TROJAN NUCLEAR PLANT

CYCLE 5 STARTUP AND POWER ESCALATION PHYSICS TESTING REPORT

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1.0 ABSTRACT

Startup physics tests were performed at the beginning of the fifth fuel cycle at the Trojan Nuclear Power Plant in order to verify that the basic static and kinetic characteristics of the core were as expected and that values used in the safety analysis were conservative.

Due to fuel failures resulting from reactor vessel internals baffle-gap water-jetting (see LER 82-06), a total of 22 fuel assemblies in the Cycle 5 core were modified to contain either three or five stainless steel pins in place of fuel rods (see License Amendment 75, July 29, 1982). In addition, eight of those fuel assemblies also have 2 x 8 partial grids at the seven midspans on the baffle-jet side of the assembly to reduce the likelihood of jetting fuel failure.

The effect on power distribution of the fuel assembly modification was expected to be small. Startup physics tests confirmed the validity of this nuclear design prediction.

This startup report is being submitted in order to fulfill the requirements of Amendment 75 of Facility Operating License No. NPF-1. The subject matter of this report is limited to the performance of the reactor core.

2.0 INTRODUCTION

The Trojan Nuclear Power Plant, located in northwest Oregon on the Columbia River, is a high-power-density 4-loop Westinghouse pressurized water reactor rated at 3423 MWt gross using 17 x 17 array nuclear fuel.

The Trojan Nuclear Power Plant completed its fourth cycle of operation on March 26, 1982. The fourth cycle core contained two assemblies that were modified to include three stainless steel pins in response to a baffle-gap water-jet impingement problem (see Topical Report PGE-1029, "Cycle 4 Startup and Power Escalation Testing Report", for additional details). Within 3 months after the commencement of Cycle 4, evidence of fuel failure was observed.

During a fuel inspection program at Trojan at the end of Cycle 4, 17 assemblies were found to have degraded fuel cladding. The inspection was planned to locate fuel assemblies that were believed to be leaking, since dose-equivalent iodine coolant activity had reached 80 to 85 percent of the Technical Specification limit near the end-of-cycle prior to the shutdown for refueling. Severe damage to eight fuel assemblies was found by visual inspection; portions of rodlets were missing and loose fuel pellets were found. After fuel sipping, nine additional assemblies had indications of failure.

The apparent cause of most fuel damage was water-jet-induced vibration of fuel rods in fuel assemblies that were adjacent to baffle plate joint locations with enlarged gaps (see Figure 2-1). The apparent degradation of the balance of the assemblies was due to minor clad defects or fuel pellet contamination from nearby grossly failed fuel bundles which was detected by the sipping technique. Two types of baffle-gap-related failures were present. Type 1 is the outside corner or center injection jetting failure. In this case, the water-jet impinges directly on the third rod from the corner and causes it to fail in the lower axial regions from direct water impingement combined with induced rod whirling/vibration.

Type 2 of baffle-gap-related failure is the inside corner or corner injection jetting failure, whereby a jet of water flows parallel to the fuel bundle perimeter face between the fuel and the baffle plate. The flow causes fuel rod whirling to occur at the first few rod locations and leads to severe rod failure in the upper axial regions.

Abnormal degradation had been previously discovered at the end of Cycle 2 in two fuel rods at Trojan. The apparent cause of this fuel damage was Type 1 water-jet impingement on the fuel rod via an enlarged baffle plate joint gap. Two fuel assemblies were modified with stainless steel pins and were located adjacent to the baffle gaps during Cycle 3. Corrective peening action followed at the end of Cycle 3 to close the outside corner baffle gaps, and the previously modified fuel assemblies were relocated for Cycle 4. It appears that the Type 2 jetting problem with the inside corner joints that occurred during Cycle 4 was caused by the peening operation that was performed at the end of Cycle 3. Although additional assemblies failed during Cycle 4 by the Type 1 mechanism, they appeared to have sustained less damage than those failing during Cycle 2 before the peening operation. No failures were observed in the two previously modified fuel assemblies with stainless steel pins.

Trojan conducted an augmented fuel inspection program at the end of Cycle 4 in which all fuel assemblies to be used in the subsequent cycle were leak checked by fuel sipping and/or visually inspected to be damage free (see Attachment A). Accessible loose pellets and debris were retrieved from the reactor vessel internals and refueling cavity. Damaged assemblies adjacent to the baffle were replaced with new modified fuel assemblies using three to five stainless steel pins in place of fuel rods in order to ensure fuel integrity. In addition, 2 x 8 partial grids were inserted at midspans for eight corner injection assemblies as an interim solution to the baffle jetting problem.

The effect of the stainless steel rods and partial grids on the nuclear design of the core was expected to be small. Startup physics tests were performed to confirm the analytical predictions as described in the following sections.

