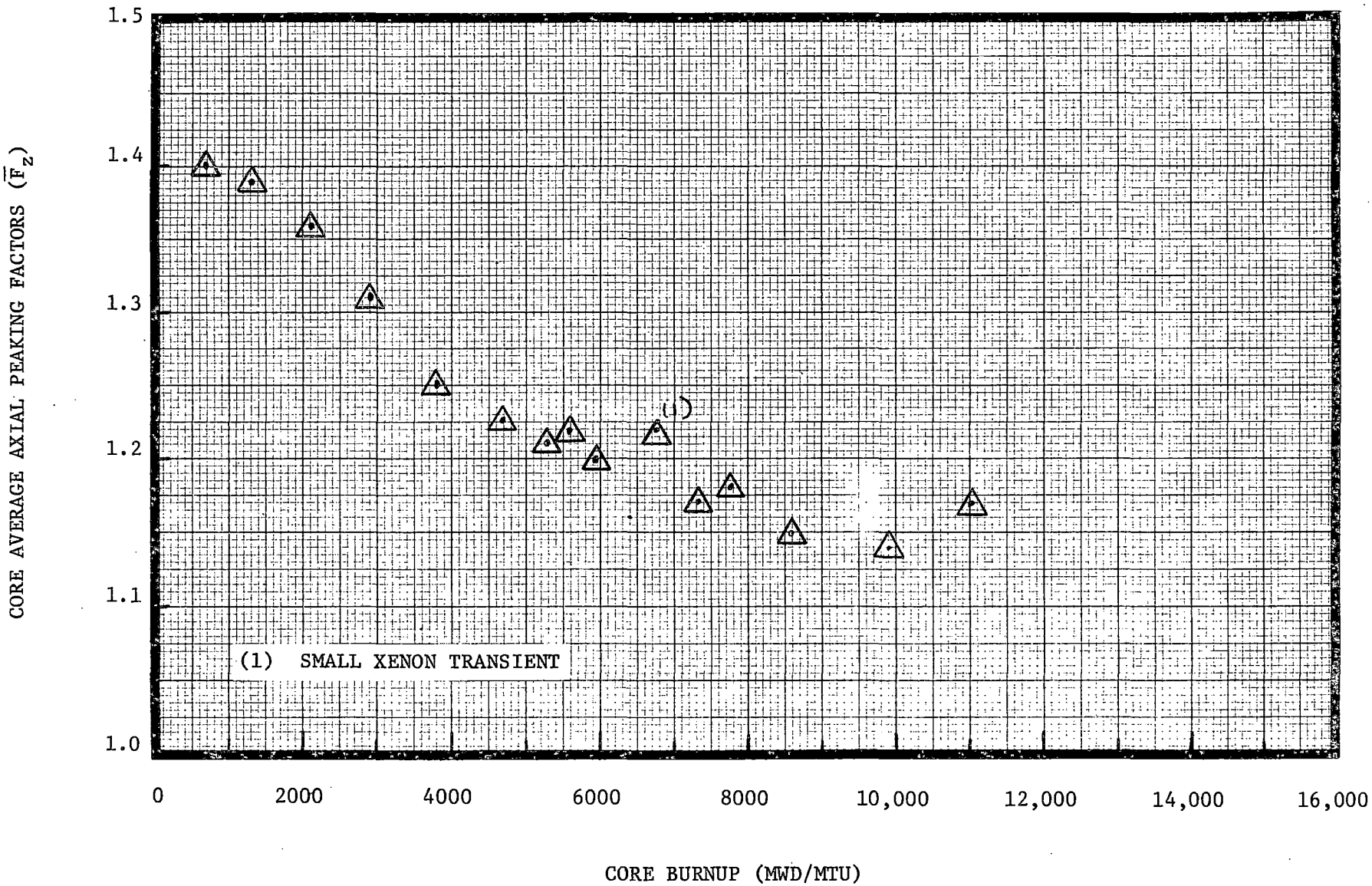
CORE AVERAGE AXIAL POWER DISTRIBUTION



SURRY UNIT 2

FIGURE 2.3.7

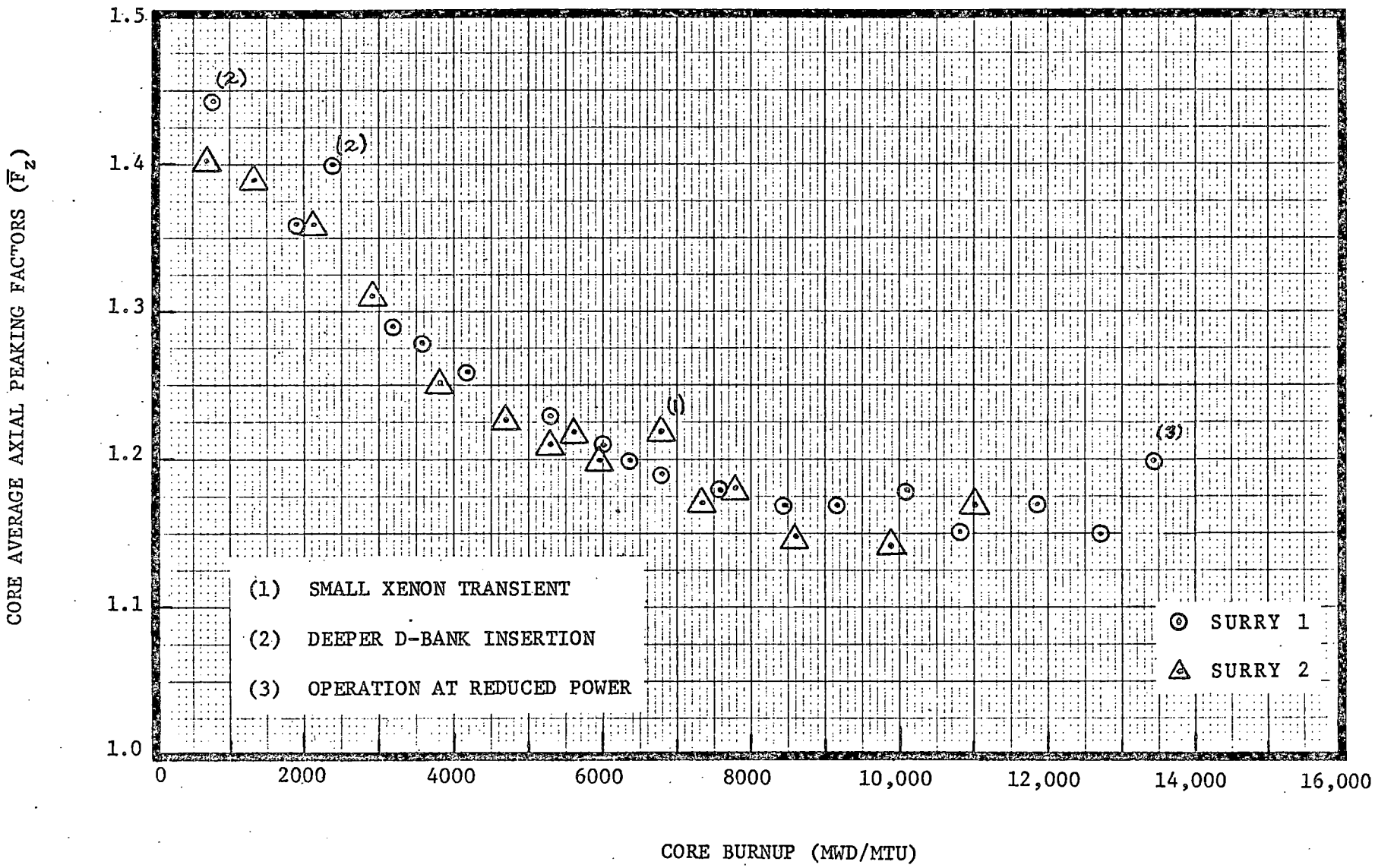
CORE AVERAGE AXIAL PEAKING FACTORS
vs.
BURNUP



COMPARISON: SURRY UNIT 1 AND 2 - CYCLE 1

FIGURE 2.3.8

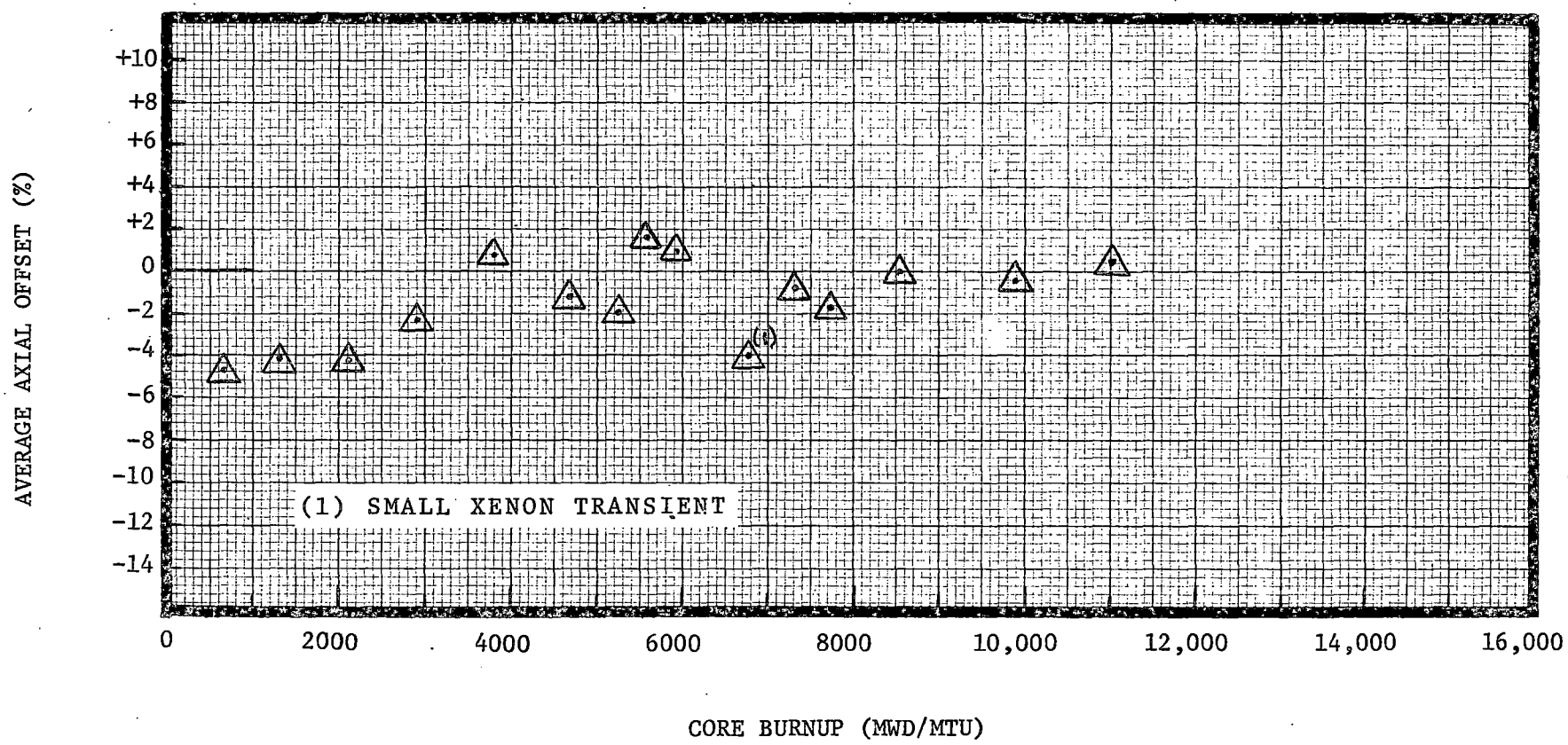
CORE AVERAGE AXIAL PEAKING FACTORS
vs.
BURNUP