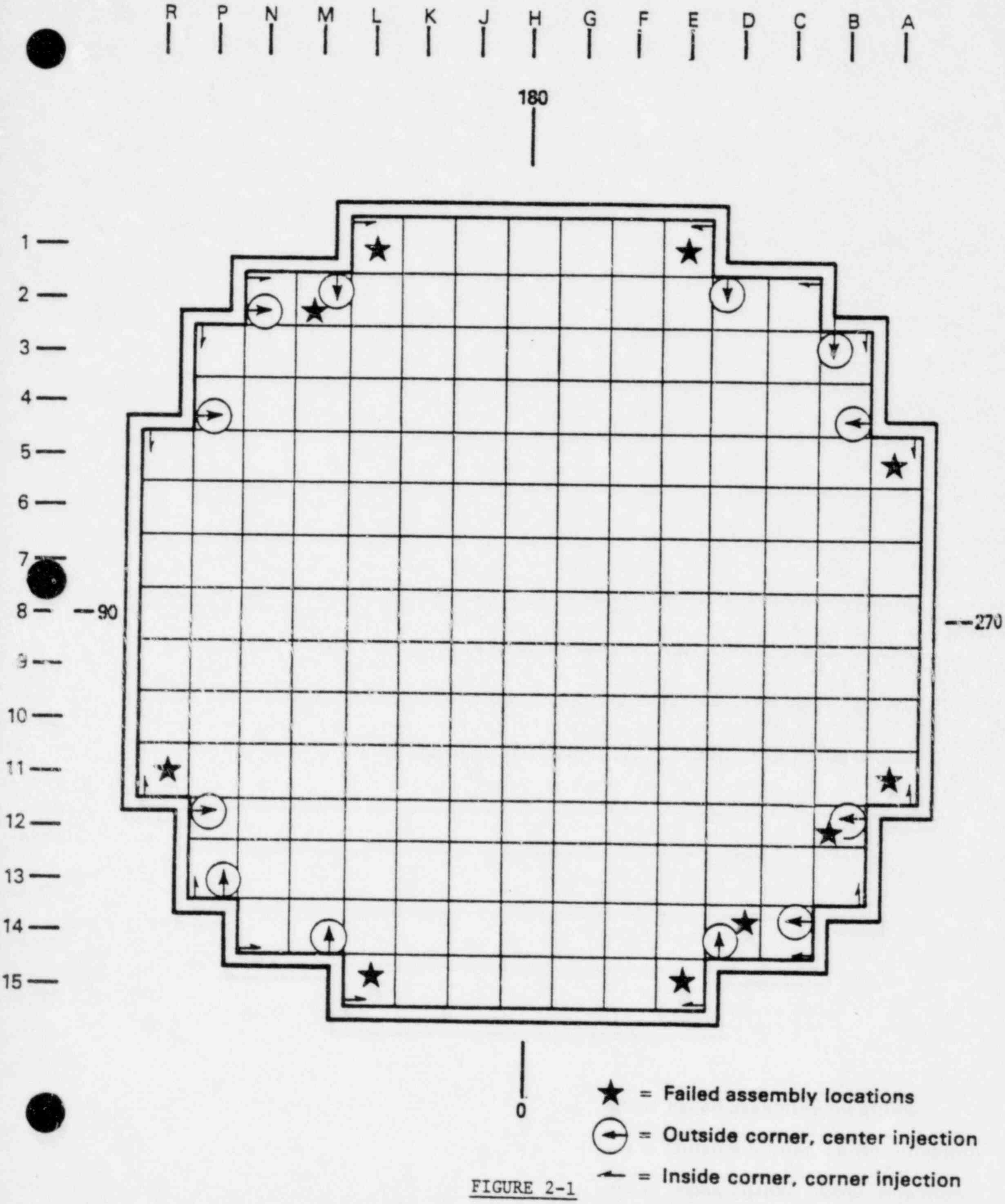

FIGURE 2-1

GRID OF TROJAN CORE

3.0 DISCUSSION

The reload startup physics tests at the beginning of Cycle 5 resulted in good agreement between predicted and measured values as shown in Table 3-1. The results were much improved over those at the start of Cycle 3 and improved over those at the start of Cycle 4.

Only the quadrant power tilt at low power was measured to be outside its acceptance criteria. The magnitudes of Cycle 5 power distribution prediction errors were not excessive and posed no safety concerns. The high power quadrant was observed to be the one predicted to be the high power quadrant. The quadrant power tilt diminished with power ascension as the full power quadrant tilt decreased to one-half percent.

The other nuclear design parameters were well within acceptance criteria and were more accurately predicted for this reload startup than for past reload startups.

TABLE 3-1 Sheet 1 of 2

PREDICTED AND MEASURED PHYSICS PARAMETERS

Parameter	Trojan Test Acceptance Criteria	Measured	Predicted
Critical Boron (ppm)			
All-rods-out	1340±50	1369	1340
D bank in	1255±18	1256	1226
D + C banks in	1165±15	1160	1135
All-rods-in less one rod	760±85	755	732
Isothermal Temperature Coefficient (pcm/°F)			
All-rods-out	-3.3±3	-3.8	-3.3
D bank in	-6.6±3	-7.6	-6.6
Moderator temperature coefficient, ARO	≤+5.0 ≥-53.6	-1.6	-1.0
Boron Worth (pcm/ppm)			
Differential boron worth, over D	-9.2±0.9	-9.6	-9.2
Differential boron worth, over C	-9.3±0.9	-8.4	-9.3
Integral Rod Worth (pcm except as noted)			
Control D	1054±105	1085	1054
Control C	846±85	807	846
Control B	1220+122 -244	1161	1220
Control A	280+140 -28	307	280
All-rods-in less one rod	5604+2000 -500	5320	5604
All-rods-in less one rod (ppm)	608+200 -50	614	608
Doppler Coefficient (pcm/% Power)			
At 30%	-17.5 to -9.5	-12.6	-10.6
At 45%	-16.0 to -8.4	-9.9	-9.9
At 69%	-13.8 to -7.7	-7.7	-9.1
At 97%	-12.8 to -6.7	-9.3	-8.2

TABLE 3-1 Sheet 2 of 2

Parameter	Trojan Test Acceptance Criteria	Measured	Predicted
Low-Power Core Power Distribution, ARO			
F_Q	$\leq 4.64 * K(z)$	2.48	2.55
$F_{\Delta H}$	≤ 1.923	1.45	1.43
F_{xy}	≤ 1.97	1.60	1.47
Quadrant tilt	≤ 1.02	1.038	1.012
Axial offset	$\leq 48 {}^{+5\%}_{-15\%}$	42%	48%
$F_{\Delta H}$	$\leq 15\%$	9.7%	
Full Power Core Power Distribution, ARO			
$F_{\Delta H}$	≤ 1.55	1.424	1.435
Quadrant tilt	≤ 1.02	1.005	~1.003
F_Q	$\leq 2.32 * K(z)$	1.725	~1.686

4.0 LOW POWER PHYSICS TESTING

The purpose of the low power physics testing program is to assure Plant management that the reactor core is operating properly within design limits and safety assumptions, and to redetermine operating parameters related to the reactor system. The measurements of critical boron concentrations, rod worths, temperature coefficients, boron worths, and core power distribution provide sufficient nuclear design parameter confirmations to approve an overall nuclear design and extrapolate or infer all necessary reactor core operating information not explicitly measured.

The Trojan Cycle 5 Core Loading Plan is shown in Figure 4-1, and the low power flux map results are presented in Figure 4-2. The Cycle 5 startup physics test results continued the improvement trend begun at the start of Cycle 4. The improved nuclear design methods were responsible for the improvement in predicted vs measured parameters. Most of the improvement was due to a more accurate assessment and handling of individual fuel assembly burnup values.

The low power flux map power depression that occurred at the perimeter of the upper left (90 to 180 degrees) quadrant during the start of Cycles 3 and 4 has disappeared since the quadrant is now loaded as the high power quadrant.