SURRY UNIT 2

FIGURE 2.3.9

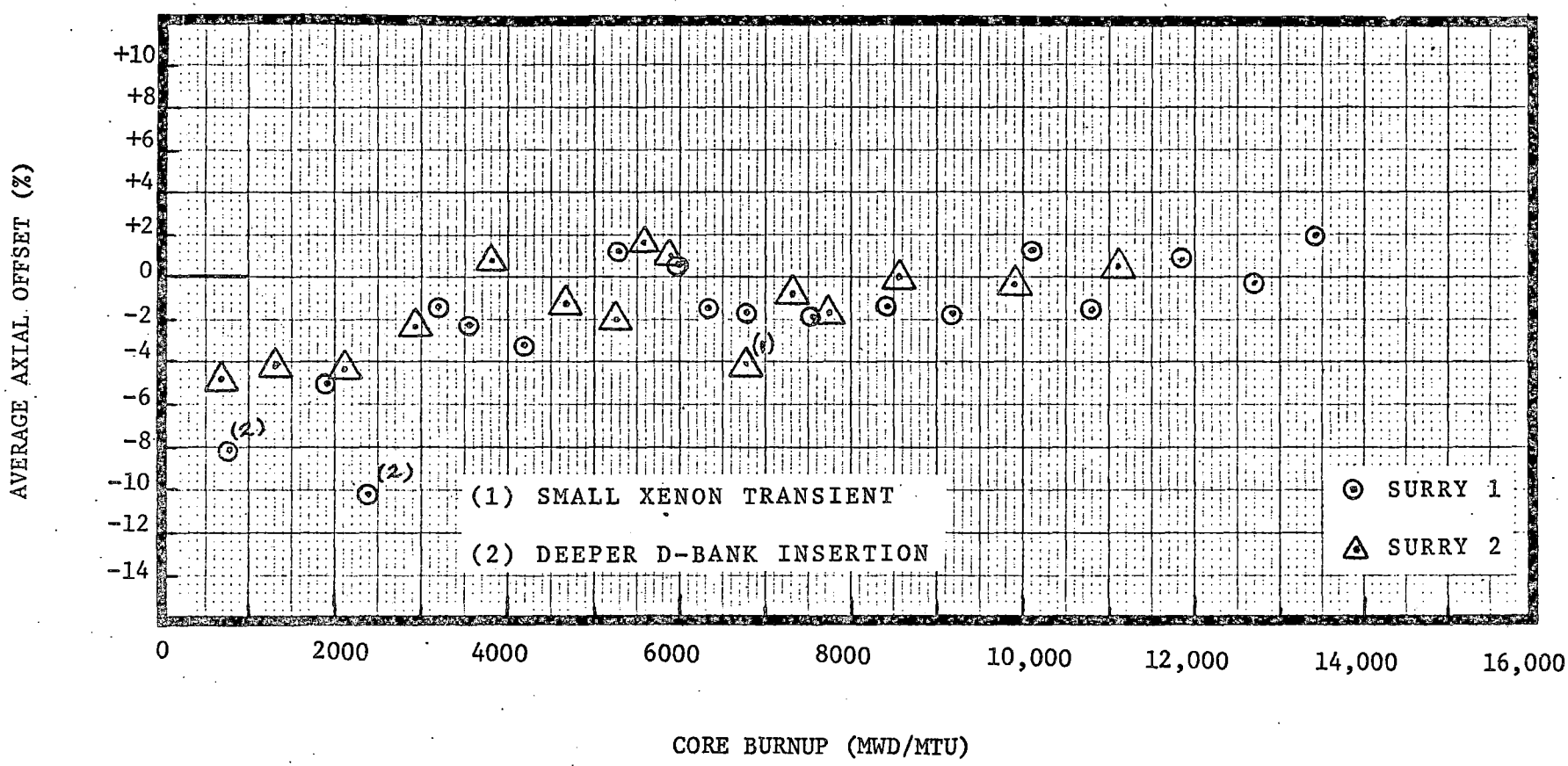
AVERAGE AXIAL OFFSET
vs.
BURNUP



COMPARISON: SURRY UNIT 1 AND 2 - CYCLE 1

FIGURE 2.3.10

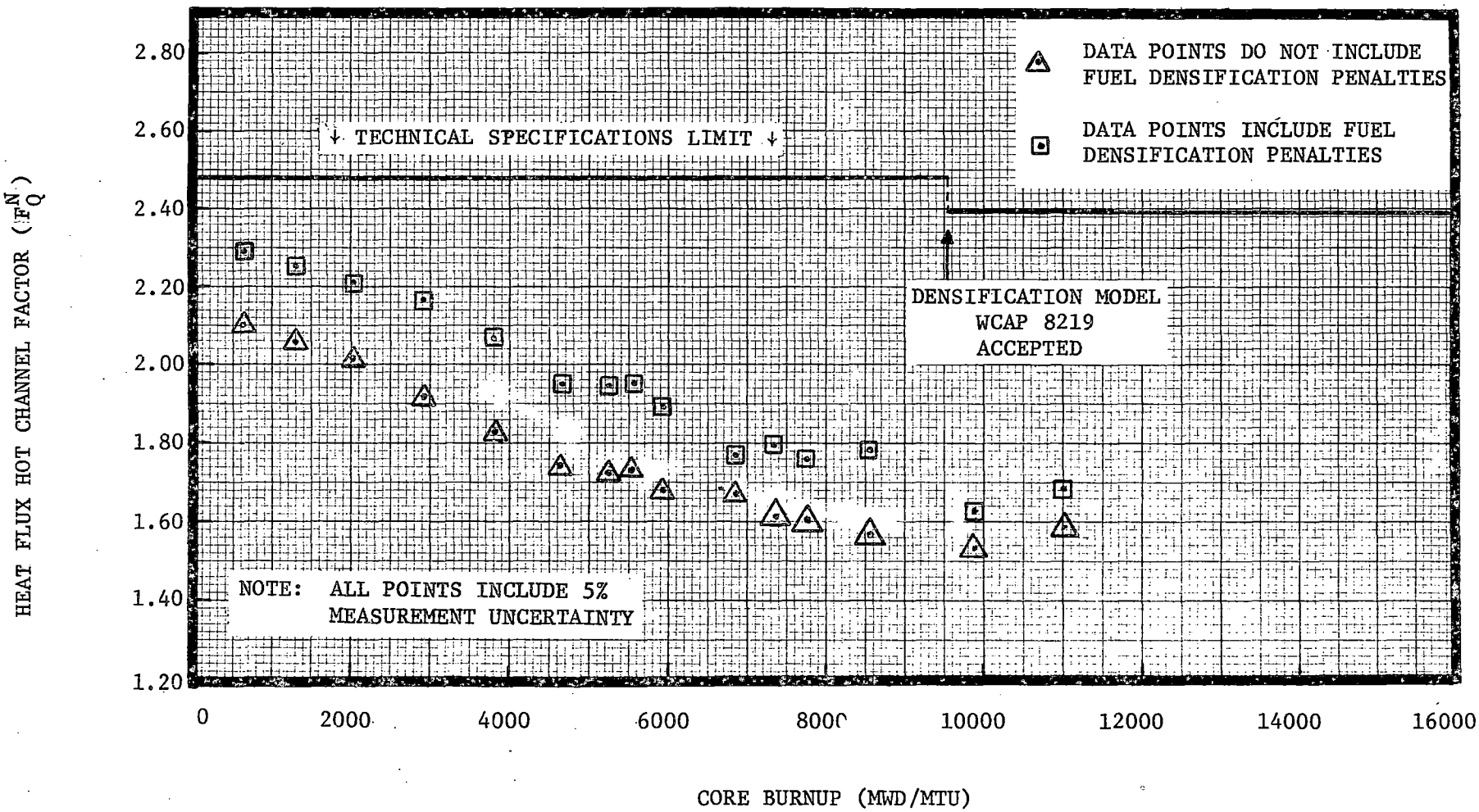
AVERAGE AXIAL OFFSET
vs.
BURNUP



SURRY UNIT 2

FIGURE 2.3.11

HEAT FLUX HOT CHANNEL FACTOR
vs.
BURNUP



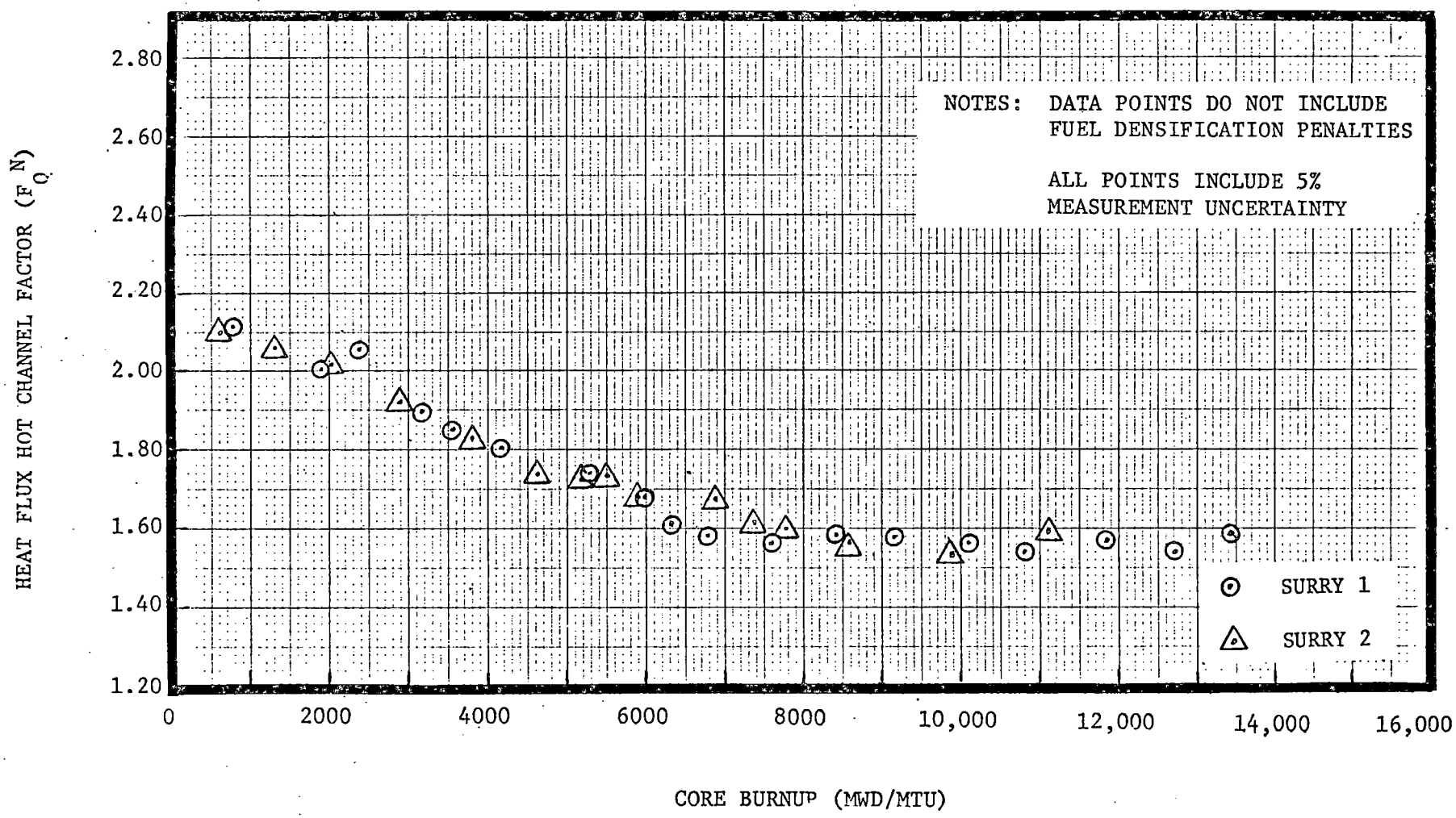
COMPARISON: SURRY UNIT 1 AND 2 - CYCLE 1

FIGURE 2.3.12

HEAT FLUX HOT CHANNEL FACTOR

vs.