FIGURE 4-1

Trojan (POR) Cycle 5 Core Loading

R	P	N	M	L	K	J	H	G	F	E	D	C	B	A	
				G03 *****	G17	D02 C-06	G20	D20 N-06	G34	G36 *****					1
		G02 ***	G45 ***	F25 C-02	E45 M-05	G08	D43 H-03	G29	E53 D-05	F53 N-02	G30 ***	G25			2
	G27	G16	D59 F-09	E27 K-12	E30 J-05	E35 J-04	F29 F-06	E37 G-04	E48 G-05	E03 F-12	D18 K-09	G19	G01 ***		3
	G33 ***	D28 J-06	E12 L-04	F37 R-06	E17 M-03	F26 J-01	E24 L-05	F41 G-01	E14 E-05	F34 A-06	E01 E-04	D03 G-06	G15 ***		4
G10 *****	F28 P-13	E13 D-06	F23 K-01	A15 * J-07	F15 E-14	A61 * C-07	F51 J-14	A13 * N-07	F32 L-14	A03 * G-07	F43 F-01	E19 D-10	F27 B-13	G41 *****	5
G39	E52 N-03	E11 L-07	E38 N-04	F06 B-11	E39 H-06	F12 P-07	E64 J-09	F50 B-07	E50 F-08	F54 P-11	E42 C-04	E33 E-07	E46 C-03	G32	6
D34 K-13	G48	E28 M-07	F-24 R-09	A57 * J-13	F42 M-14	D39 J-13	E36 G-07	D27 C-09	F09 P-12	A04 * D-10	F47 A-09	E49 D-07	G31	D54 F-13	7
G28	D30 N-08	E51 K-06	E15 *** H-12	D48 ** D-14	A06 * P-06	F48 R-05	D08 P-08	F13 B-04	A16 * F-02	F31 G-02	E05 *** H-04	E08 K-10	D16 C-08	G38	8 270°
D31 K-03	G09	E06 M-09	F45 R-07	A40 * J-03	F20 P-04	D14 N-07	E59 G-09	D57 G-03	F22 D-02	A42 * G-03	F10 A-07	E62 D-09	G43	D19 F-03	9
G07	E60 N-13	E63 L-09	E31 N-12	F38 B-05	E20 K-08	F44 P-09	E23 J-07	F29 B-09	E40 H-10	F46 P-05	E32 C-12	E07 E-09	E54 C-13	G18	10
G37 *****	F01 P-03	E47 M-08	F16 K-15	A47 * J-09	F33 E-02	A48 * C-09	F36 J-02	A58 * N-09	F35 L-02	A44 * G-09	F17 F-15	E55 M-06	F40 E-03	G23 *****	11
	G40 ***	D36 J-10	E09 L-12	F49 R-10	E34 L-11	F39 J-15	E18 D-03	F52 G-15	E26 D-13	F55 A-10	E02 E-12	D56 G-10	G42 ***		12
	G47 ***	G04	D23 F-07	E61 K-04	E58 J-11	E44 J-12	E04 F-10	E57 G-12	E22 G-11	E21 F-04	D46 K-07	G46	G05		13
		G13	G06 ***	F08 C-14	E56 M-11	G14	D41 H-14	G22	E25 D-11	F14 N-14	G21 ***	G11 ***			14
				G35 *****	G26	D13 C-10	G44	D60 N-10	G24	G12 *****					15

0°

A	Region 1 (2.1 w/o) * From Cycle 1	F	Region 6 (3.2 w/o)
D	Region 4 (3.1 w/o) ** From Cycle 2	G	Region 7 (3.2 w/o) *** 3 Stainless Steel Rods ***** 5 Stainless Steel Rods
E	Region 5 (3.1 w/o) *** 3 Stainless Steel Rods	XXX YYY	Assembly Ident. Position in Previous Cycle

FIGURE 4-2

Sheet 1 of 9

FLUX MAP 121 (3 PERCENT POWER)

```
           TROJAN FLUX MAP #121  08/23/82   3% BU(0    ) CYS D=217 CYS BOL    -HAIR

CALCULATED POWER TILTS (NORMALIZED TO 1.000)

      . 1.0393.0.9902 .                       .                       .                .
        .     .     .                         .                         . 1.0147   .
          .   .   .                    1.0382 . 0.9739                    .       .
    1.0371 . . . 0.9576                       .                             .   .
      . . . . . . . . .               . . . . . . . . .               1.0239  . 0.9687
    1.0107 . . . 0.9798                       .                             .   .
          .   .   .                    0.9992 . 0.9888                    .       .
        .     .     .                         .                         . 0.9927   .
      . 0.9877.0.9977 .                       .                       .                .



          POSITIVE "Y" VS. NEGATIVE "Y" TILT
           1.0060            0.9940



          POSITIVE "X" VS. NEGATIVE "X" TILT
           0.9813            1.0187
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      TROJAN FLUX MAP #121   08/23/82    3% BU(0     ) CY5 D=217 CY5 BOL     -BAIR

THE FOLLOWING CALCULATIONS ARE BASED ON A DIVISION

OF THE CORE INTO "OCTANTS", THAT IS, QUADRANTS

DIVIDED INTO TWO AXIAL REGIONS OF EQUAL VOLUME.

RELATIVE POWER IN          RELATIVE POWER IN          PERCENT AXIAL OFFSET      CORE AVERAGE
UPPER HALF OF CORE         LOWER HALF OF CORE         TOWARD TOP OF CORE        AXIAL OFFSET

(-,+)    .    (+,+)        (-,+)    .    (+,+)        (-,+)    .    (+,+)
         .                          .                          .
 1.4698  .  1.3878          0.6066  .  0.5599          41.571  .   42.507           42.088
         .                          .                          .
.  .  .  .  .  .  .        .  .  .  .  .  .  .        .  .  .  .  .  .  .
         .                          .                          .
 1.4209  .  1.4047          0.5775  .  0.5728          42.206  .   42.066
         .                          .                          .
(-,-)    .    (+,-)        (-,-)    .    (+,-)        (-,-)    .    (+,-)


POWER TILT IN              POWER TILT IN
UPPER HALF OF CORE         LOWER HALF OF CORE

(-,+)    .    (+,+)        (-,+)    .    (+,+)        (-,+)    .    (+,+)
         .                          .                          .
 1.0345  .  0.9768          1.0473  .  0.9667          THESE   .   EDITS
         .                          .                          .
.  .  .  .  .  .  .        .  .  .  .  .  .  .        .  .  .  .  .  .  .
         .                          .                          .
 1.0001  .  0.9887          0.9970  .  0.9890          ADDED   .   JAN.,1969
         .                          .                          .
(-,-)    .    (+,-)        (-,-)    .    (+,-)        (-,-)    .    (+,-)
```

FIGURE 4-2

```
                    TROJAN FLUX MAP #121  08/23/82   3% BU(0    ) CYS D=217 CYS BOL    -BAIR

 TOP TWENTY NUCLEAR F-DELTA-H                      TOP TWENTY NUCLEAR FQ


258M 5MD                FDHN=1.4516          324K 5EN               FQN=2.4788
287L 4DM                FDHN=1.4438          325K 5FN               FQN=2.4777
225N 3LK                FDHN=1.4268          358J 4FE               FQN=2.4760
208P 7MF                FDHN=1.4266          359J 4DE               FQN=2.4693
209P 7LE                FDHN=1.4240          272M11MN               FQN=2.4585
210P 7LD                FDHN=1.4197          513E12NE               FQN=2.4575
226N 3KI                FDHN=1.4193          292L 6NE               FQN=2.4556
352J 2FM                FDHN=1.3992          258M 5MD               FQN=2.4554
272M11MN                FDHN=1.3985          208P 7MF               FQN=2.4497
353J 2EL                FDHN=1.3963          209P 7LE               FQN=2.4451
513E12NE                FDHN=1.3958          287L 4DM               FQN=2.4421
214P 9ML                FDHN=1.3947          210P 7LD               FQN=2.4376
354J 2DL                FDHN=1.3921          444G12NM               FQN=2.4372
215P 9LM                FDHN=1.3903          225N 3LK               FQN=2.4343
216P 9LN                FDHN=1.3851          326K 5ED               FQN=2.4327
324K 5EN                FDHN=1.3834          381J14FE               FQN=2.4292
325K 5FN                FDHN=1.3828          268M 9EL               FQN=2.4267
448G14LE                FDHN=1.3766          226N 3KI               FQN=2.4218
358J 4FE                FDHN=1.3748          382J14EF               FQN=2.4212
449G14MF                FDHN=1.3723          383J14DF               FQN=2.4114


NOTE= VALUES ARE BEST ESTIMATE AND DO NOT INCLUDE ENGINEERING OR NUCLEAR UNCERTAINTY.
```

FIGURE 4-2

Sheet 4 of 9

LOCA FQ ENVELOPE LIMIT AXIALLY

AXIAL POINT	FQ(Z) LIMIT	MEAS. FQ(Z)	SOURCE NO.ID
1	1.9952	1.4010	282L 2NM
2	2.4035	1.4706	272M11MN
3	2.8026	1.7810	272M11MN
4	3.2062	2.0445	513E12NE
5	3.6053	2.2242	272M11MN
6	4.0043	2.2991	513E12NE
7	4.1760	2.2887	358J 4FE
8	4.3802	2.5430	513E12NE
9	4.3894	2.6219	513E12NE
10	4.4034	2.6778	358J 4FE
11	4.4080	2.6808	324K 5EN
12	4.4266	2.6778	358J 4FE
13	4.4358	2.6555	258M 5MD
14	4.4498	2.6325	258M 5MD
15	4.4590	2.4584	225N 3LK
16	4.4730	2.5071	208P 7MF
17	4.4822	2.5945	225N 3LK
18	4.4962	2.5561	225N 3LK
19	4.5101	2.5394	225N 3LK
20	4.5194	2.4995	225N 3LK
21	4.5286	2.5689	252M 2NM
22	4.5426	2.3952	225N 3LK
23	4.5565	2.3191	225N 3LK
24	4.5658	2.0988	352J 2FM
25	4.5797	2.1949	282L 2NM
26	4.5890	2.1295	225N 3LK
27	4.6029	2.0555	258M 5MD
28	4.6168	2.0372	225N 3LK
29	4.6261	1.9342	258M 5MD
30	4.6354	1.8978	225N 3LK

FIGURE 4-2

```
        LOCA FQ ENVELOPE LIMIT AXIALLY
AXIAL       FQ(Z)       MEAS.       SOURCE
POINT       LIMIT       FQ(Z)       NO.ID
31          4.6400      1.8385      225N 3LK
32          4.6400      1.6718      282L 2NM
33          4.6400      1.7652      282L 2NM
34          4.6400      1.6251      282L 2NM
35          4.6400      1.5179      258M 5MD
36          4.6400      1.4949      225N 3LK
37          4.6400      1.4031      258M 5MD
38          4.6400      1.3437      225N 3LK
39          4.6400      1.3387      252M 2NM
40          4.6400      1.2292      225N 3LK
41          4.6400      1.1955      282L 2NM
42          4.6400      1.1021      282L 2NM
43          4.6400      1.0425      258M 5MD
44          4.6400      1.0089      225N 3LK
45          4.6400      0.9620      282L 2NM
46          4.6400      0.9252      252M 2NM
47          4.6400      0.8425      258M 5MD
48          4.6400      0.8096      225N 3LK
49          4.6400      0.7378      282L 2NM
50          4.6400      0.6360      258M 5MD
51          4.6400      0.6767      225N 3LK
52          4.6400      0.6360      258M 5MD
53          4.6400      0.6032      258M 5MD
54          4.6400      0.5737      194R 50M
55          4.6400      0.5137      492E 4NM
56          4.6400      0.4590      258M 5MD
57          4.6400      0.4390      282L 2NM
58          4.6400      0.3526      214P 94L
59          4.6400      0.2802      282L 2NM
60          4.6400      0.2989      282L 2NM
```