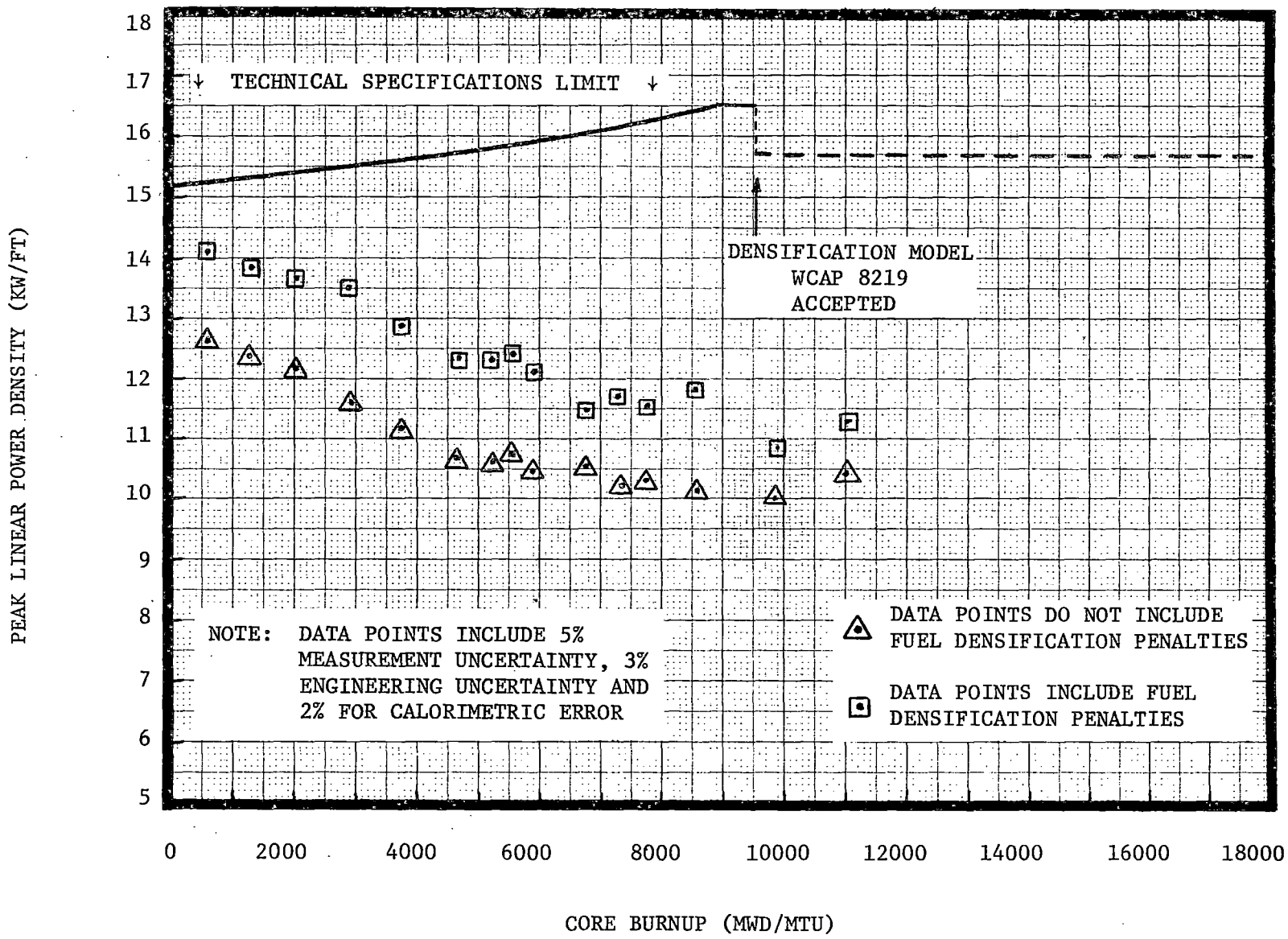
BURNUP



SURRY UNIT 2

FIGURE 2.3.13

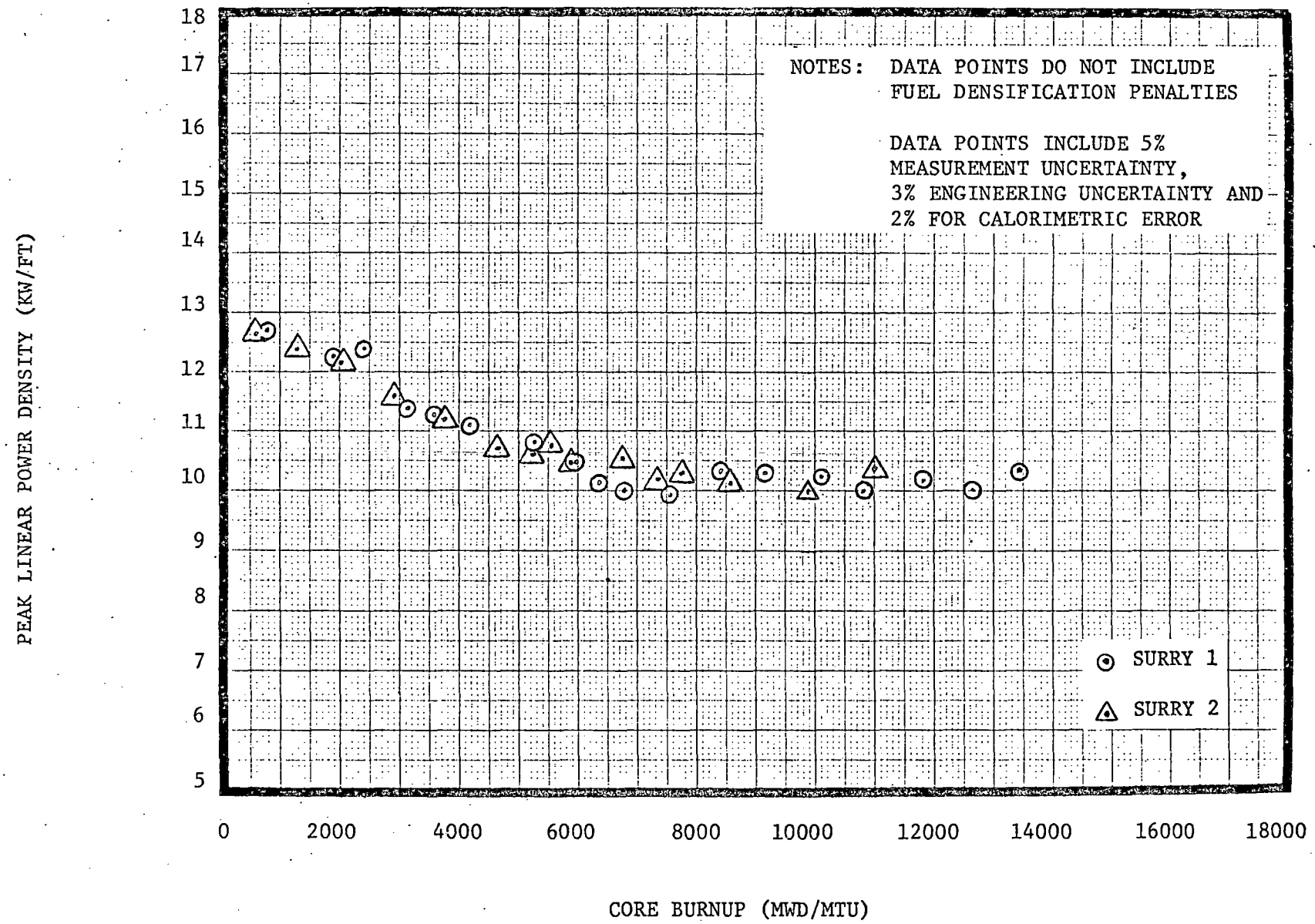
PEAK LINEAR POWER DENSITY
vs.
BURNUP



COMPARISON: SURRY UNIT 1 AND 2 - CYCLE 1

FIGURE 2.3.14

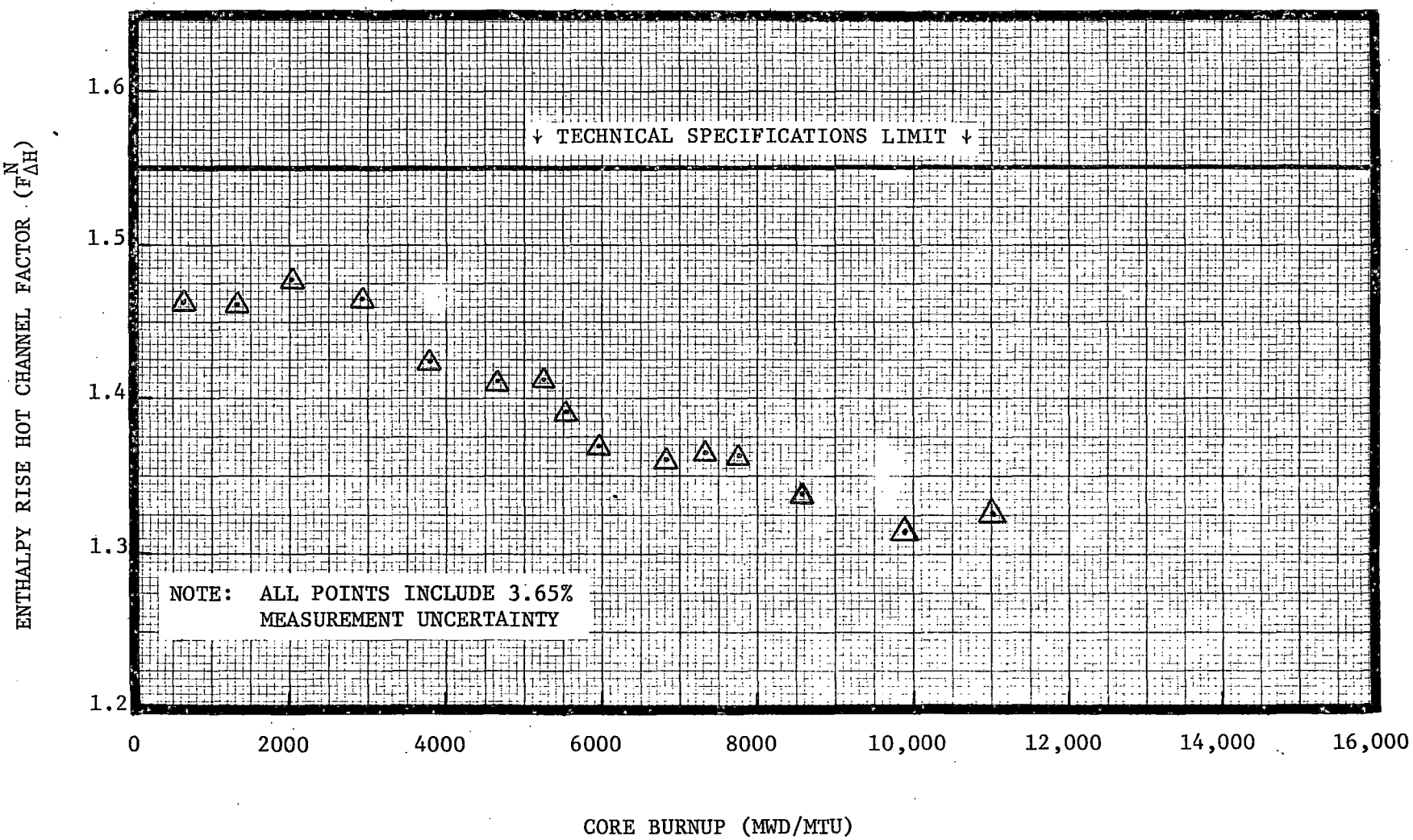
PEAK LINEAR POWER DENSITY
vs.
BURNUP



SURRY UNIT 2

FIGURE 2.3.15

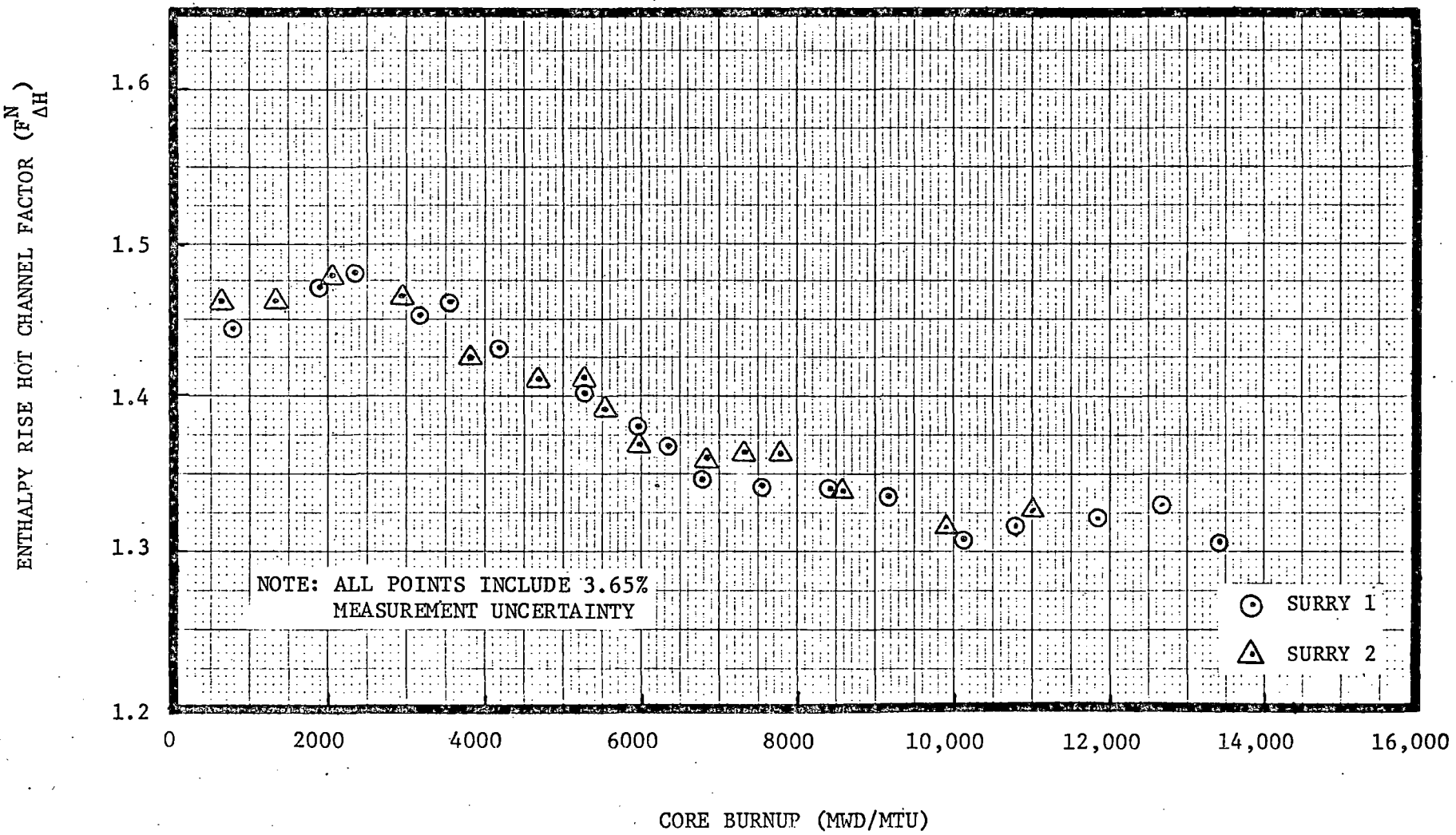
ENTHALPY RISE HOT CHANNEL FACTOR
vs.
BURNUP



COMPARISON: SURRY UNIT 1 AND 2 - CYCLE 1

FIGURE 2.3.16

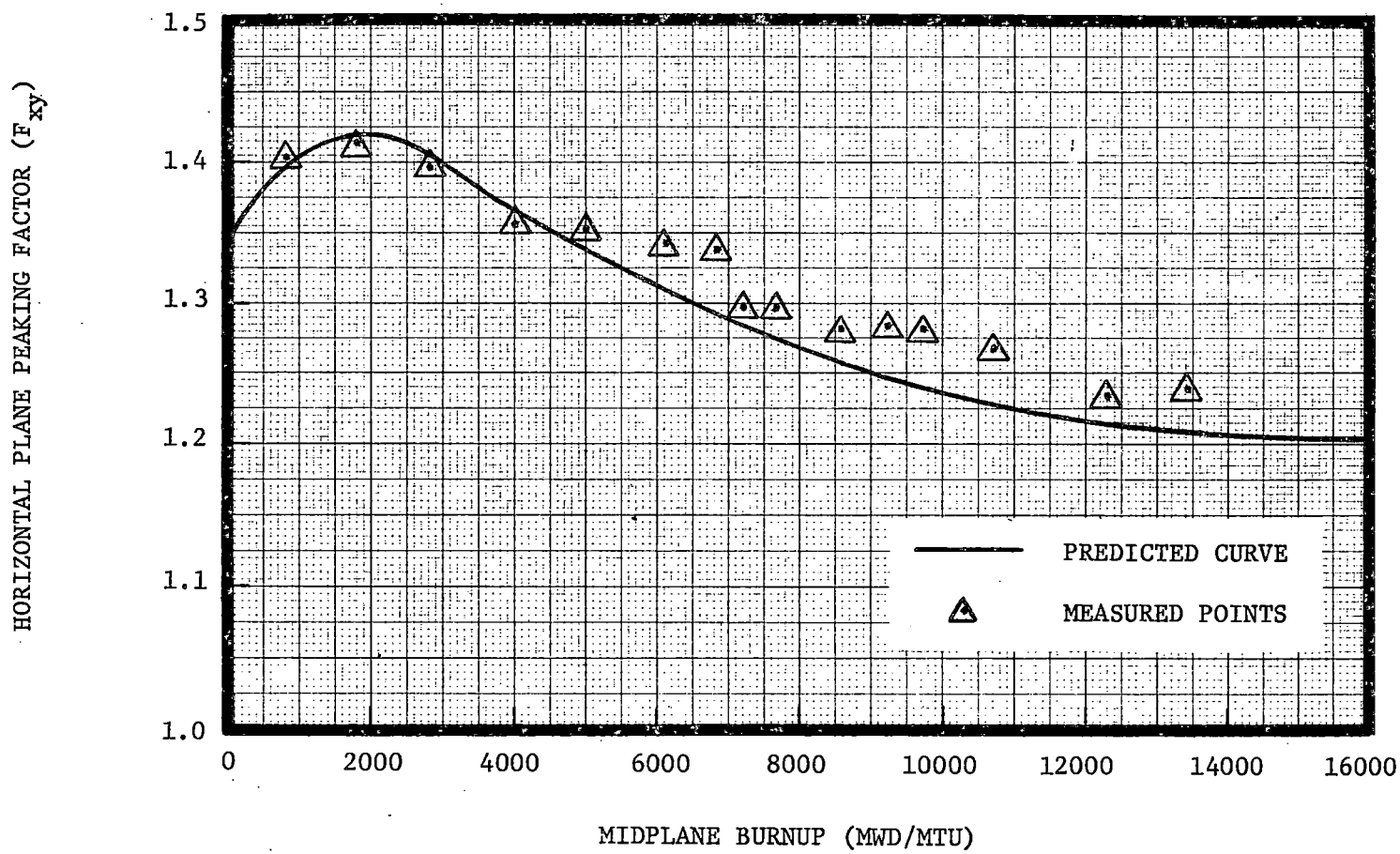
ENTHALPY RISE HOT CHANNEL FACTOR
vs.
BURNUP



SURRY UNIT 2

FIGURE 2.3.17

HORIZONTAL PLANE PEAKING FACTOR AT CORE MIDPLANE
vs.
BURNUP



COMPARISON: SURRY 1 AND 2 - CYCLE 1

FIGURE 2.3.18

HORIZONTAL PLANE PEAKING FACTOR AT CORE MIDPLANE
vs.
BURNUP

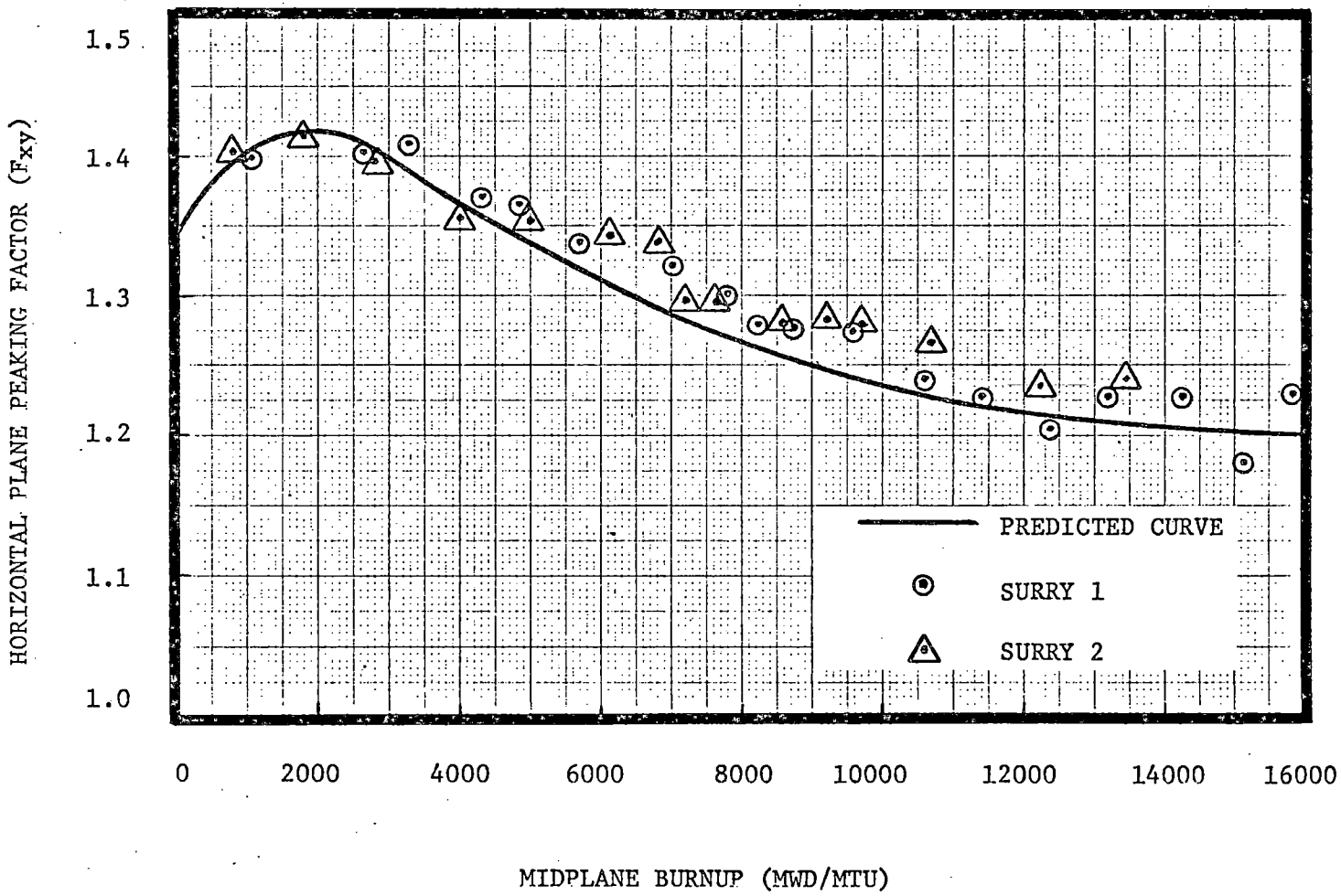
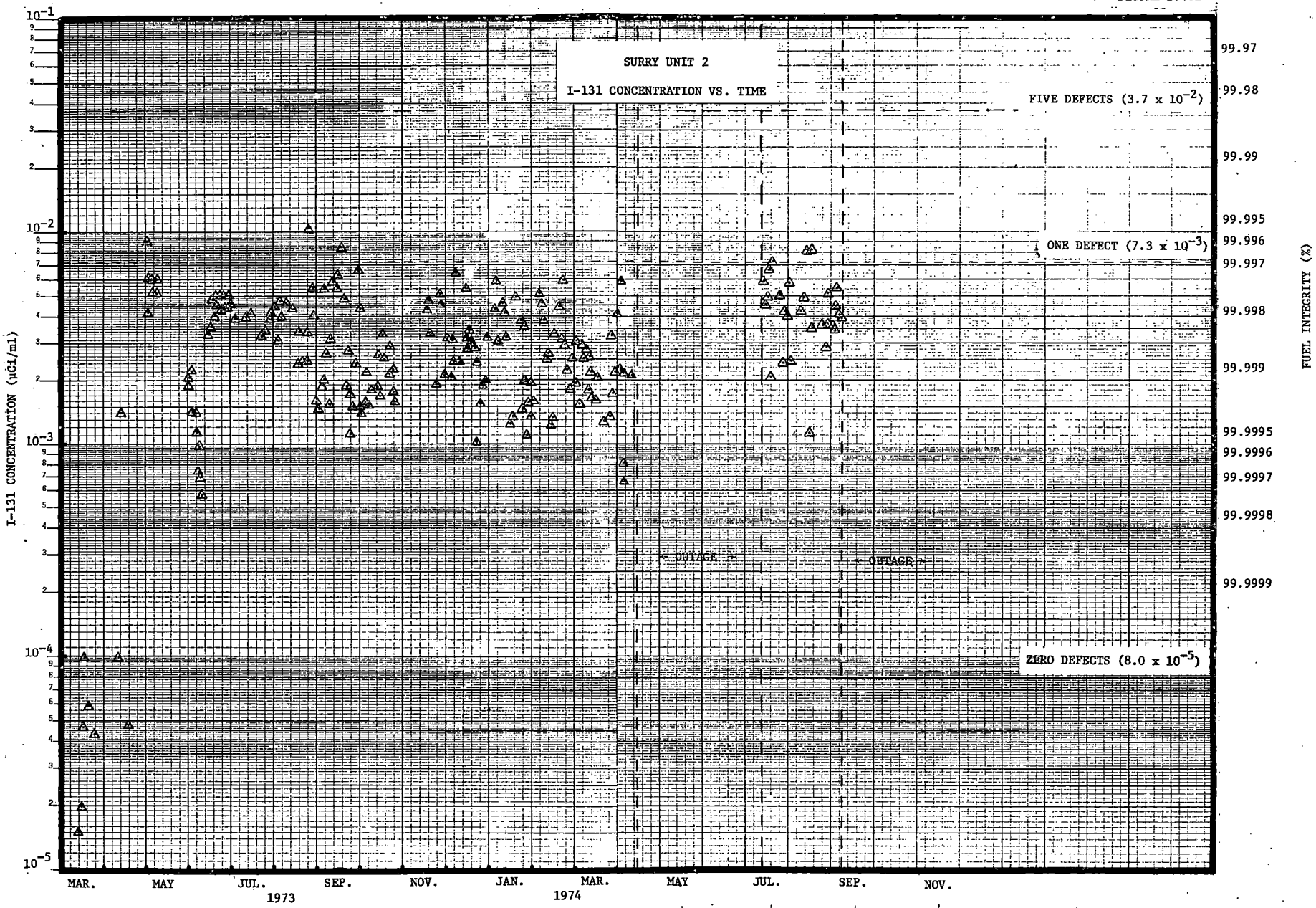


FIGURE 2.4.1


SURRY UNIT 2
I-131 CONCENTRATION VS. TIME
FIVE DEFECTS (3.7 x 10^-2)
ONE DEFECT (7.3 x 10^-3)
ZERO DEFECTS (8.0 x 10^-5)
OUTAGE
OUTAGE
I-131 CONCENTRATION (µCi/ml)
FUEL INTEGRITY (%)
10^-1
10^-2
10^-3
10^-4
10^-5
99.97
99.98
99.99
99.995
99.996
99.997
99.998
99.999
99.9995
99.9996
99.9997
99.9998
99.9999
MAR.
MAY
JUL.
SEP.
NOV.
JAN.
MAR.
MAY
JUL.
SEP.
NOV.
1973
1974

SURRY UNIT 2

I-131/I-133 RATIO vs. TIME

FIGURE 2.4.2

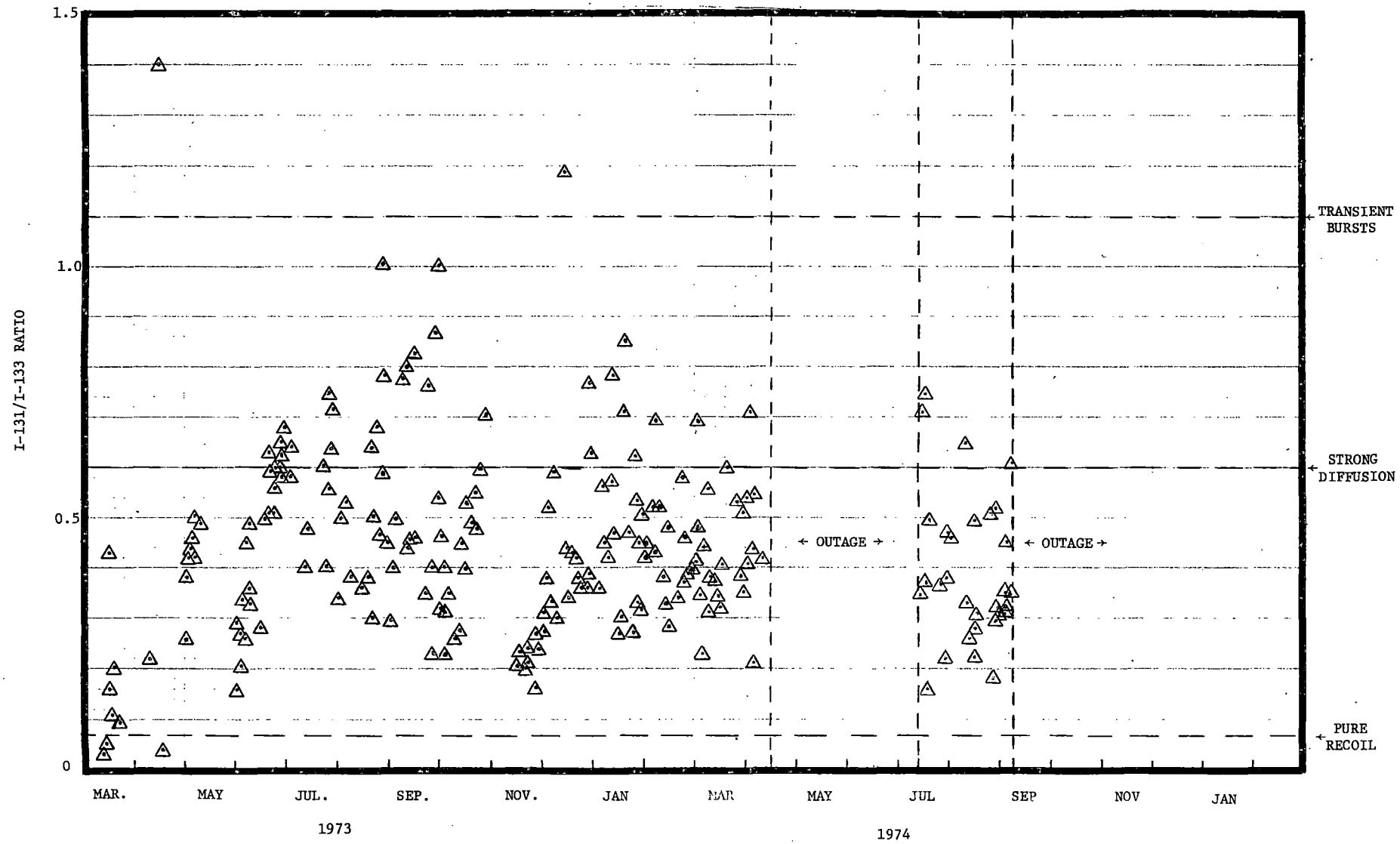


TABLE 2.5.1

LOCATIONS OF DENSIFICATION POWER SPIKES

-- SURRY UNIT 2 --

Strip-Chart Figure Number(1)	Assembly Location	Detector	Fuel Region(2)	Enrich-ment (w/o U235)	UO_2 Density (% Theoretical)	Power Spike (%) June 30 1974	Power Spike (%) Dec. 31 1974	Power Spike (%) Δ	Change in Last 3 Maps	Location of Spike (3)	Status
1	B-8	D	1	1.86	93.7	-	0.8	-	large	1	confirmed
2	J-7	All	1	1.86	93.7	0.4	0.6	0.2	nil	1,3	confirmed
3	G-9	E	1	1.86	93.7	0.5	0.5	0.0	nil	1	confirmed
4	G-14	D	3	3.11	91.8	0.1	0.5	0.4	slight	1	confirmed
5	F-6	B	1	1.86	93.7	0.3	0.2	0.1	slight	1	confirmed
6	N-7	E	1	1.86	93.7	-	0.5	-	large	1	suspected
7	J-5	B	1	1.86	93.7	-	0.4	-	slight	1,3	suspected
8	L-11	B	1	1.86	93.7	0.1	0.3	0.2	slight	1	suspected
9	D-12	E	1	1.86	93.7	0.1	0.2	0.1	slight	1	suspected

(1) See Appendix E

(2) Standard W region definition

(3) 1-upper thrid; 2-midplane third; 3-lower third

COMPARISON: SURRY 1 AND 2 TABLE 2.5.2

DENSIFICATION POWER SPIKES

UNIT	ASSEMBLY LOCATION	FUEL REGION	NOMINAL UO_2 DENSITY (% TD)	BLIP MAGNITUDE (%)	CORE AXIAL LOCATION (1)
SURRY 1	B-10	3	3.12	4.8	1
	N-12	3	3.12	4.3	1
	F-2	3	3.12	2.8	1
	B-7	3	3.12	2.7	1
	L-8	2	2.57	1.8	1
	H-13	2	2.57	1.5	1
	F-9	2	2.57	1.5	1
	M-3	3	3.12	1.5	1
	R-8	3	3.12	1.4	3
	N-5	3	3.12	1.3	1
	N-10	2	2.57	1.2	1
	A-9	3	3.12	1.0	1
	G-9	1	1.87	0.8	2
	H-11	2	2.57	0.8	2
	H-1	3	3.12	0.8	1
	L-14	3	3.12	0.8	1
	D-7	2	2.57	0.7	2
	L-4	2	2.57	0.5	1
SURRY 2	B-8	1	1.86	0.8	1
	J-7	1	1.86	0.6	1,3
	G-9	1	1.86	0.5	1
	G-14	3	3.11	0.5	1
	F-6	1	1.86	0.2	1

(1) 1-upper third; 2-midplane third; 3-lower third

Section 3

CONCLUSIONS

The Surry 2 core has operated for over three quarters of its normal cycle now with all performance indicators comparing closely to design predictions and all Technical Specifications limits being met by a significant margin. No abnormalities in core reactivity, power distributions, or burnup accumulation have been detected. In addition, the excellent mechanical integrity of the core has not changed perceptibly since the last report, as indicated by the radio-iodine analysis. Lastly, fuel densification effects in terms of blip formation are less than anticipated.

DEFINITION OF TERMS

ACTIVITY - Number of nuclear disintegrations per unit time taking place in a radioactive nuclide. Usually expressed in terms of μCi (3.7×10^4 disintegrations per second).

AXIAL OFFSET - The percent difference between the fraction of total core power produced in the upper half of the core and that produced in the lower half of the core.

BATCH - A group of assemblies which are inserted into the reactor at the same time. All of the assemblies in a batch may or may not have the same nuclear characteristics or be discharged at the same time. (See REGION)

BORON (Soluble) - A strong neutron absorber which is dissolved in the reactor coolant and used for reactivity control. The boron concentration in the coolant is expressed in terms of parts per million water (ppm).

BURNUP - The quantity of energy produced per unit weight of fuel. It is a measure of fuel consumption and typically has units of megawatt-days per metric ton of initially contained uranium (MWD/MTU).

CRITICAL - Condition in which the neutron chain reaction in a reactor is just self-sustaining.

CRITICAL BORON CONCENTRATION - The concentration of soluble boron in the coolant at which the reactor is just critical.

CRITICAL HEAT FLUX (DNB) - The point of transition between nucleate boiling and film boiling at the coolant-clad interface. Beyond this critical heat flux point, a vapor blanket forms on the cladding surface and acts as an insulator, thereby resulting in abnormally high clad temperatures.

DENSIFICATION - A recently discovered phenomenon in which the UO_2 fuel pellets shrink both radially and axially as a result of neutron irradiation.

DENSIFICATION-INDUCED GAPS - When a column of UO_2 pellets in a fuel rod shrinks due to densification, gaps may be formed in the pellet column due to pellet-clad interaction.

FISSION PRODUCTS - Residual nuclei which are generated during the fission process and which retain nearly all of the energy formed in the process.

FLUX (Neutron) - A measure of the intensity of neutrons, i.e., the number of neutrons passing through one square centimeter in one second.

FLUX MAP - A three-dimensional representation of the flux distribution throughout the core. It is obtained from measurements made with the movable detector system. (See MOVABLE DETECTOR)

HALF-LIFE - Period of time in which a radioactive element decays to half its original concentration.

IODINE-131; IODINE-133 - Fission products which, because of their radioactive properties, can be used to determine fuel clad defects.

LINEAR POWER DENSITY - Power generated per unit length of fuel rod. This parameter is a measure of the central temperature of the fuel rod and stored heat. Usually expressed in units of Kw/ft.

LOAD FACTOR - The ratio of the actual reactor energy generated over a period of time to the potential energy which could have been generated by the reactor over that same period of time.

MOVABLE DETECTOR - A traversing incore fission chamber which generates a voltage signal proportional to the flux level the chamber "sees". Five such detectors are moved at one time through the core to monitor the flux distribution. A total of 50 locations are traversed to generate a complete flux map of the core (See FLUX MAP)

NODE - The core is divided into 60 equally spaced axial segments by the movable detector monitoring system. Nodal representation is then used by the INCORE program in deriving the power distributions.

POWER DENSITY - Power generated per unit volume in the core. Usually expressed in units of Kw/Liter.

POWER SPIKE - A local increase in power due to densification-induced gaps in the pellet stack.

RADIAL POWER MAP - An X-Y distribution of power on an assembly basis, normalized to the average assembly power.

REACTIVITY - In a nuclear reactor, a measure of the departure from a just critical condition. Usually expressed in units of pcm (10^{-5} $\Delta K/K$), it is normal to refer to a pcm quantity of reactivity associated with some component of the reactor since removing that component will change the reactivity of the reactor by that amount.

REGION - A group of assemblies which have essentially the same nuclear design characteristics and are inserted into the reactor at the same time. (See BATCH)

TECHNICAL SPECIFICATIONS - The document setting forth mandatory operational and surveillance requirements for a nuclear facility. It is issued by the AEC as part of the operating license.

TILT - A deviation from perfect symmetry. Usually used with respect to radial burnup or power distributions and relates each quadrant to the average of all four quadrants.

XENON - A gaseous fission product which has a very strong neutron absorption capability. Unless controlled, xenon concentration can shift up and down the axial axis of the core, thereby causing axial power transients.

$\Delta K/K$ - Mathematical expression for reactivity, where "K" is the ratio of the number of neutrons present in a reactor in any one neutron generation to that in the immediately preceding generation. (See REACTIVITY)

Appendix B

TOTE PROGRAM DESCRIPTION

TOTE is an isotopic and burnup follow program written by Westinghouse to accurately keep track of core isotopics and accumulated burnup. It is presently operational on the Virginia Electric and Power Company's IBM-370 computer system.

In the analysis of in-core flux maps the INCORE code punches out burnup rate information for every fuel region. These regions normally include each fuel assembly (and fueled follower) and about one hundred individual fuel rods of interest. The burnup rate is given as the megawatt-hours generated in a given fuel region per 1000 megawatt-hours generated by the core. The total for the fuel region is given as well as the value for each of four axial segments of approximately equal length. In addition, the core average axial power distribution is punched out.

The TOTE user inputs: (a) the core energy (megawatt-hours) associated with each of the above burnup rate decks; (b) cards describing each fuel region (including MTU, corresponding INCORE source number, previous burnup, isotopic depletion type, etc.); (c) tables of the change in isotopics (U-235, U, Pu, etc., up to ten) with burnup; and, (d) the burnup rate decks from INCORE. Printed output includes input; core, cycle and fuel region burnup; isotopics; the energy weighted core average axial power distribution; and the initial and current uranium values for each fuel batch and the core. Interpolation for isotopics is quadratic generally using the two preceding and one succeeding table entry. Interpolation for uranium value is linear. Punched output consists of Item (b) above for subsequent TOTE runs.

Appendix C

FOLLOW PROGRAM DESCRIPTION

FOLLOW is a data analysis computer program written by Westinghouse to process reactor operation data and calculate nominal boron concentrations. It is presently operational on the Virginia Electric and Power Company's IBM-370 computer system.

The FOLLOW Code is designed to describe the nearly linear relationship between available core reactivity and cycle burnup. It is most convenient to use boron as a measure of core reactivity with off nominal* corrections being made for power, xenon and samarium, temperature, and control rods in terms of their boron worth. These off nominal corrections are made as can be seen from this equation:

$$\begin{array}{l}
\text{corrected or nominal boron concentration} = \text{measured boron concentration} + \left[\text{inverse boron worth}\right] \left[\text{off nominal reactivity correction due to rod group 1 position}\right] \\
+ \text{off nominal reactivity correction due to rod group 2 position} + \text{off nominal reactivity correction due to moderator temperature} \\
+ \text{off nominal reactivity correction due to power} + \text{off nominal reactivity correction due to xenon and samarium behavior}\Big]
\end{array}$$

Options should be chosen so as to satisfy the above equation in ways appropriate to the reactor and its method of operation.

---

* Nominal conditions have generally meant hot full power equilibrium conditions with control rods at their upper limits.

The boric acid concentration in the primary loops of operating PWR's is typically measured one to three times per day. After proper normalization, this data is plotted against cycle burnup and form the "boron depletion curve". Since this curve is well behaved and nearly linear from beginning to end of the cycle, it can provide the following information:

1) Detection of abnormal (unexpected) behavior in core reactivity Technical Specifications require boron follow for this purpose.

2) Extrapolation to end-of-cycle life for scheduling refueling, or determination of end-of-life for contractual purposes.

3) Rate of loss of reactivity with burnup for confirmation of design procedures.

4) Indication of the need for updating reactivity coefficients needed for plant operation.

5) Best estimate of beginning of cycle, hot-full-power criticality under equilibrium conditions.

Appendix D

INCORE PROGRAM DESCRIPTION

INCORE is a data analysis computer program written by Westinghouse to process information obtained by in-core instrumentation. It is presently operational on the Virginia Electric and Power Company's IBM-370 computer system.

In the reduction of in-core flux and temperature measurements the INCORE code performs the following:

1. Reads input consisting of (a) a description of the amount and type of data to be read in (such as number of flux traces and thermocouple readings, etc.); (b) a description of the reactor when the measurements were made (such as power level, inlet and outlet temperature, etc.); (c) the actual data and information relevant to it (such as what flux thimbles were used, neutron cross sections of the sensor, etc.); (d) analytical information (such as calculated thimble fluxes); and (e) specification of options as to what thimbles will be employed in local power predictions, what calculations are to be done, etc.
2. Corrects raw pointwise flux measurements for background current, changes in power level between measurements, relative detector sensitivities, etc., to determine pointwise reaction rate in the flux thimbles.
3. Compares the measured reaction rates determined above with expected values and rejects data if they differ from expected values by more than an input rejection criteria. An error analysis is performed for subsequent determination of the uncertainty to attach to calculated peaking factors.

4. Computes relative local power in each fuel assembly, and in each fuel rod chosen for attention. Local relative power is computed as:

$$\frac{\left[\text{Reaction Rate in Flux Thimble}\right]_{\text{Measured}} \times \left[\frac{\text{Local Power}}{\text{Reaction Rate in Flux Thimble}}\right]_{\text{Analytical}}}{\left[\text{Average of Numerator for All Fuel in Core}\right]}$$

Local absolute power or heat flux is then computed by multiplying the above quantity by the average specific power or heat flux in the core determined from the measured total core power at the time the data were taken. A weighted average of data from all nearby thimbles can be used in determining local relative power. Different PDQ ratios of power to reaction rate are used depending on the control rod configuration at each elevation.

5. Calculates the relative quadrant powers and the power weighted average axial distribution in the core. The expected and measured power peaking factors are compared for each power generating region.

6. Outputs the twenty highest values of $F^N_{\Delta H}$ and F^N_Q in descending order with an identifying number so that hot spot locations in the core can be determined.

7. Calculates the rate at which burnup is being accumulated for four axial regions for each fueled area.

8. Corrects thermocouple data for calibration, and converts them to local enthalpy. Relative local enthalpy rise is then calculated using the vessel inlet and outlet temperatures and the core bypass flow. The local enthalpy rise measured by thermocouples is compared with

that predicted from flux measurements using relative local flow rates.