FIGURE 4-2

```
MEASURED AND PERCENT. DIFF. OF FDHH  TROJAN FLUX MAP #121  08/23/82   3% BU(0    ) CYS D#217 CYS HOL    -BAIR
       R       P       N       M  . .L . . .K . . .J . . .H . . .G . . .F . . .E . .   D       C       B       A
                                    . 0.728.  0.819.  0.505.  0.658.  0.502.  0.818.  0.723.
 1                                  .   0.5.    0.5.    1.9.    2.1.    4.7.    5.7.    5.7.
                    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 
                    . 0.803.  1.094.  1.242.  1.046.  1.218.  0.798.  1.190.  1.011.  1.138.  1.006.  0.730.
 2                  .   5.5.    5.5.    5.5.    0.5.    2.1.    2.2.    3.0.    2.6.    2.9.    3.3.    2.1.
            . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 
            . 0.791.  1.282.  0.955.  1.119.  1.039.  1.032.  0.969.  0.988.  0.976.  1.013.  0.887.  1.182.  0.721.
 3          .   4.1.    4.1.    4.1.    5.5.    0.5.    2.6.    2.6.    1.5.   -0.5.    1.4.    3.3.    2.1.    0.9.
            . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 
            . 1.069.  0.943.  1.122.  1.336.  1.118.  1.288.  1.067.  1.249.  1.030.  1.235.  1.019.  0.864.  0.963.
 4          .   2.7.    2.7.    2.7.    2.7.    2.4.    1.5.    2.9.    2.0.    0.4.   -0.1.   -1.2.   -0.2.   -1.7.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 
    . 0.796.  1.220.  1.073.  1.317.  0.980.  1.306.  0.942.  1.243.  0.927.  1.231.  0.889.  1.205.  0.970.  1.066.  0.656.
 5  .   9.7.    3.5.    0.5.    0.5.    2.4.    2.4.    2.0.    3.1.    3.3.    0.9.   -2.9.   -3.7.   -4.5.   -4.5.   -4.5.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 
    . 0.897.  1.083.  1.037.  1.093.  1.286.  1.193.  1.231.  1.100.  1.185.  1.126.  1.198.  1.020.  0.957.  0.955.  0.739.
 6  .   9.7.    4.0.   -0.2.   -0.1.    2.0.    2.8.    2.9.    4.0.    1.6.    0.0.   -2.2.   -3.4.   -3.6.   -3.6.   -4.5.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 
    . 0.528.  1.243.  1.017.  1.252.  0.904.  1.243.  0.930.  0.959.  0.886.  1.212.  0.887.  1.209.  0.962.  1.144.  0.477.
 7  .   6.7.    3.2.    0.4.    0.0.    0.9.    2.4.    3.6.    4.2.    1.9.    1.8.    0.4.   -1.6.   -1.1.   -0.5.    0.5.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 
    . 0.671.  0.810.  0.977.  1.055.  1.125.  0.918.  1.194.  0.816.  1.087.  0.894.  1.172.  1.028.  0.930.  0.754.  0.624.
 8  .   2.7.    2.1.    1.4.    0.5.   -0.1.    2.3.    4.3.    2.9.    1.5.    1.7.    0.4.   -1.6.   -1.0.   -1.1.   -1.5.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 
    . 0.503.  1.216.  1.021.  1.258.  0.899.  1.232.  0.908.  0.933.  0.900.  1.237.  0.892.  1.212.  0.976.  1.171.  0.480.
 9  .   2.5.    2.1.    1.4.   -0.0.   -1.4.    0.7.    1.7.    1.2.    2.6.    2.9.   -1.5.   -3.2.   -2.1.   -0.8.   -1.7.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 
    . 0.811.  1.037.  1.040.  1.096.  1.282.  1.150.  1.144.  1.038.  1.148.  1.157.  1.220.  1.040.  0.953.  1.007.  0.791.
10  .   1.5.    1.5.    1.4.    1.0.    1.0.   -0.4.   -4.6.   -3.3.   -3.9.   -0.3.   -4.0.   -4.3.   -7.2.   -2.2.   -2.2.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 
    . 0.722.  1.173.  1.048.  1.296.  0.941.  1.250.  0.892.  1.190.  0.888.  1.269.  0.925.  1.250.  0.985.  1.160.  0.713.
11  .   1.5.    1.5.    1.5.    1.0.   -0.5.   -1.0.   -4.2.   -4.6.   -5.7.   -1.8.   -3.6.   -4.0.   -7.2.   -0.9.   -0.9.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 
            . 1.018.  0.884.  1.058.  1.263.  1.057.  1.234.  1.044.  1.252.  1.086.  1.294.  1.080.  0.864.  1.002.
12          .   0.1.   -1.3.   -1.1.   -1.4.   -1.5.   -3.6.   -3.8.   -3.8.   -1.9.   -0.8.   -0.8.   -5.2.   -3.1.
            . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 
            . 0.740.  1.200.  0.886.  1.017.  1.005.  1.005.  0.971.  1.015.  1.018.  1.037.  0.899.  1.184.  0.715.
13          .  -0.4.   -0.4.   -1.2.   -2.7.   -2.2.   -1.3.   -1.4.   -2.2.   -3.2.   -2.1.   -0.9.   -3.1.   -5.2.
            . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 
                    . 0.744.  1.000.  1.121.  1.004.  1.195.  0.800.  1.199.  1.017.  1.154.  1.022.  0.733.
14                  .  -0.3.   -1.9.   -3.6.   -2.8.   -0.9.   -0.8.   -1.8.   -3.3.   -2.1.   -0.9.   -3.0.
                    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .                 . . . .
                                    . 0.687.  0.787.  0.491.  0.655.  0.489.  0.796.  0.712.                        . MEAS .
15                                  .  -4.2.   -2.9.   -1.4.   -1.4.   -3.3.   -3.3.   -2.1.                        . DIFF .
                                    . . . . . . . . . . . . . . . . . . . . . . . . . . . .                         . . . .
```

FIGURE 4-2

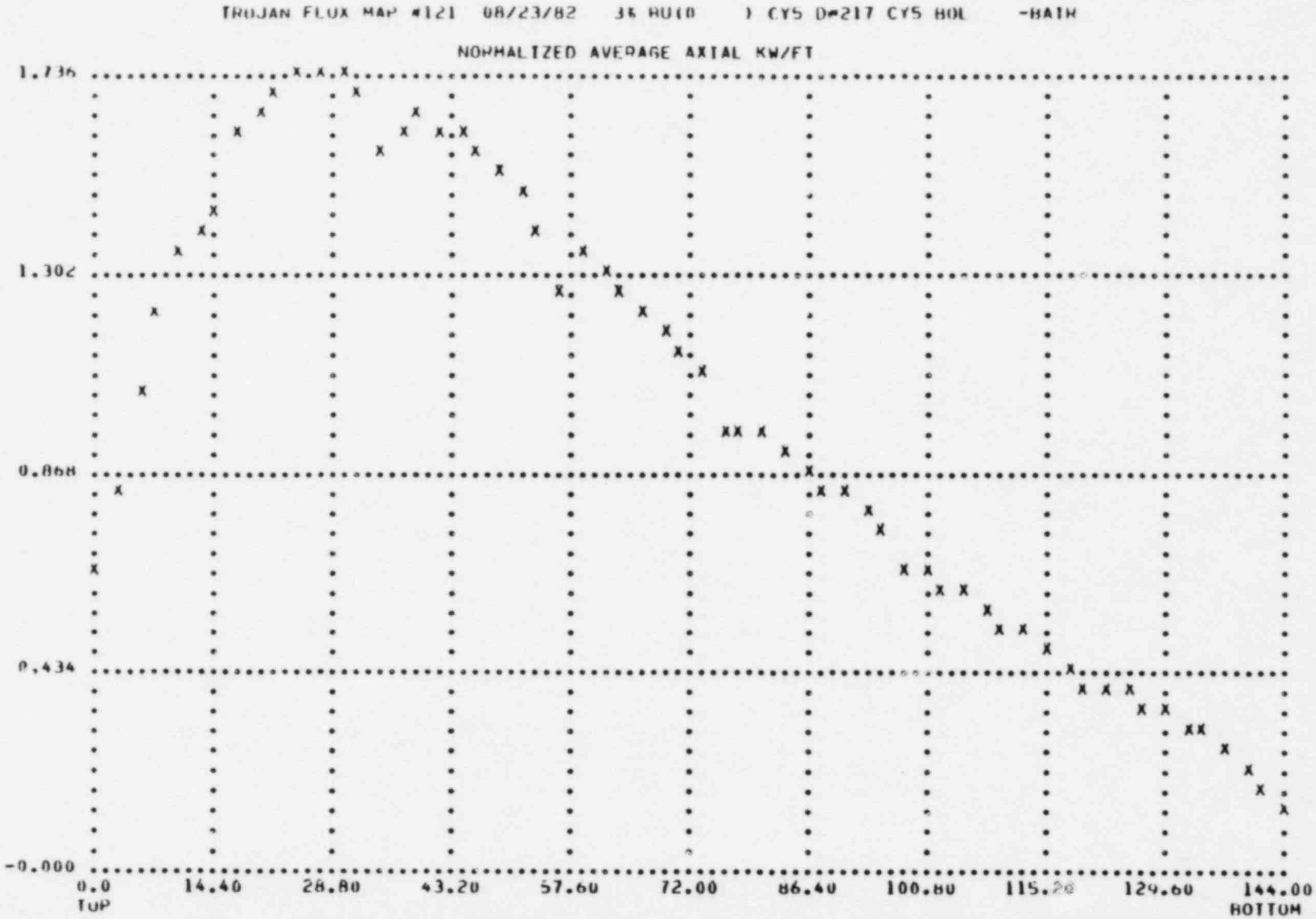
Sheet 7 of 9

```
PERCENT. DIFF. OF EXPECT. AND MEAS. FDHN  TROJAN FLUX MAP #121  08/23/82   3% BU(0     ) CYS D=217 CYS BOL    -BAIR
    R     P     N     M   . .L . . .K . . .J . . .H . . .G . . .F . . .E . .  D     C     B     A
                          .     .     .  1.9.     .     .  5.7.     .
1                         .     .     .     .     .     .     .     .
              . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
              .  5.5.     .     .     .     .  2.2.     .     .     .     .     .
2             .     .     .     .     .     .     .     .     .     .     .     .
        . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
        .     .     .     .     .     .     .     .     . -0.5.     .  3.3.     .  0.9.
3       .     .     .     .     .     .     .     .     .     .     .     .     .     .
        . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
        .     .  2.7.     .     .     .     .  2.9.     .     .     .     .     .     .
4       .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .     .     .     .     .     .     .     .     .  3.3.     . -2.9.     . -4.5.     .     .
5 .     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .  9.7.     . -0.2.     .     .  2.8.     .     .     .     .     .     .     .     .     .
6 .     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .     .     .     .  0.0.     .     .  3.6.     .     .  1.8.     .     . -1.1.     .     .
7 .     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .  2.7.     .  1.4.     . -0.1.     .  4.3.     .     .  1.7.     . -1.6. -1.0. -1.1.     .
8 .     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .     .  2.1.     .     .     .     .     .     .  2.6.     .     .     .     .     . -1.7.
9 .     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .     .     .     .     .     .     . -4.6.     .     .     .     . -4.3.     .     .     .
10.     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .  1.5.     .     .     . -0.5.     .     . -4.6.     .     . -3.6.     .     .     . -0.9.
11.     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
        .     .     .     .     . -1.5.     .     . -3.8.     .     .     .     .     .
12      .     .     .     .     .     .     .     .     .     .     .     .     .     .
        . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
        .     . -0.4.     . -2.7.     .     . -1.4.     .     .     .     .     . -5.2.
13      .     .     .     .     .     .     .     .     .     .     .     .     .     .
        . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
              . -0.3.     .     .     . -0.9.     .     . -3.3.     . -0.9.     .
14            .     .     .     .     .     .     .     .     .     .     .     .
              . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
                          . -4.2.     .     .     .     .     .     .
15                        .     .     .     .     .     .     .     .
                          . . . . . . . . . . . . . . . . . . . . . .
```

FIGURE 4-2

```
TROJAN FLUX MAP #121  08/23/82   3% HU(0    ) CYS D=217 CYS ROL    -BAIR
        POINT       SOURCE       NUCLEAR FXY                        POINT      SOURCE       NUCLEAR FXY

          1       282 L 2NM        2.0251                             31      225 N 3LK       1.5652
          2       272 M11MN        1.6403                             32      282 L 2NM       1.5845
          3       272 M11MN        1.5995                             33      282 L 2NM       1.7392
          4       513 E12NE        1.5787                             34      282 L 2NM       1.5843
          5       272 M11MN        1.5361                             35      258 M 5MD       1.5440
          6       513 E12NE        1.5434                             36      225 N 3LK       1.5756
          7       358 J 4FE        1.4864                             37      258 M 5MD       1.5392
          8       513 E12NE        1.4797                             38      225 N 3LK       1.5335
          9       513 E12NE        1.4603                             39      252 M 2NM       1.6008
         10       358 J 4FE        1.4629                             40      225 N 3LK       1.5779
         11       324 K 5EN        1.4399                             41      282 L 2NM       1.7479
         12       358 J 4FE        1.4265                             42      282 L 2NM       1.6039
         13       258 M 5MD        1.4254                             43      258 M 5MD       1.5709
         14       258 M 5MD        1.4457                             44      225 N 3LK       1.5485
         15       225 N 3LK        1.4712                             45      282 L 2NM       1.5570
         16       208 P 7MF        1.4583                             46      252 M 2NM       1.5948
         17       225 N 3LK        1.4631                             47      258 M 5MD       1.5223
         18       225 N 3LK        1.4693                             48      225 N 3LK       1.5556
         19       225 N 3LK        1.4777                             49      282 L 2NM       1.5400
         20       225 N 3LK        1.4826                             50      258 M 5MD       1.4826
         21       252 M 2NM        1.5566                             51      225 N 3LK       1.5385
         22       225 N 3LK        1.4973                             52      258 M 5MD       1.5297
         23       225 N 3LK        1.5395                             53      258 M 5MD       1.5407
         24       352 J 2FM        1.5533                             54      194 R 5OM       1.5628
         25       282 L 2NM        1.5288                             55      492 F 4NM       1.5102
         26       225 N 3LK        1.5169                             56      258 M 5MD       1.4944
         27       258 M 5MD        1.5165                             57      282 L 2NM       1.6263
         28       225 N 3LK        1.5359                             58      214 P 9ML       1.5807
         29       258 M 5MD        1.5075                             59      282 L 2NM       1.6045
         30       225 N 3LK        1.5463                             60      282 L 2NM       2.3045

NOTE= VALUES ARE BEST ESTIMATE AND DO NOT INCLUDE ENGINEERING OR NUCLEAR UNCERTAINTY.
```