9. Calculates the margin to departure from nucleate boiling (DNB) using the W-3 correlation for selected channels.

10. Outputs the input data, parameters used, and major calculated values.

Appendix E

DENSIFICATION STRIP-CHART TRACES

The following nine figures are strip-chart recorder traces taken during the flux mapping process and show confirmed or potential power spikes encircled:

Figure No.	Thimble
1	B-8
2	J-7
3	G-9
4	G-14
5	F-6
6	N-7
7	J-5
8	L-11
9	D-12

FIGURE 1

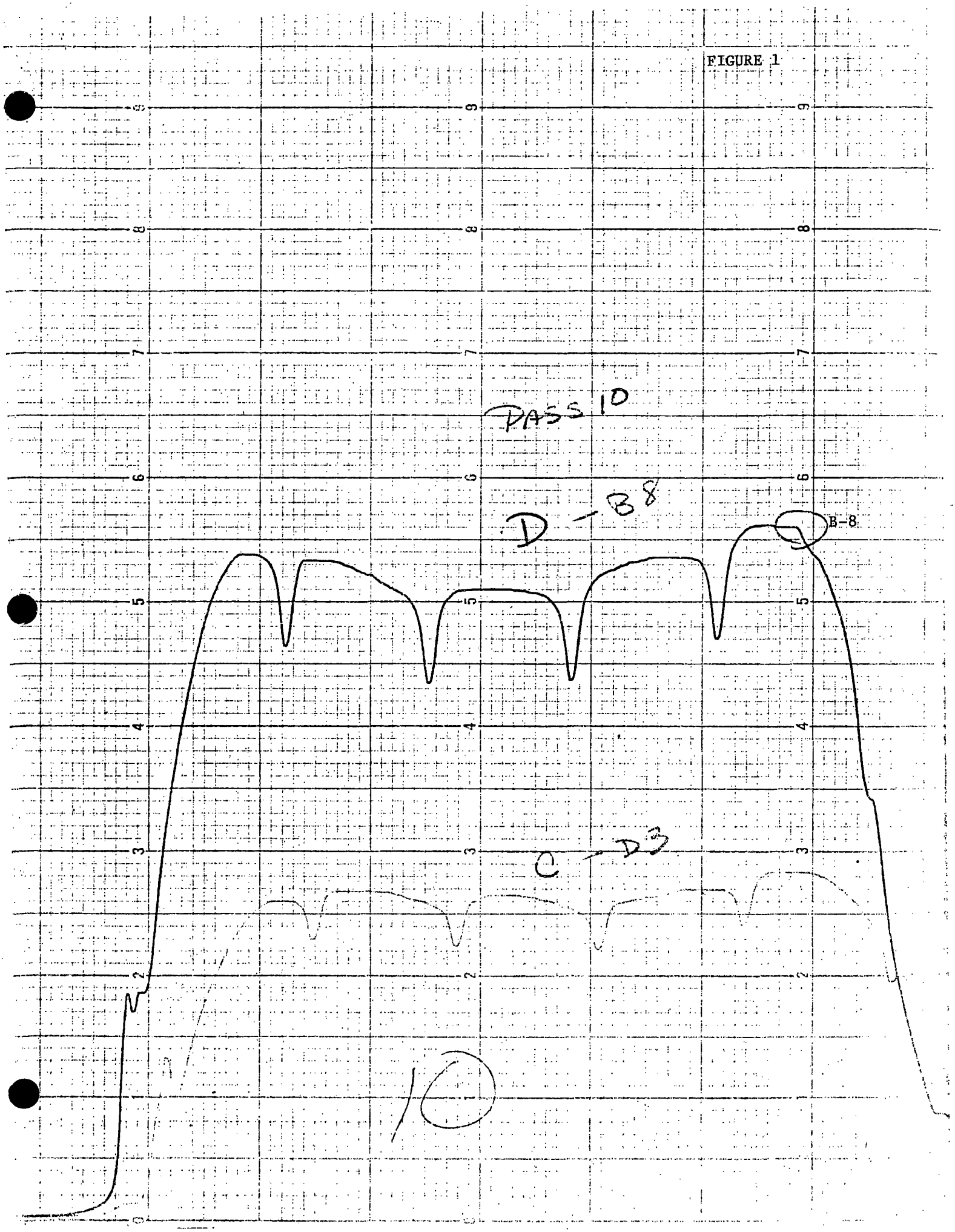


FIGURE 2

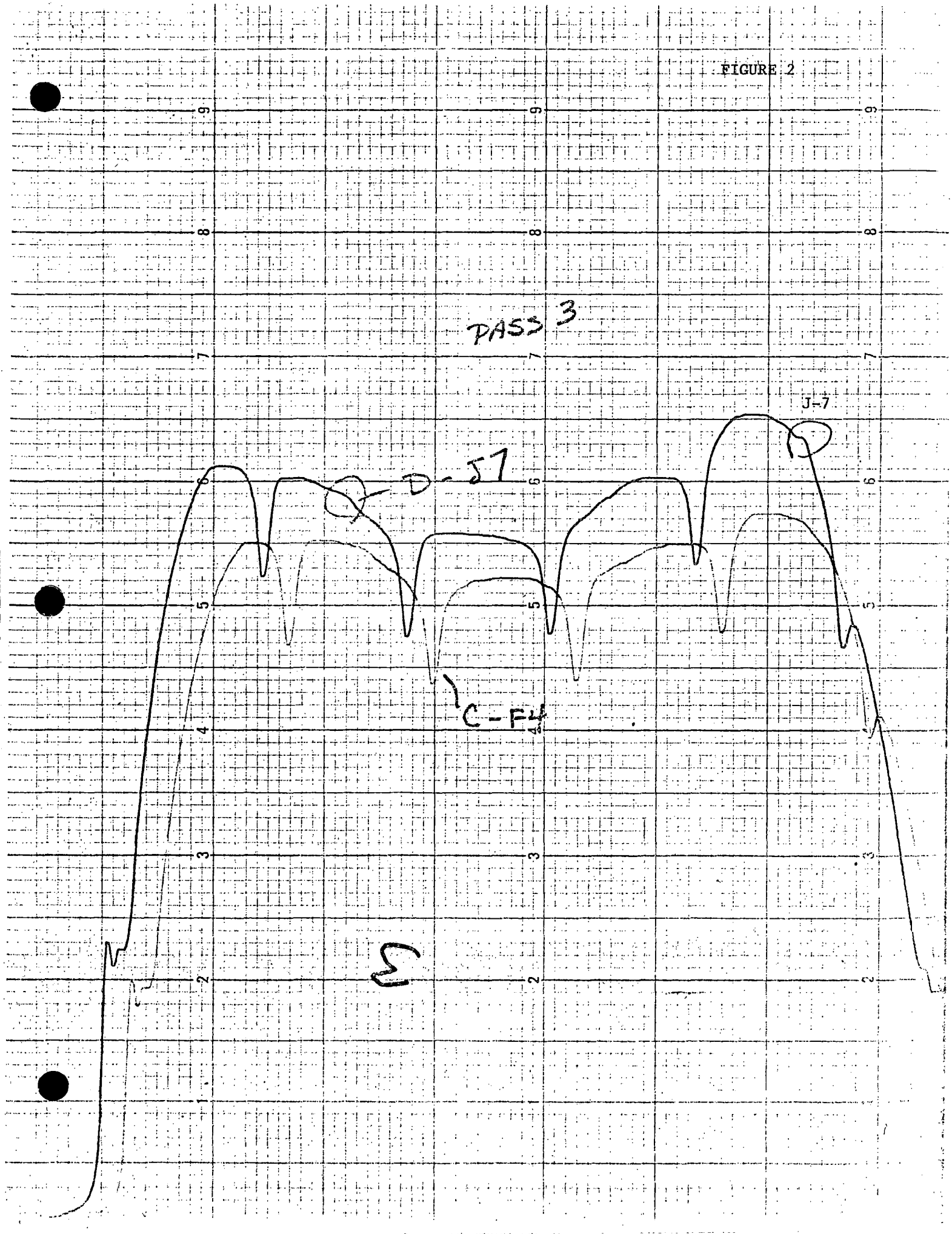
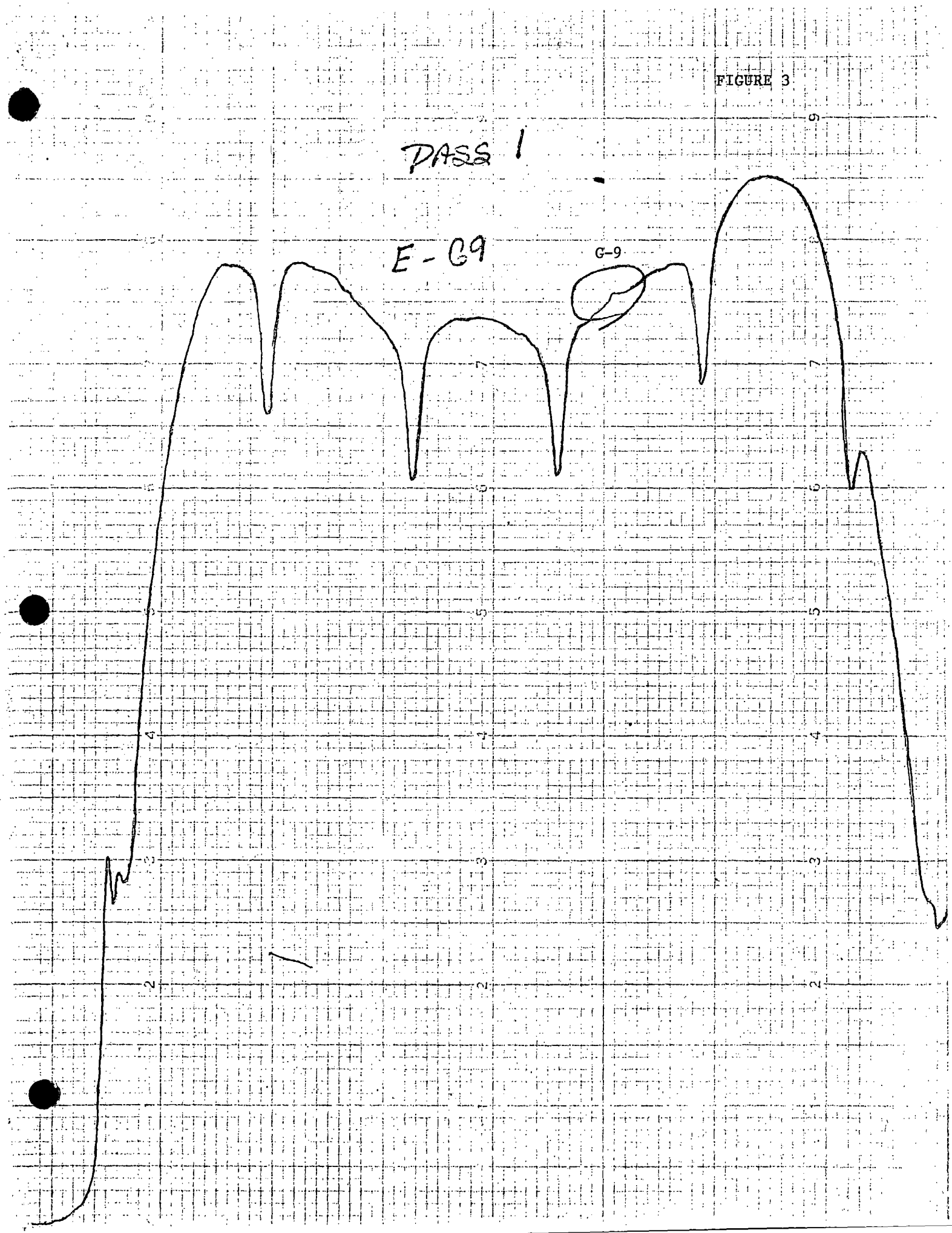


FIGURE 3



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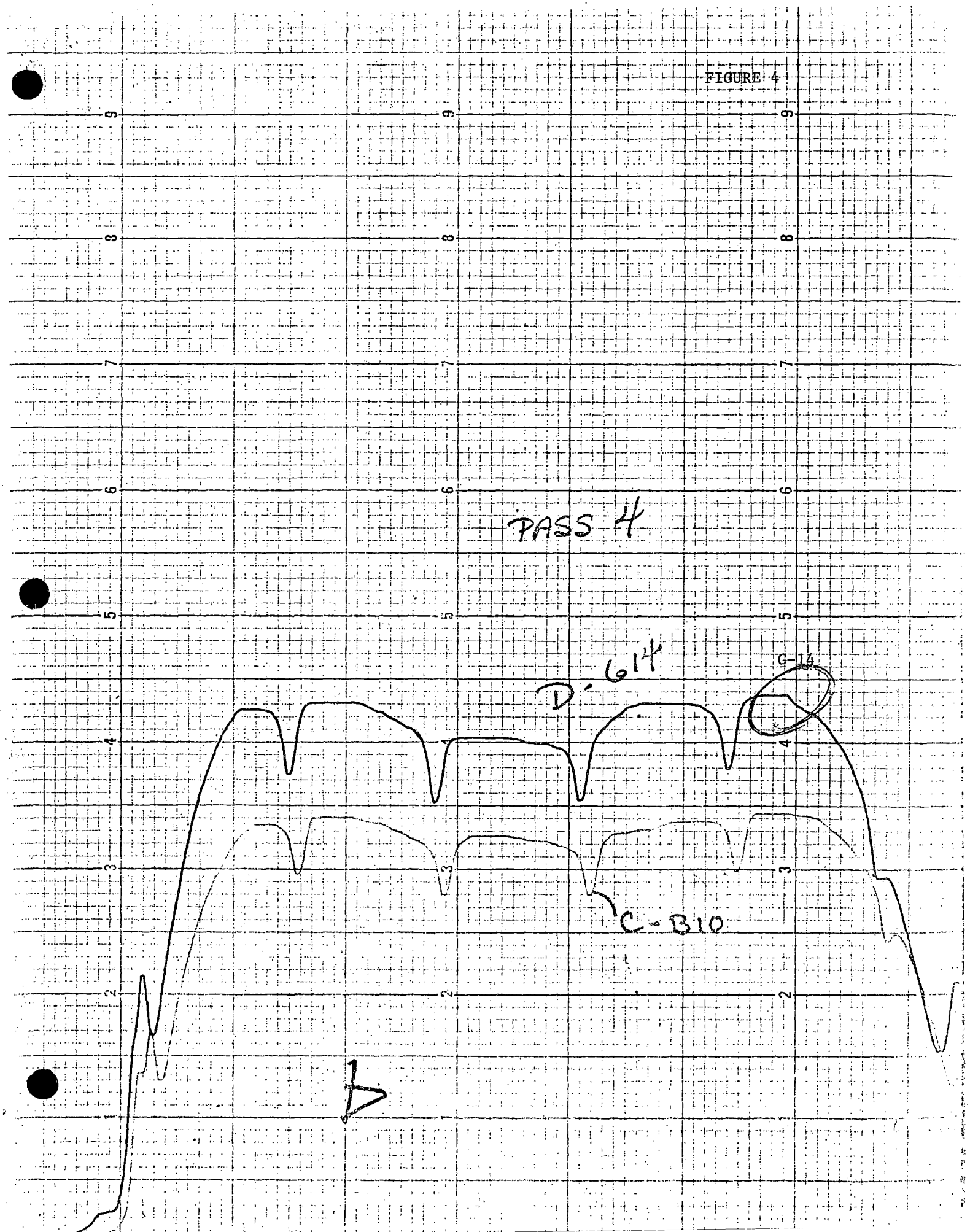

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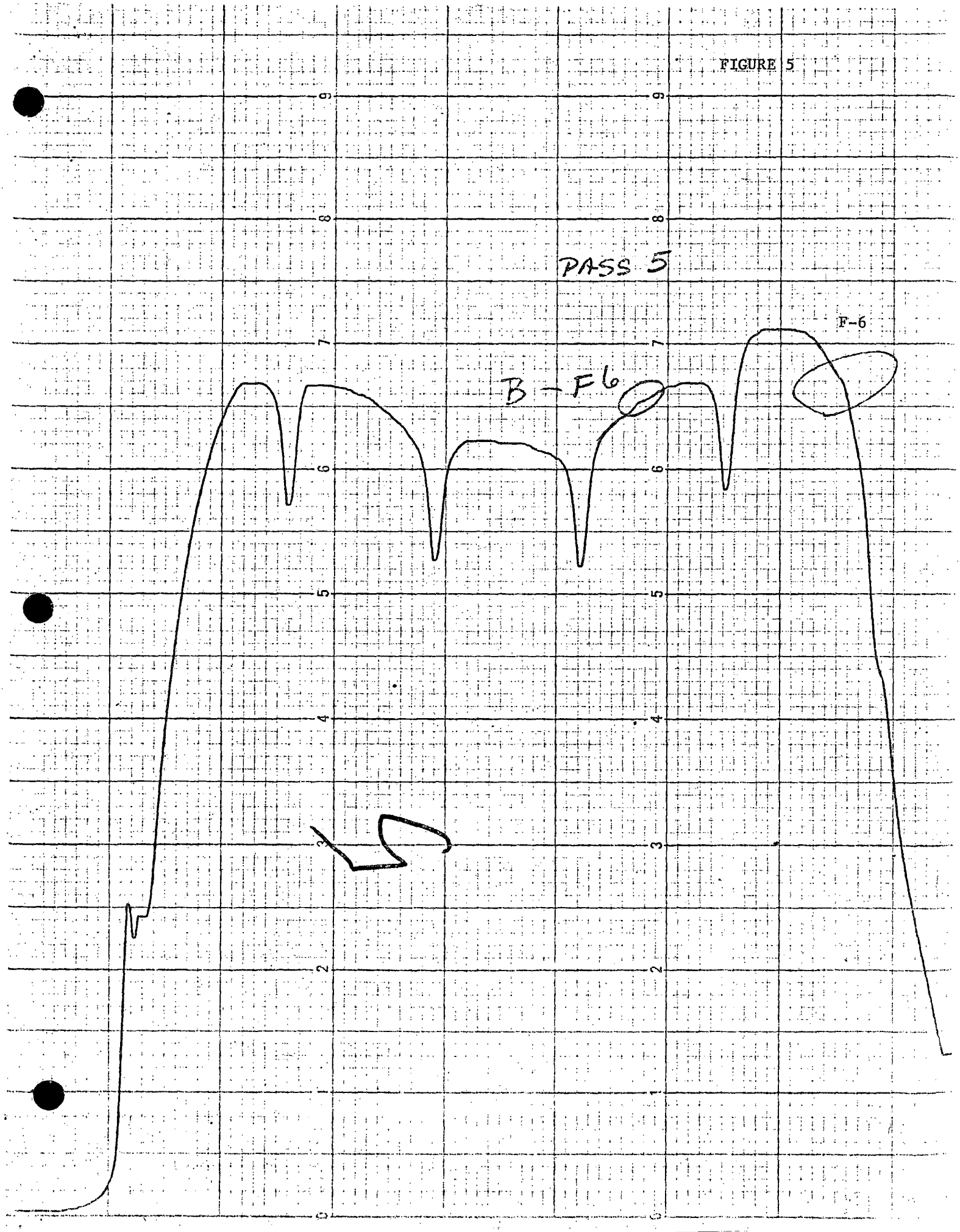


FIGURE 6

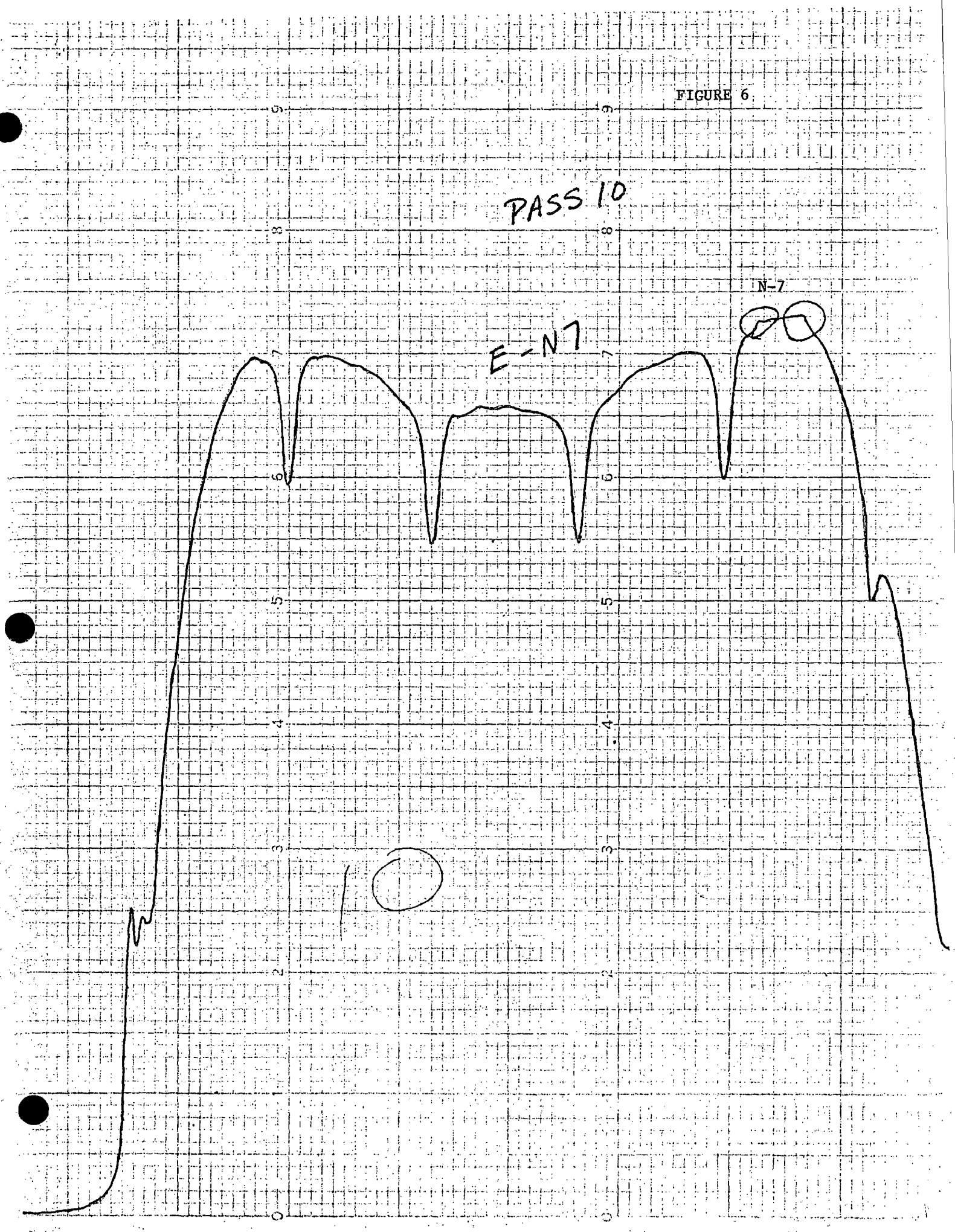


FIGURE 7

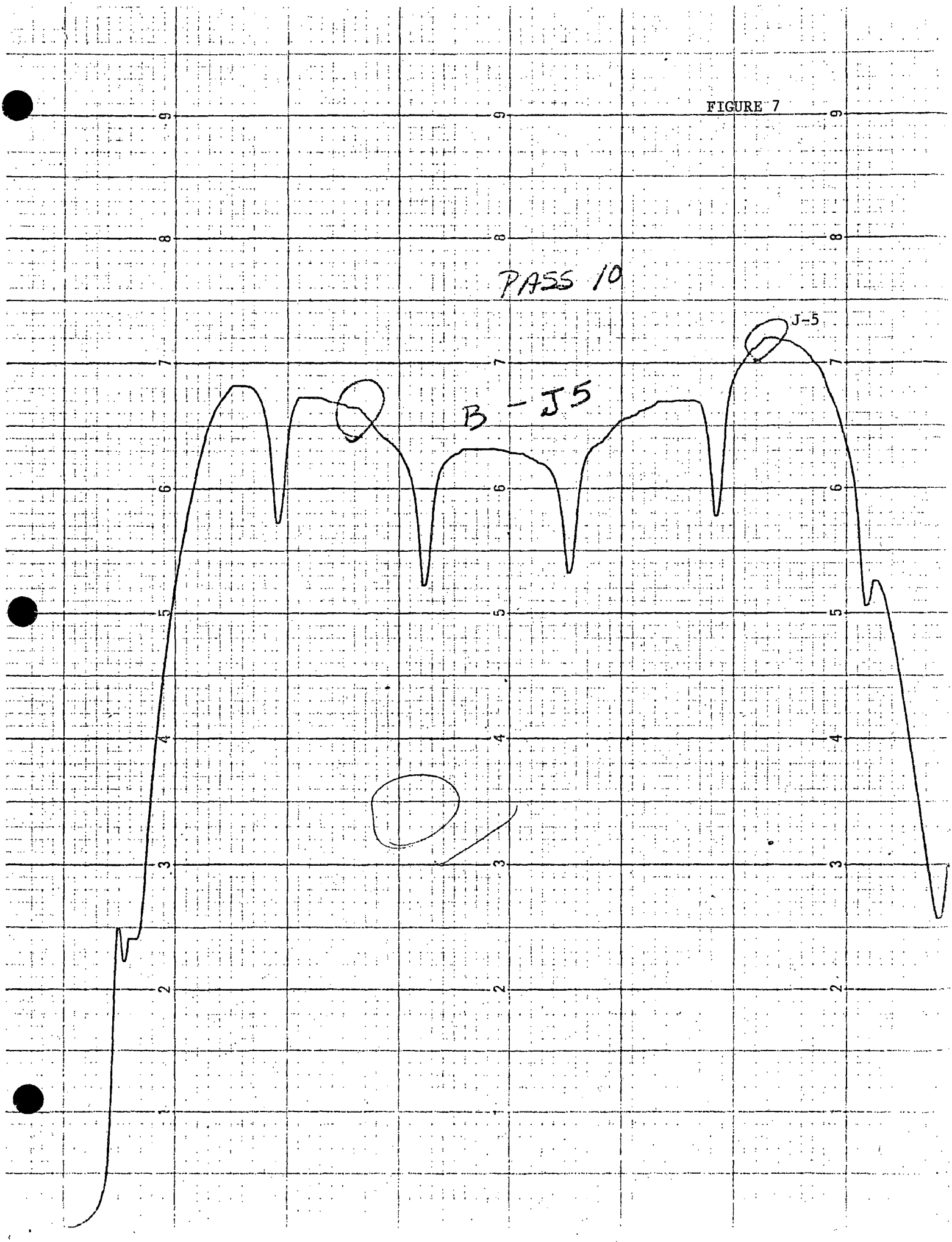


FIGURE 8

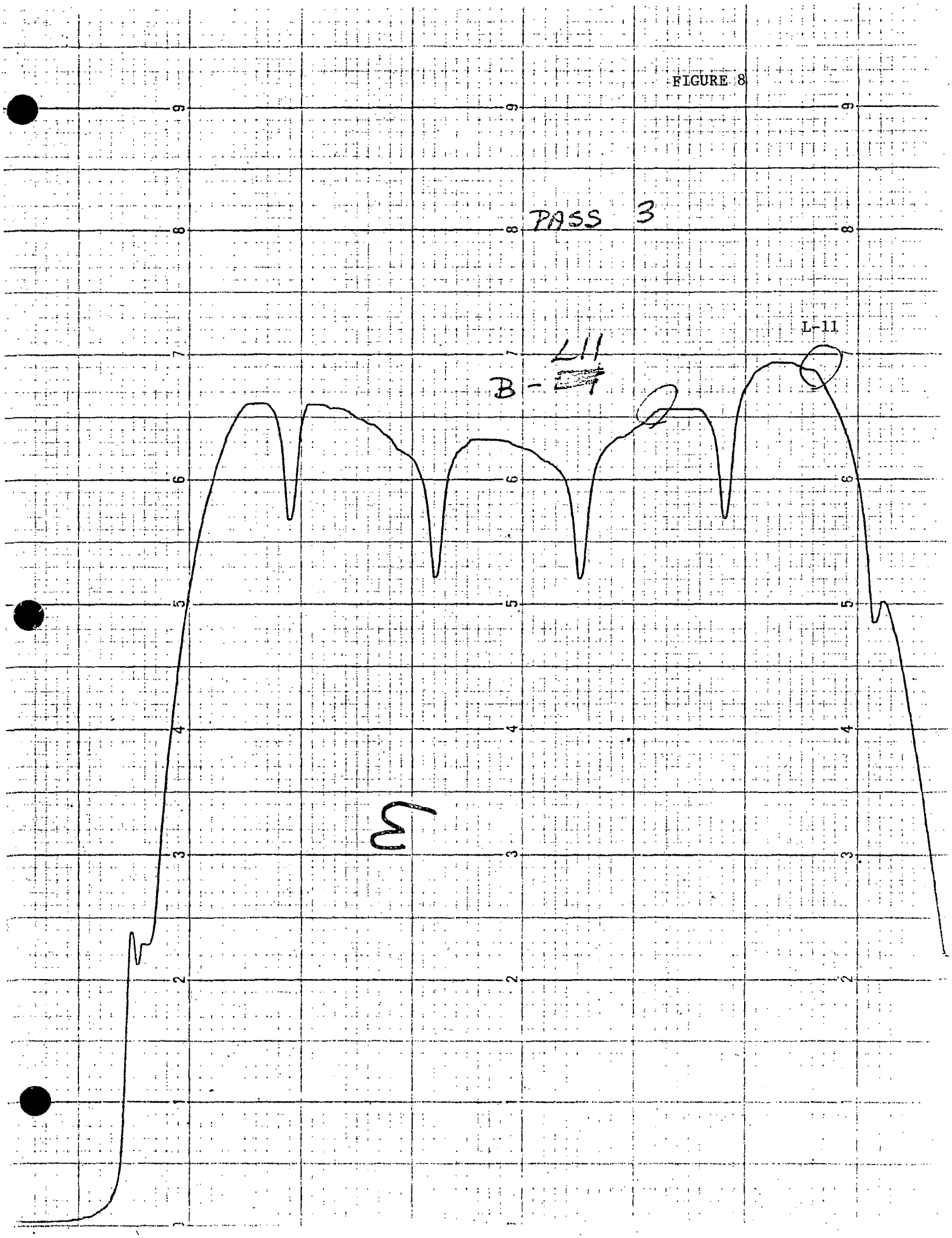
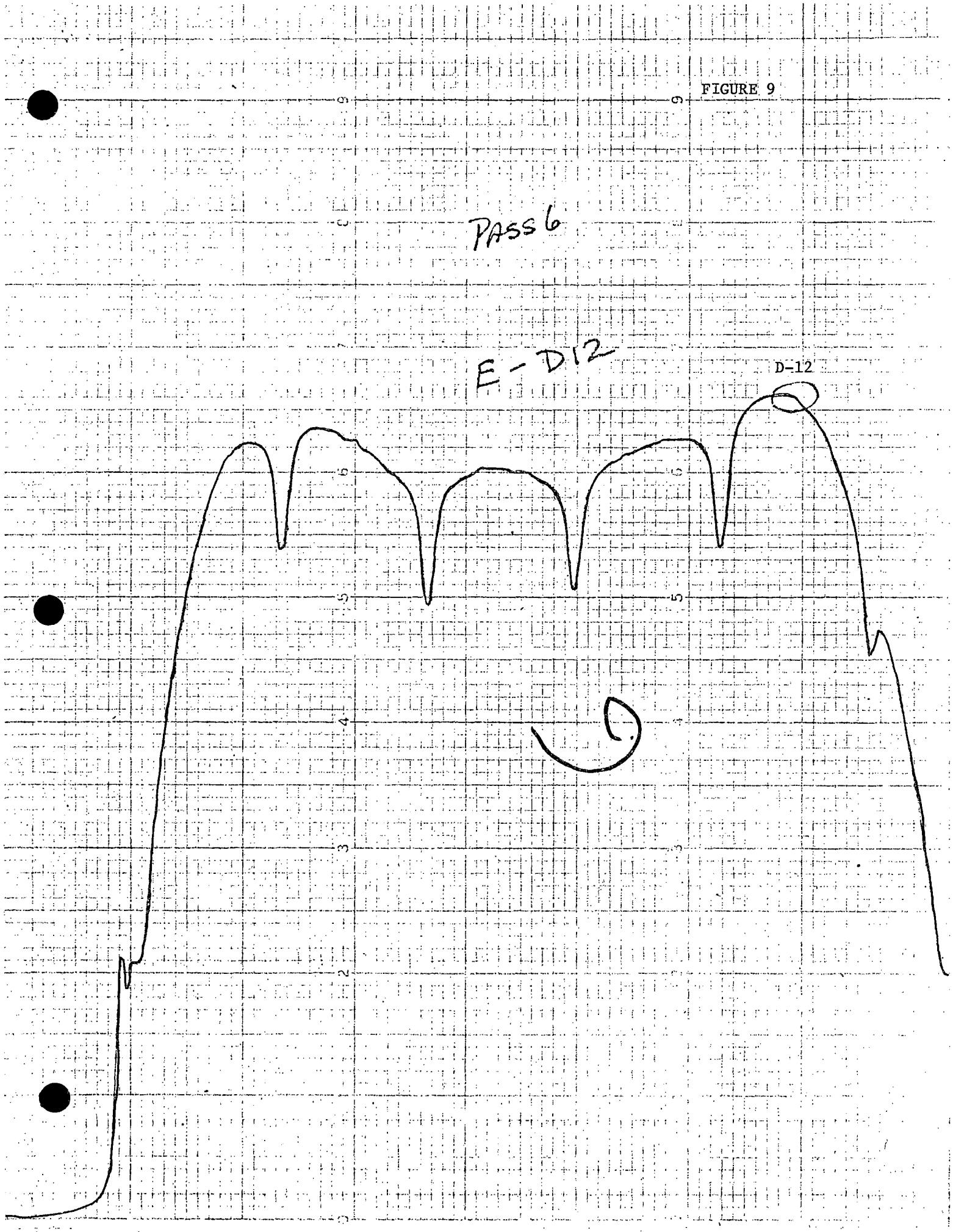


FIGURE 9



ACKNOWLEDGMENTS

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The authors want to express their appreciation to Mr. J. M. Huckabee for his assistance in preparing several of the figures and tables that went into this report.

11.5 CHANGES IN PROCEDURES

The following changes were made to the station procedures during the reporting period.

11.5.1 Administrative Procedures

A summary of the changes to Administrative Procedures made during the reporting period is presented in Table 10.5.1-1.

11.5.2 Abnormal Procedures

A summary of the changes to Abnormal Procedures made during the reporting period is presented in Table 10.5.2-1.

11.5.3 Annunciator Procedures

A summary of the changes to Annunciator Procedures made during the reporting period is presented in Table 10.5.3-1.

11.5.4 Chemistry and Health Physics Procedures

A summary of the changes to Chemistry and Health Physics Procedures made during the reporting period is presented in Table 10.5.4-1.

11.5.5 Emergency Procedures

A summary of the changes to Emergency Procedures made during the reporting period is presented in Table 10.5.5-1.

11.5.6 Maintenance Procedures

A summary of the changes to Maintenance Procedures made during the reporting period is presented in the following tables:

10.5.6-1 Mechanical Maintenance Procedures

10.5.6-2 Electrical Maintenance Procedures

10.5.6-3 Instrument Maintenance Procedures

11.5.7 Operating Procedures

A summary of the changes to Operating Procedures made during the reporting period is presented in the following tables:

10.5.7-1 Operating Procedures

10.5.7-2 Maintenance Procedures

11.5.8 Periodic Test Procedures

A summary of the changes to Periodic Test Procedures made during the reporting period is presented in Table 10.5.8-1.

11.5.9 Quality Control Procedures

A summary of the changes to Quality Control Procedures made during the reporting period is presented in Table 10.5.9-1.

11.5.10 Start-Up Test Procedures

A summary of the changes to Start-Up Test Procedures made during the reporting period is presented in Table 10.5.10-1.

11.5.11 Special Test Procedures

A summary of the changes to Special Test Procedures made during the reporting period is presented in Table 10.5.11-1.

11.6 UNIT 2 MAINTENANCE

The following is a summary of the maintenance performed during the report period.

11.6.1 Unit 2 Mechanical Maintenance

A summary of Unit 2 mechanical maintenance is tabulated in Table 11.6.1-1.

11.6.2 Unit 2 Electrical Maintenance

A summary of Unit 2 electrical maintenance is tabulated in Table 11.6.2-1.

11.6.3 Unit 2 Instrument Maintenance

A summary of Unit 2 instrument maintenance is tabulated in Table 11.6.3-1.

SURRY POWER STATION
UNIT NO. 2
MECHANICAL MAINTENANCE
JULY THROUGH DECEMBER, 1974

Table 11.6.1-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
7-03-74	Liquid Waste Evaporator Circ. Pump 1-LW-P-8	Leak on pump discharge line.	None	Renewed 1" SS line, weld procedure P8-10, MR-S2-1908.	N/A	8 Hrs.
7-04-74	Boron Injection Tank Discharge Valves MOV-1867 C & D	Suspected leakage, investigative.	None	Disassembled valves, lapped and blued seats & discs. Liquid penetrant inspection of discs. MR-S2-1910 & 1911.	Reactor at cold shutdown. MMP-C-001	2 Days
7-06-74	Main Steam Non-Return Valves NRV-MS-201A, B & C	Piston and disc assy. was broken.	None	Renewed piston & disc assy's, MR-S2-1009.	Reactor at cold shutdown. MMP-C-001.	10 Days
7-06-74	Steam Generator 2-RC-E-1B	Wastage of tubes.	None	Employed eddy current inspection and plugged (6) tubes, MR-S2-1877 and 1899.	Reactor at cold shutdown. MMP-C-RC-010.	8 Days
7-29-74	Charging Pump 2-CH-P-1B	Head gasket deterioration.	None	Renewed head gasket, MR-S2-1731.	Redundant pump available.	1½ Days
7-31-74	Liquid Waste Pump LW-P-2A	Normal wear of mechanical seal.	None	Renewed mechanical seal parts, MR-S2-1704.	N/A	10 Hrs.
7-31-74	Reactor Coolant Letdown Filter	High filter D/P.	None	Renewed filter assy. MR-S2-1835	None	10 Hrs.
8-06-74	Main Steam Trip Valves 2-MS-TV-201B, C	Rockshaft froze due to phosphate build up and mechanical binding.	None	Cleaned shafts and stuffing box, honed leakoff bushing, MR-S2-2099	Unit at cold shutdown.	24 Hrs.