FIGURE 4-2


TROJAN FLUX MAP #121 08/23/82 3% RU(D) CYS D=217 CYS BOL -BATR
NORMALIZED AVERAGE AXIAL KW/FT
1.736
1.302
0.868
0.434
-0.000
0.0
TOP
14.40
28.80
43.20
57.60
72.00
86.40
100.80
115.20
129.60
144.00
BOTTOM

5.0 POWER ESCALATION TESTING

The purpose of the power escalation physics testing program is primarily to monitor core power distribution at elevated power levels and to recalibrate instrumentation settings for important Plant parameters that may vary with core loading, power level, or other Plant changes.

In addition, the nuclear doppler/power coefficients are measured to further confirm the nuclear design.

The following measurements were performed during the power escalation testing:

(1) Incore thermocouple correction factors were obtained (see Table 5-1).

(2) Doppler coefficient was measured (see Figure 5-1).

(3) Delta temperature correlation was realigned (60°F equals 100 percent power, see Figure 5-2).

(4) Feedwater flow correlation was confirmed linear (see Figure 5-3).

(5) Incore-excore detector calibration relationship was established for incore and excore axial offsets (see Table 5-2 and Figures 5-4 through 5-15).

(6) Core power distributions were taken (see Figures 5-16 and 5-17 for Flux Maps 122 and 125). Quadrant tilting decreased with increasing power level and burnup. Hot channel factors limits were met.

TABLE 5-1

INCORE THERMOCOUPLE CORRECTION FACTORS

DATA SHEET 1a
T/C CALCULATIONS
Final results

True RTD
Correct Temperature: 557.4 °F

Hot Junction Box Temperatures: 159.5
(Computer U0058, U0059)

T/C No.	Measured Temp		(Meas-Truth) Difference (°F)		T/C No.	Measured Temp		Difference (°F)	
	Toggle	Computer	Toggle	Computer		Toggle	Computer	Toggle	Computer
(A8) 1	553.7	552.1	-3.7	-5.3	(A9) 34	557.3	555.3	-0.1	-2.1
(B3) 2	555.7	554.6	-1.7	-2.8	(A11) 35	558.0	555.7	+0.6	-1.7
(B10) 3	555.3	554.5	-2.1	-2.9	(B5) 36	557.5	555.6	+0.1	-1.8
(C8) 4	555.7	554.4	-1.7	-3.0	(C3) 37	559.0	556.5	+1.6	-0.9
(C13) 5	555.0	553.6	-2.4	-3.8	(C12) 38	558.5	555.9	+1.1	-1.5
(D3) 6	556.0	554.6	-1.4	-2.8	(D7) 39	556.8	554.8	-0.6	-2.6
(E4) 7	556.3	554.8	-1.1	-2.6	(D9) 40	557.8	555.4	+0.4	-2.0
(E6) 8	553.2	552.3	-4.2	-5.1	(E2) 41	557.5	555.1	+0.1	-2.3
(E8) 9	555.0	554.2	-2.4	-3.2	(E14) 42	554.0	552.0	-3.4	-5.4
(E10) 10	555.2	554.0	-2.2	-3.4	(F5) 43	557.8	556.0	+0.4	-1.4
(F12) 11	554.9	553.8	-2.5	-3.6	(F9) 44	558.5	555.9	+1.1	-1.5
(F15) 12	555.0	554.1	-2.4	-3.3	(F11) 45	554.5	552.3	-2.9	-5.1
(G2) 13	555.8	554.4	-1.6	-3.0	(G4) 46	558.0	555.4	+0.6	-2.0
(G9) 14	555.2	554.4	-2.2	-3.0	(G8) 47	558.3	555.9	+0.9	-1.5
(G11) 15	555.2	554.4	-2.2	-3.0	(H5) 48	557.5	555.6	+0.1	-1.8
(H01) 16	552.8	551.6	-4.6	-5.8	(H9) 49	558.8	556.2	+1.4	-1.2
(H3) 17	553.3	552.2	-4.1	-5.2	(H11) 50	557.3	554.3	-0.1	-3.1
(H8) 18	555.3	554.8	-2.1	-2.6	(H14) 51	557.5	555.8	+0.1	-1.6
(H13) 19	554.8	553.4	-2.6	-4.0	(J7) 52	557.5	555.4	+0.1	-2.0
(J10) 20	555.5	554.3	-1.9	-3.1	(K11) 53	557.5	555.1	+0.1	-2.3
(K3) 21	552.8	549.6	-4.6	-7.8	(K13) 54	557.0	555.0	-0.4	-2.4
(K5) 22	555.3	554.2	-2.1	-3.2	(L2) 55	—	—		
(K15) 23	553.8	552.4	-3.6	-5.0	(L9) 56	557.5	555.8	+0.1	-1.6
(L1) 24	555.5	554.2	-1.9	-3.2	(L14) 57	557.3	555.1	-0.1	-2.3
(L8) 25	555.3	554.2	-2.1	-3.2	(M5) 58	558.3	556.1	+0.9	-1.3
(L12) 26	555.5	553.9	-1.9	-3.5	(M12) 59	—	—		
(M10) 27	557.3	556.4	-0.1	-1.0	(N2) 60	558.0	555.6	+0.6	-1.8
(M13) 28	555.3	553.3	-2.1	-4.1	(N8) 61	559.0	556.4	+1.6	-1.0
(N3) 29	555.8	554.3	-1.6	-3.1	(N13) 62	557.3	555.3	-0.1	-2.1
(N9) 30	555.0	554.1	-2.4	-3.3	(P7) 63	558.6	556.0	+1.2	-1.4
(P5) 31	555.7	554.3	-1.7	-3.1	(R5) 64	559.0	556.3	+1.6	-1.1
(P11) 32	555.8	554.6	-1.6	-2.8	(R10) 65	558.0	555.2	+0.6	-2.2
(R08) 33	555.5	554.0	-1.9	-3.4					