Table 11.6.1-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
8-14-74	Component Cooling To Charging Pump 2-CC-P-2A	Normal wear, seal leakage.	None	Renewed pump shaft and mechanical seal, MR-S2-2164.	MMP-C-004	24 Hrs.
8-15-74	Component Cooling Pump to Charging Pump 2-CC-P-2A	Motor bearing.	None, redundant pump available.	Renewed bearings, MR-S2-2199.	MMP-C-004	8 Hrs.
8-20-74	Reactor Coolant Pressurizer Spray Line	While performing NDT-PT-100 in preparation for freeze seal on line for repairs to PCV-2455A, discovered linear indication.	None	Ground out inddcation and repair welded. Weld Procedure, P8-3, MR-S2-2265.	MMP-S-021, unit at cold shutdown.	4 Hrs.
8-20-74	Reactor Coolant Pressurizer Spray Valve PCV-2455A	Ruptured bellows on valve stem.	None	Renewed valve internals, MR-S2-2219	MMP-S-021, unit at cold shutdown.	7 Hrs.
8-21-74	Boron Injection Tank Inlet Valves MOV-2867 A & B	Valve leakage past seat, "A" valve seat scored.	None	Inspected, blued B valve inspected lapped and blued A valve, MMP-C-001, MR-S2-2234.	Unit at cold shutdown.	16 Hrs.
9-04-74	Boron Recovery Bottoms Filter, 1-BR-FL-3B	None, normal, high D.P.	None	Renewed filter basket, MR-S2-2317.	N/A	8 Hrs.
9-12-74	#2 Emergency Diesel	None, Annual PMP.	None	Annual preventative maintenance MMP-P-007, MR-S2-2364 & 2091	N/A	10 Hrs.
9-12-74	#3 Emergency Diesel	None, Annual PMP.	None	Annual preventative maintenance MR-S2-2366	N/A	5 Hrs.
9-21-74	Chemical & Volume Control System, HCV-2310	Body to bonnet gasket leak.	None	Renewed bonnet & cage gaskets, MR-S2-2382 & 2106.	N/A	2½ Hrs.
9-22-74	Reactor Coolant System Loop Stop Valve MOV-2595	Blown packing.	None	Repacked valve, MR-S2-1937 and 2392	Cold Shutdown	20 Hrs.

Table 11.6.1-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
9-22-74	Safety Injection Valves 2-SI-7 & 12	Packing leak, normal wear.	None	Repacked valves, renewed one (1) flange gasket, MR-S2-2424.	Cold shutdown.	3½ Hrs.
9-21-74	Main Steam Non-Return Valves, NRV-MS-201A, B & C	None. Installed modified discs.	None	Installed modified piston, disc assy., MR-S2-2412.	Cold shutdown.	6 Days
9-30-74	Emergency Service Water Pumps, SW-P-1A, B & C	None, annual PMP.	None	Performed annual preventative maintenance as per MMP-P-006, MR-S2-2458.	N/A	4 Days
10-09-74	Radiation Monitoring Pump RMS-259	Carbon vanes broken.	None	Renewed carbon vanes. MR-S2-2506	N/A	4 Hrs.
10-10-74	Gaseous Vent System Valve TV-VG-209A	Dirt - O - Rings	None	Cleaned valve and renewed O-Rings MR-S2-2494.	N/A	8 Hrs.
10-10-74	Radiation Monitor Trip Valves TV-RM-200 B & C	None, failed to pass leak rate test.	None	Cleaned, lapped and tested. MR-S2-2503.	Cold shutdown.	5 Hrs.
10-10-74	Safety Injection Accumulator Vent Valve 2-SI-231	None, failed to pass leak rate test.	None	Adjusted closing pressure. MR-S2-2516.	Cold shutdown.	1 Hr.
10-11-74	Steam Generators 1-RC-E-1, A,B,C	None, opened hand holes for inspection and sludge lancing.	None	Inspected and flushed sludge from tube sheets with primary grade water. MR-S2-2583.	Cold shutdown.	6 Days
10-18-74	Steam Generator 2-RC-E-1B	None, Eddy current inspection.	None	Eddy current inspection. MR-S2-2405	Cold shutdown.	8 Days
10-18-74	Steam Generator 2-RC-E-1A	None, Eddy current inspection.	None	Eddy current inspection. MR-S2-2393 & 2404	Cold shutdown.	9 Days
10-18-74	Steam Generator 2-RC-E-1C	None, Eddy current inspection.	None	Eddy current inspection. MR-S2-2406.	Cold shutdown.	9 Days

Table 11.6.1-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
10-18-74	Charging Pump Intermediate Seal Cooler 2-SW-E-1B	Erosion - tube bundle.	None	Renewed tube bundle. MR-S2-2444.	Cold shutdown	20 Hrs.
10-22-74	Charging Pump Service Water Pump 2-SW-P-10A	Normal wear, leaking seal.	None	Installed rebuilt pump. MR-S2-2580.	Cold shutdown.	20 Hrs.
10-23-74	Charging Pump Intermediate Seal Cooler ^-SW-E-1A	Erosion - tube bundle.	None	Renewed tube bundle. MR-S2-2443.	Cold shutdown.	8 Hrs.
10-23-74	RCC Change Fixture	None.	None	Extended tool length. MR-S2-2575	N/A	20 Hrs.
10-12-74	Reactor Coolant Valve 2-RC-160	Unknown, leaks by seat.	None	Cleaned valve internals, tested. MR-S2-2526.	N/A	2 Hrs.
10-17-74	Charging Pump Component Cooling Pump 2-CC-P-2A	Worn mechanical seal.	None	Renewed mechanical seal. MR-S2-2524.	N/A	16 Hrs.
10-23-74	E.H.C. System	Filters - normal use.	None	Renewed control valve filters and E.H. pump filters. MR-S2-2581.	N/A	7 Hrs.
10-19-74	Air Ejector Trip Valve TV-SOV-202	Unknown, leaks by seat.	None	Cleaned valve internals, tested. MR-S2-2554.	N/A	10 Hrs.
11-13-74	Service Air 2-SA-C-1	None, Annual PMP	None	Overhauled compressor. MR-S2-2325.	N/A	48 Hrs.
11-25-74	Safety Injection Valve SI-MOV-2842	Valve would not pass leak rate test PT-16.4	None	Lapped seat and disc. MR-S2-2573.	N/A	24 Hrs.
11-25-74	CVCS Valve FCV-2160	Valve would not pass leak rate test PT-16.4	None	Renewed plug, stem and cage assy. MR-S2-2572.	N/A	28 Hrs.

Table 11.6.1-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
9-07-74 12-17-74	#2 L.P. Turbines	Opened for investigation, found L.P. Turbine blade and shroud damage.	None	Emergency Repairs of L.P. Rotors MR-S2-2572.	Cold shutdown.	6 Weeks
12-19-74	Charging Pump Service Water Pump 2-SW-P-10B	None- mechanical seal leaking.	None	Replaced pump with rebuilt pump MR-S2-2782.	Cold shutdown.	6 Hrs.

SURRY POWER STATION
UNIT NO. 2
ELECTRICAL MAINTENANCE
JULY THROUGH DECEMBER, 1974

Table 11.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
7-02-74	EMG - 1,2,3 Batteries	Monthly battery inspection.	Specific gravity & volt readings taken on emergency diesel gatteries.	All readings were positive.	EMP-C-DC-02	4 Hrs.
7-01-74	TV-BD-200C, TV-BD-200D	Testing blowdown valves	Improved jumpers on cubicle 25H4 trip valves.	Fleeced jumps in cubicle 25H4.	Opened breaker. EMP-C-MOV-01.	1½ Hrs.
7-01-74	2-CH-35 B-Line Heat Trace 385-152	Low readings on AMA circuit.	Corrected low temperature alarm.	Recalibrated low temperature alarms. MR-S2-1987	EMP-C-HT-01.	1 Hr.
7-01-74	MOV-2867A	Test Mrj-750 mR bridge A-B-13.25, A-C-13.23, B-C-13.24.	Reactor at cold shutdown with positive test results.	Connect leads and bridge and megger.	Fuse disconnect EMP-C-MOV-01	2 Hrs.
7-01-74	PT-23.1 Station Service Battery Unit #2	Check battery test.	None.	Performed PT-23.1 on Unit #2.	Open breaker following PT-23.1 EMP-C-DC-01.	4 Hrs.
7-03-74	Heat Tracing Panel II, Circuit 5	Opened connection.	Connected an opened circuit and tested it after organizing exposed heat tracings.	Reconnected opened connection, took ampere readings & taped all exposed heat tracing to pipe.	Opened breaker, EMP-C-HT-01.	2 Hrs.
7-05-74	MOV - Main Steam NRV-MS-201C	Bridge and megger on motors.	Safety testing on Unit #2 to guarantee proper operation of non-return valves.	Reconnect motor and limit switches, then take bridge and megger readings.	EMP-C-MOV-01, open breakers	3 Hrs.

Table 11.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
7-05-74	MOV - Main Steam NRV-MS-201B	Bridge and megger on motors.	Motor testing on Unit #2 to insure correct operation of non-return valves.	Reconnect motor & limit switches then take bridge & megger readings.	EMP-C-MOV-01	3 Hrs.
7-05-74	MOV - Main Steam NRV-MS-201A	Bridge and megger on motors.	Motor testing on Unit #2 to quarantee proper functioning of non-return valves.	Reconnect motor & limit switches then take bridge & megger readings.	EMP-C-MOV-01	3 Hrs.
7-07-74	MOV-2595	Testing load on motor operated valve.	The MOV responded to every directive from the control room, indicating safe & reliable performance.	MOV was operated successfully from the motor control center & tested during open and closing process.	EMP-C-MOV-01	2 Hrs.
7-07-74	2-CS-P-1B	Switch contacts bf indicating lights failed to mesh.	New switches resulted in proper connections which made the green operating light work correctly.	Replaced switches on 2-CS-P-1B.	Reactor at cold shutdown.	1 Hr.
7-07-74	MOV-2594	Testing load on motor operated valve.	MOV responded positively to control room orders, indicating safe and effective performance.	Opening & closing tests for MOV were successful, and completed from control room.	EMP-C-MOV-01.	2 Hrs.
7-07-74	MOV-2590, 2591, 2593	Resetting switches on MOV's.	Electrically backseating valves provides positive control for starts or stops on MOV's.	Backseat MOV's to respond to control room switch.	EMP-C-MOV-01.	3 Hrs.
7-07-74	MOV-2587	Valve failed to close.	A thorough check of the MOV resulted after electronic and manual closing methods failed.	Load check on MOV & electronic closing methods failed.	EMP-C-MOV-01.	1 Hr.
7-07-74	2-SW-10A	Overload on motor.	Motor trip resulted from faulty packing on valve stem, which caused overloading after a short running time.	Checked control circuits, contact arrangements, & bridge & meggered. Faulty packing on valve was corrected. MR-S2-1923.	Reactor at cold shutdown.	1 Hr.
7-10-74	CH 245, 246, Panel 8 & 9	Maladjusted high-low temp. alarms.	Properly set limit switches on alarms provide safe indications as to the status of CH245 & 246.	Adjusted high limit to 190°F and low to 132°F. Ampere readings taken on panel 8 & 9.	RWP-1 work permit observed. EMP-C-HT-01.	

Table 11.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
7-13-74	S-SW-P-10A	Motor disconnected for mechanical dept.	Service water pump connected after repair to Unit #2 valves.	Motor connected & bridge, load check & megger tests performed.	EMP-C-SW-01	1½ Hrs.
7-16-74	Units 1 & 2 Electrical Penetrations	Low pressures.	Nitrogen restored to correct levels.	Filled all low pressures to normal pressure.	PT-34	½ Hr.
7-18-74	Containment Spray 2-CS-P-1B	Loose connection resulted in no indication light.	Indication light for containment spray in control rm. was repaired	Checked control rm. lights and found loose connection, which was tightened. MR-S2-1918	EMP-CS-P-01	1 Hr.
7-19-74	Instrument Air Compressor Alarm Panel	Improper alarm drops.	Corrected alarm failure & tested to insure proper alarm response.	Cleaned drops and adjusted reset arm.	Opened breaker, EMP-C-1A-01.	1 Hr.
7-23-74	SOV-MS-202	Solenoid valve burned open.	Burned opened main steam solenoid valve repaired and satisfactorily tested to insure closing when needed.	Replaced same type of coil as present. Energized & tested. MR-S2-2023	EMP-C-SOV-01	2 Hrs.
7-23-74	SOV-2853C	Dirty valve.	Solenoid valve will now open freely after being cleaned.	Removed solenoids and cleaned small stones from inside valve body.	EMP-C-SOV-01.	1½ Hrs.
7-24-74	Station Batteries	Periodic testing 23.1 & 23.2	Station battery tests indicate power capacity of station service	Took all required readings and entered them on operating forms.	None, EMP-C-DC-01.	8 Hrs.
7-26-74	Emergency Diesel Batteries	Clean batteries in normal maintenance.	Normal battery maint. resulted in proper upkeep of batteries.	Batteries thoroughly cleaned on #1,2, & 3 emergency diesels.	EMP-C-DC-02	4 Hrs.
7-30-74	Emergency Diesels 1,2, & 3	Monthly battery check.	Emergency diesel batteries tested with normal results insureing proper operation.	Batteries checked on 1,2, and 3 emergency diesel batteries.	EMP-C-DC-02	2 Hrs.
7-31-74	2-1A-C-2A Instrument Air Compressor	Trouble alarm.	2-1A-C-2A alarm system under repair by Mech. Dept.	Access load on start up triggers alarm. Problem referred to Mech. Dept. for maint. order.	EMP-C-1A-01.	½ Hr.

Table 11.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
7-31-74	MOV-AS-200, FCV-CN-207 Hydrogen Supply Pressure Alarm, & Moisture Alarm	Removed tags from circuits.	Tag out of aux. steam and condensate pump motors after maintenance	Tag out circuits and re-routed conduits.	EMP-C-MOV-01, EMP-C-CN-01	3 Hrs.
8-06-74	2-FW-P-1A	Improperly set motor on feed water pump.	2-FW-P-1A tripped while being started. Corrective testing was run on motor.	Motor was bridged and meggered with positive results. MR-S2-2131	MR-S2-2131	1 Hr.
8-06-74	MS-TV-201 A,B,C	Improperly set main steam trip valves.	Trip valves set properly and tested between 5° adn 6°.	Remounted paper olders on MS-TV-201 A,B,C. Adjusted limit switches for 6° stroke test.	EMP-C-MS-01.	2 Hrs.
8-12-74	2-CC-P-2A	Faulty check valve on 2-CC-P-2B.	Back flow from check valve on 2-CC-P-2B resulted in pump movement. All electrical circuits are in proper condition and valve check is urged.	Pump continued to move after meter shut off. Checked electrical circuits and contacts. MR-S2-2163	EMP-S-PL-02.	½ Hr.
8-16-74	RL-VG-102	Open breaker prevented motor from running.	None.	Closed an open breaker and ran motor. Testing indicates proper operation. MR-S2-2193	N/A	½ Hr.
8-20-74	MOV-2289-B	Thermal trip on MOV.	Motor operated valve returned to service after successful testing.	Removed cover on MOV bridge and megger, reset torque switch and tested. MR-S2-0231	EMP-C-MOV-01 SRWP-1	1 Hr.
8-20-74	MOV-VS-200D	Reported valve would not open.	After manual operation of MOV, it operated correctly.	Checked control circuit at motor control center checked and load recorded. MR-S2-2230	EMP-C-MOV-01	1 Hr.
8-21-74	2-SW-P-10B	Disconnect motor.	Service water pump motor disconnected for repair by mechanics.	Motor disconnected for mechanics to repair. MR-S2-2245, 0239.	EMP-MOV-C-01	1 Hr.

Table 11.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
8-21-74	MOV-2867A MOV-2867B	Reconnect motors.	Motor operated valves installed and tested ran at satisfactory performance level.	Motors connected, bridge, meggered and load check readings taken.	EMP-C-MOV-01 SWP-1	2 Hrs.
8-21-74	MOV-2592	Needed limit switch made up.	Motor operated valve now has limit switch for automatic shutdown.	Opened valve fully and had circuit made up. All test satisfactory.	MEP-C-MOV-01.	2 Hrs.
8-21-74	2-SW-P-10B	Reconnect motor leads.	After properly installing motor leads on service water pump, motor tested satisfactorily.	Motor leads connected, bridge and megger and checked at motor control center.	EMP-C-MOV-01.	1 Hr.
8-22-74	Pressure Relief Isolation Valve MOV-2536	Valve would not open.	Monitoring the circuit as control room ran tests indicated a closed circuit.	Watched motor control center while control room cycled valve. MR-S2-2217	EMP-C-MOC-01.	½ Hr.
8-22-74	MOV-SW-204 A,B,C MOV-SW-205 A.B.C	Motors tripped on overload.	Motor operated valves operated properly after overload reset.	Cycled MOV's by hand, operated valves electrically.	EMP-C-MOV-01	1 Hr.
8-27-74	2-CC-P-2B	Test readings.	Bridge and megger motor.	Megger: 500 MΩ Bridge: T1-T2 4.584Ω T2-T3 4.577Ω T1-T3 4.543Ω	PT 17.3	½ Hr.
9-03-74	Emergency Diesel Generators	Monthly battery check.	Check specific gravity and voltage.	All tests satisfactory.	EMP-C-DC-02	3 Hrs.
9-05-74	2-RS-P-2B	Recirculation spray vibration alarm out of adjustment.	Vibration alarm during PT-17.3.	Adjusted setpoint and tested for satisfactory operation.		½ Hr.
9-10-74	2-DA-P-4A Sump Pump	Motor to be reconnected.	Motor disconnected for mechanics.	Connected bridged and meggered motor. Test results positive.	Opened breaker.	1 Hr.
9-16-74	GW-F-1B	Motor shorted to ground.	Overload tripped.	Water in tank; not able to remove motor at this time. MR-S2-2378		½ Hr.
9-19-74	RM-GW-109 Radiation Monitor	Wrong take-up spool.	Operation can not read.	Replaced with correct one. MR-S2-2292		1½ Hrs.

Table 11.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
9-19-74	MOV-2595	Disconnected for mechanics.	None.	Disconnected motor and control leads.	Opened circuit	2 Hrs.
9-20-74	1-VS-E-4C	Chiller capacity control valve out of adjustment.	Chiller unit will not cool; two units still operational.	Adjusted capacity control and tested for correct operation. MR-S2-2390	MR-S2-2390.	3 Hrs.
9-22-74	2-1A-C-2A	Motor burnt-up.	Overload heater melted, motor bridge readings not balanced low resistance to ground.	Motor to be rewound-replaced heaters.	SEMP-PL-02	1 Hr.
9-22-74	RL-RMS-2S-9	Pump not operating.	Pump was found to be operating.	Adjusted flow to normal setting. MR-S2-1942	MR-S2-1942	2 Hrs.
9-23-74	MOV-2867A	Disconnect for mechanics.	None- Unit 2 at cold shutdown.	Disconnected motor.	EMP-C-01.	1½ Hrs.
9-23-74	MS-NRV-201A,B,C	Reset limit switches after mechanical repairs.	None - Unit 2 at cold shutdown.	Replaced limit switch 201C and adjusted all limit switches.	Opened circuit.	6 Hrs.
9-23-74	MOV-FW-251-B	Disconnect for mechanics.	Unit 2 at cold shutdown.	Disconnect for mechanics. MR-S2-2419	EMP-S-18	2 Hrs.
9-23-74	MOV-2595	Reconnect motor.	Mechanics work complete.	Reconnect motor, bridge, megger and set limits, all test results positive.	EMP-S-18	3 Hrs.
9-23-74	2-1A-C-2A	Remove motor for repair.	Unit 2 at cold shutdown.	Motor beyond repair, Ordered new motor.	SEMP-02	4 Hrs.
9-23-74	Radiation Monitor RMS 259	Filter advance binding.	Filter advance not operating.	Cleaned and lubricated. MR-S2-2426.	SEMP-RM-01	3 Hrs.
9-24-74	RMS-153	Cable guide pully broke loose from safety cable.	None.	Repositioned cable guide pully and reattached to safety cable. MR-S2-2434 .	MR-S2-2434	½ Hr.

Table 11.6.2-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
9-29-74	Station Batteries	Perform PT-23.1	Unit 2 at cold shutdown.	All tests satisfactory.	PT-23.1	2 Hrs.
9-29-74	MOV-2867-A MOV-2867-B	Reconnect for Mech.	Unit 2 at cold shutdown.	Reconnected, bridge and megger, test satisfactory.	EMP-C-MOV-01	2 Hrs.
9-30-74	Station Batteries 1A, 1B, 2A, 2B	Monthly test.	Unit 2 at cold shutdown.	All tests satisfactory.	PT-23.1	6 Hrs.
10-01-74	2-RCP-1A, 1B, 1C	Suspected oil leak.	None.	Hydrostatic test lower oil cooler.	Unit at cold shutdown.	13½ Hrs.
10-01-74	2-RCP-1A	Testing & inspection.	None.	Drained upper oil pot and cooler, filled with industrial 21.	Unit at cold shutdown.	1½ Hrs.
10-05-74	2-1A-C-2A	Motor burnt up.	Compressor will not run.	Replaced motor, bridge and megger satisfactory.	Unit at cold shutdown.	5 Hrs.
10-08-74	2-RCP-1A, 1B, 1C	Suspected insulation melting.	None.	No problems found.	Unit at cold shutdown.	2 Hrs.
10-16-74	HCV-2200C	Incorrect wiring.	Valve will not close.	Not complete.	Unit at cold shutdown	5 Hrs.
11-06-74	Part Length Control Rods	Disconnect.	None.	Take resistance reading on part length control rods.	Unit at cold shutdown.	10 Hrs.
11-15-74	TV-RM-200B,C	33 Contact out of adjustment.	Light indicates open continuously.	Adjusted 33 contact, all normal.	N/A	3 Hrs.
12-04-74	#2 Emergency Generator	Diesel will not idle and stops to quickly.		Adjusted idle speed and time delay relay. MR-S2-2642.	Unit at cold shutdown.	2 Hrs.
12-04-74	#3 Emergency Diesel	High L.O. Temperature at shutdown.	None.	Recommended change to 160°F high and 115°F normal. MR-S2-2721.	Unit at cold shutdown.	1 Hr.
12-04-74	#2 Emergency Diesel	Fuel System Alarm will not lock in.	None.	No trouble found. MR-S2-2592.	Unit at cold shutdown.	½ Hr.

SURRY POWER STATION
UNIT NO. 2
INSTRUMENTATION & CONTROLS
JULY THROUGH DECEMBER, 1974

Table 11.6.3-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
7-02-74	Narrow Range Steam Generator Level B Protection Channel 3 LT-2-486	Electronic drift of zero span.	During routine calibration check with unit at cold shutdown LT-2-486 was found to have drifted 119MV on bias and 30 MV on span. Redundant instruments were within spec.	Ran complete calibration check of all steam generator levels including wide range and found them to be within spec.	Placed channel in test, used approved procedures. Reactor at cold shutdown with redundant channels in service.	8 Hrs.
7-13-74	LT-930 Accumulator Tank 3 Level	While operations were performing a check valve leakage test prior to criticality the transmitter knife edge became dislocated causing 100% level indication.	Redundant instrument was in service providing normal indication, no adverse effect on safe operation.	Placed knife edge in proper position, checked calibration of transmitter, results satisfactory.	Used approved procedures, redundant channels in service and normal.	1 Hr.
7-13-74	FT-2-426 Reactor Coolant Flow	Electronic bias drift.	Redundant channels did not agree. Redundant instruments were in service and operating normally. No adverse effect on safe operation.	Checked calibration of transmitter, adjusted bias, returned to service.	Placed channel in test, used approved procedures.	1 Hr.
7-14-74	LT-2-494 Steam Generator C Narrow Range Level Protection Channel 2	Air in transmitter and sludge in the sensing lines.	Transmitter was indicating 30% higher than redundant channels. No adverse effect on safe operation, channel was placed in test.	Vented transmitter and blew down sensing lines, returned to service. Transmitter returned to normal indication.	Placed channel in test, used approved procedures.	1 Hr.
8-10-74	Reactor Coolant Temp. Channel 1 Protection Over Power Delta T Setpoint Summator TM-2-412G	Electronic span shift.	The over power trip setpoint was 5% high on the high end of the span which would have resulted in a late trip signal generation from channel 1 protection.	Replaced module with a spare unit immediately, calibrated, checked for proper operation by performing PT-2.1	Channel in test redundant channels in service and operating normally. Used approved procedure.	4 Hrs.

Table 11.6.3-1

Date	System or Component Involved	Cause of the Malfunction	Results and Effect On Safe Operation	Corrective Action Taken To Prevent Repetition	Precautions Taken To Provide for Reactor Safety During Repair	Time Req'd For Maint.
8-25-74	Protection Channel 3 Pressurizer High Level Trip Comparator LC-1-461A output No. 1	Electronic drift.	The comparator was found to be operating 13MV. in the non-conservative direction which would have generated a trip signal at 92.25% rather than 92% as per specification.	Recalibrated comparator, checked for proper operation returned to service.	Channel in test, redundant instruments in service & normal, used approved procedures.	1 Hr.
9-19-74	Pressurizer Level Comparator LC-1-459A	Electronic component failure. Rendered both A & B outputs inoperable.	Both the high level trip and low level safety injection signals failed to operate. Comparator would not trip.	Replaced faulty module with a spare unit. Calibrated to proper setpoints, checked by performing Periodic Test. Results satisfactory.	Placed channel in test. Used approved procedure. Redundant channels in service.	1 Hr.
9-20-74	Pressurizer Level Comparator LC-1-461A Output No. 1 High Level Reactor Trip	Electronic drift.	The High Level Reactor Trip would have occurred at 92.15% rather than 92% which is .15% in the non-conservative direction.	Replaced faulty module with a spare unit. Calibrated to proper setpoints. Performed Periodic Test. Results Satisfactory	Placed channel in test. Used approved procedure. Redundant channels in service.	1 Hr.
11-08-74	Reactor Coolant Flow Comparator FC-1-425 Setpoint Drift	Electronic component drift.	The setpoint had drifted from a normal 92% trip to 93.5% which is 1.5% in the conservative direction. The trip occurred early.	Calibrated comparator, checked trip setting numerous times to assure repetition.	Reactor at cold shutdown, redundant channels in service, used approved procedure.	1 Hr.
11-19-74	Intake Canal Level Circulating Water Magnetic Amplifier Switch LS-CW-101C Setpoint Drift	Electronic drift resulted in a setpoint change.	This switch in series with the same switch on Unit #2 will shut down the reactor on canal low level via a turbine trip. Due to the magnitude of the drift a turbine trip would not be initiated.	Recalibrated the magnetic switch to the proper setpoint, will increase suveillance to insure no further malfunction. Submitted design change to replace Mag amp with a comparator.	Both units at cold shutdown used approved procedures.	1 Hr.

11.7 RESULTS OF SURVEILLANCE TESTS

The majority of periodic test results for July were satisfactory; however, the following problems were noted:

a) PT-5.0 - Analog Rod Position Instrumentation, 7-20-74

It was necessary to reset the bistable setpoints on rod channel J-9. Trips were occurring at an improper voltage and step reading.

b) PT-6.0 - Control Rod Assembly Movement, 7-12-74

The difference in the Bank Overlap Counter reading and the Bank D Step Counter reading was greater than the allowable difference. Counters were realigned.

c) PT-8.3A - Safety Injection System Logic (Normal Conditions) 7-21-74

The red indicator light for the "F-2" ("Steam Generator Hi Level") annunciator would not lock in. The problem was corrected after the issuance of Maintenance Order 2013.

d) PT-26.1 - Radiation Monitoring Equipment Check

1) 7-6-74 - A problem was encountered with the radiation monitor RM-SW-220. Maintenance Order 1920 was issued which reinstalled N_2 purge and changed detectors. The problem was corrected and was operating properly on 7-8-74.

2) 7-13-74 - Again a problem was encountered with radiation monitor RM-SW-220. Maintenance Order 1974 replaced the rotary solenoid and rectifier bridge. The monitor performed properly for the performance test on 8-17-74.

3) 7-28-74 - RM-SW-220 again gave improper data. The problem was immediately corrected and proper readings were received for the PT on the following day.

e) PT-36 - Instrumentation Check, 7-14-74

LI-2-494, Steam Generator "A" narrow range detector, was not energized. The proper number of channels were functioning and no violation of technical specification occurred. The problem was corrected.

The majority of periodic test results for August were satisfactory; however, the following problems were noted:

a) PT-2.1 - Reactor Coolant Temperature, 8-11-74

Temperature monitor TM-412G shifted 5% and caused the overpower ΔT to be too high in the non-conservative direction. The deviation was classified as an abnormal occurrence, and the monitor was replaced and calibrated.

b) PT-2.10 - Feedwater Flow - 8-18-74

Multiplier divider FM-2-486 drifted out of specifications in the conservative direction. A new module was installed. Test was performed successfully following maintenance.

c) PT-6.0 - Control Rod Assembly Partial Movement - 8-23-74

Analog rod position indicators failed to indicate proper insertion for control rod assemblies G3, C9, N7, L5 and M12. Indicators were realigned.

d) PT-10 - Reactor Coolant Leakage - 8-19-74

Identified leakage from other than control leakage sources was greater than 1 gpm limit. The source of the leak was the packing of PCV-2456. It was necessary to shut the unit down to repair the leak.

e) PT-14 - Main Steam Line Trip Valves - 8-10-74

Main steam line trip valves failed to stroke the required 6°.

TV-MS-201B slammed shut when tested the second time and a unit trip resulted. The deviation was classified as an abnormal occurrence. Failure was due to binding in the valve bushings. The periodic test was completed successfully on 8-6-74 following maintenance.

f) PT-26.1 - Radiation Monitoring Equipment - 8-19-74

Radiation monitor RM-SW-220 failed to respond to check source. Maintenance order 2224 was submitted, and the problem was corrected.

g) PT-29.1A - Turbine Main Steam Stop and Governor Valve Test, 8-2-74.

Stop valve #3 failed to indicate shut. The problem was corrected following maintenance.

h) PT-34 - Electrical Penetration Leakage Test

Several electrical penetrations indicated a loss of pressure. In each case, the penetrations were recharged to the correct pressure.

The majority of periodic test results for September were satisfactory; however, the following problems were noted:

a) PT-2.1A - Reactor Coolant Wide Range Temperature, 9-10-74

Summator TM-2-420-B was noisy. A new summator was installed, calibrated and performed satisfactory.

b) PT-6.0 - Control Rod Assembly Partial Movement, 9-6-74

The difference between the Bank overlap counter reading and the Bank D step counter reading was greater than that allowed. Counters were realigned.

c) PT-34 - Electrical Penetration Leakage Test

Several electrical penetrations indicated a loss of pressure.

In each case, the penetrations were recharged to the correct pressure.

d) PT-36 - Instrumentation Check, 9-7-74

The deviation in source range instrumentation was greater than allowed. The problem was promptly corrected.

The majority of periodic test results for October were satisfactory; however, the following problems were noted:

a) PT-2.10 - Feedwater Flow, 10-10-74

Comparible readings for low flow, two loop operation were not received from multiplier divider TP-2-486-7. Instrument was replaced and calibrated. No violation of protective setting occurred.

b) PT-26.1 - Radiation Monitoring Equipment, 10-1-74 and 10-30-74

Radiation monitor RM-SW-220 for the discharge tunnel has been out of service for the entire month. Failure has been attributed to flooding of the monitoring equipment in the discharge tunnel. A design change is pending to correct this problem.

c) PT-34 - Electrical Penetration Leakage Test

Several penetrations indicated a loss of pressure. In each case, the penetrations were recharged to the correct pressure.

The majority of periodic test results for November were satisfactory; however, the following problems were noted:

a) PT-34 - Electrical Penetration Leakage Test

Several electrical penetrations indicated a loss of pressure. In each case, the penetrations were recharged to the correct pressure.

The majority of periodic test results for December were satisfactory; however, the following problems were noted:

a) PT-2.1 - Reactor Coolant Temperature, 12-23-74.

Function generator NM-412C had drifted beyond calibration limits. Instrument was recalibrated and the test was completed satisfactorily.

b) PT-2.6 - Steam Line Pressure, 12-19-74

Pressure Indicator PI-2-485 was not reading within acceptable accuracy limits. Indicator was calibrated and performed satisfactorily.

c) PT-2.8 - First Stage Pressure, 12-20-74

Pressure setpoint was too high on steam flow comparator due to out of specification reading on PM-2-446B. Instument was recalibrated and performed satisfactorily.

d) PT-2.9 - Steam Flow, 12-20-74

Multiplier/Deviders FM-2-474 and FM-494 were found to be out of calibration limits. Both instruments performed satisfactorily following recalibration.

e) PT-2.10 - Feedwater Flow, 12-20-74

Multiplier/Deviders FM-2-286 and FM-496 and Flow Comparator FC-2-498 were found to be out of calibration limits. Instruments were recalibrated and performed satisfactorily.

f) PT-34 - Electrical Penetration Leakage Test

Several electrical penetrations indicated a loss of pressure. In each case, penetrations were recharged to the correct pressure.

g) PT-39 - Suppressor Inspection, 12-28-74

Suppressor 2-CH-HSS-301 was found empty of oil. The suppressor was filled.

11.8 PERIODIC CONTAINMENT LEAKAGE RATE TEST

Periodic Test 16.5 Containment Personnel Airlock Test, was performed quarterly during the reporting period. No significant leakage was detected.

11.9 CHANGES, TESTS AND EXPERIMENTS REQUIRING AUTHORIZATION FROM THE ATOMIC ENERGY COMMISSION

11.9.1 Technical Specification Changes

Changes made to the Technical Specifications, Units Nos. 1 and 2, Surry Power Station during the reporting period are summarized in Table 10.9.1-1. These changes were issued by the U.S. Atomic Energy Commission pursuant to Section 50.59, Title 10, Code of Federal Regulations.

11.9.2 Test of Experiments

There were no tests or experiments conducted on Unit No. 2 during the reporting period which required approval of the U.S. Atomic Energy Commission.

11.9.3 Facility Design Changes

There were no facility design changes implemented during the reporting period which required authorization from the U.S. Atomic Energy Commission.

11.10 TESTS AND EXPERIMENTS NOT REQUIRING AUTHORIZATION FROM THE ATOMIC ENERGY COMMISSION

Start-Up Test SU-65 - "Large load reduction test", was performed to satisfy requirements of the initial start-up test program. This test was not performed during the initial start-up test program due to power level restrictions imposed as a result of fuel densification.

Special Test ST-12 - "F_z surveillance following large load reductions" was performed at the request of the Atomic Energy Commission to provide core peaking factor information following a large load reduction.

Special Test ST-25 - "Measurement of steam generator parameters", was performed to obtain data for a proposed low power steam generator water level control system.

Special Test ST-26 - "Auxiliary feedwater stop valve performance", was conducted to ensure that the motor operated auxiliary feedwater stop valves actually operated as designed under maximum flow and differential pressure conditions.

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6.6.A.6	5.0
6.6.A.7	5.0
6.6.A.8	6.0
6.6.A.9	4.0
6.6.A.10	9.0