Completed By: Jim Kasden JHB Date 8/20/82 Time 1800

Engineering Supervisor: Alan D. Cailey Date 8/31/82

TABLE 5-2

Sheet 1 of 4

INCORE/EXCORE DETECTOR CALIBRATION AND POINTS ANALYSIS SHEET

```
                              TROJAN NUCLEAR PLANT
                 F(DELTA Q) CALIBRATION AND POINTS ANALYSIS SHEET
                                   GARY HAIR
          TROJAN MAPS 122,123,124,50%;121A,25%;C,35%;D,75%;125,100% HAIR 8/30/82


INPUT DATA
                TOP CHANNEL CURRENT                      BOTTOM CHANNEL CURRENT

     AO        41        42        43        44         41        42        43        44

    15.4     115.0     124.0     112.0     124.0      104.0     107.0     100.0     112.0      MEASURED
    15.4     328.7     359.1     327.0     358.9      297.3     309.9     292.0     324.1      NORMALIZED
    20.0      85.0      91.0      82.0      91.0       74.0      75.0      79.0      79.0      MEASURED
    20.0     334.7     366.7     333.9     365.6      291.3     302.3     285.1     317.4      NORMALIZED
     2.4     154.0     166.0     152.0     163.0      154.0     159.0     151.0     168.0      MEASURED
     2.4     313.0     341.7     310.5     336.3      313.0     327.3     308.5     346.7      NORMALIZED
    12.0     160.0     174.0     157.0     169.0      147.0     152.0     144.0     160.0      MEASURED
    12.0     326.3     357.1     322.9     350.8      299.7     311.9     296.1     332.2      NORMALIZED
     7.3     157.0     170.0     155.0     166.0      150.0     156.0     147.0     165.0      MEASURED
     7.3     320.1     349.9     317.7     342.5      305.9     320.1     301.3     340.5      NORMALIZED
     2.2     231.0     250.0     227.0     243.0      230.0     239.0     224.0     254.0      MEASURED
     2.2     313.7     342.0     311.6     333.9      312.3     327.0     307.4     349.1      NORMALIZED
    -1.4     308.0     336.0     304.0     328.0      318.0     333.0     315.0     355.0      MEASURED
    -1.4     308.0     336.0     304.0     328.0      318.0     333.0     315.0     355.0      NORMALIZED


FLUX DIFFERENCE METER VALUES
                  TOP CHANNEL                                BOTTOM CHANNEL

     AO        41        42        43        44         41        42        43        44


    10.0     322.8     352.7     320.6     348.3      303.2     316.3     298.4     334.7      NORMALIZED
   -10.0     298.5     324.7     294.3     313.5      327.5     344.3     324.7     369.5      NORMALIZED
    20.0     335.0     366.7     333.7     365.7      291.0     302.3     285.3     317.3      NORMALIZED
   -20.0     285.3     310.7     281.2     296.1      339.7     358.3     337.8     386.9      NORMALIZED
    30.0     347.2     380.8     346.9     383.1      278.8     288.2     272.2     299.9      NORMALIZED
   -30.0     274.1     296.6     268.0     278.7      351.9     372.3     351.0     404.3      NORMALIZED
```

TABLE 5-2

TROJAN NUCLEAR PLANT
F(DELTA Q) CALIBRATION AND POINTS ANALYSIS SHEET
GARY HAIR
TROJAN MAPS 122,123,124,50%;121A,25%;C,35%;D,75%;125,100% HAIR 8/30/82

EXCORE DETECTOR	INCORE AXIAL OFFSET	I-TOP MICROAMP		I-BOT MICROAMP		V-TOP VOLTS	V-BOT VOLTS	DELTA V VOLTS	I TOTAL MICRO A	V/I TOP K OHMS	V/I BOT K OHMS
		100%	120%	100%	120%						
CH-41	0.0	310.6	372.8	315.4	378.4	8.333	8.333	0.0	626.0	0.02683	0.02642
CH-41	13.0	326.5	391.8	299.5	359.4	8.758	7.915	0.843	626.0	0.02683	0.02642
CH-41	3.0	314.3	377.1	311.7	374.1	8.431	8.236	0.195	626.0	0.02683	0.02642
CH-41	-3.0	307.0	368.4	319.0	382.8	8.235	8.430	-0.195	626.0	0.02683	0.02642
CH-41	-45.0	255.8	307.0	370.2	444.2	6.863	9.781	-2.918	626.0	0.02683	0.02642
CH-41	-50.0	249.7	299.7	376.3	451.5	6.700	9.942	-3.242	626.0	0.02683	0.02642
CH-41	59.4	383.0	459.6	243.0	291.6	10.273	6.422	3.852	626.0	0.02683	0.02642
CH-42	0.0	338.7	405.4	330.3	396.4	8.333	8.333	0.0	669.0	0.02460	0.02523
CH-42	13.0	356.9	428.3	312.1	374.5	8.781	7.873	0.908	669.0	0.02460	0.02523
CH-42	3.0	342.9	411.5	326.1	391.3	8.436	8.227	0.210	669.0	0.02460	0.02523
CH-42	-3.0	334.5	401.4	334.5	401.4	8.230	8.439	-0.210	669.0	0.02460	0.02523
CH-42	-45.0	275.6	330.7	393.4	472.1	6.781	9.924	-3.143	669.0	0.02460	0.02523
CH-42	-50.0	268.6	322.3	400.4	480.5	6.609	10.101	-3.493	669.0	0.02460	0.02523
CH-42	59.4	422.0	506.4	247.0	296.4	10.382	6.232	4.149	669.0	0.02460	0.02523
CH-43	0.0	307.4	368.9	311.6	373.9	8.333	8.333	0.0	619.0	0.02710	0.02675
CH-43	13.0	324.5	389.4	294.5	353.4	8.796	7.876	0.919	619.0	0.02710	0.02675
CH-43	3.0	311.4	373.7	307.6	369.1	8.440	8.228	0.212	619.0	0.02710	0.02675
CH-43	-3.0	303.5	364.2	315.5	378.6	8.226	8.438	-0.212	619.0	0.02710	0.02675
CH-43	-45.0	248.3	298.0	370.7	444.8	6.731	9.914	-3.182	619.0	0.02710	0.02675
CH-43	-50.0	241.8	290.1	377.2	452.7	6.553	10.089	-3.536	619.0	0.02710	0.02675
CH-43	59.4	385.4	462.5	233.6	280.3	10.447	6.247	4.201	619.0	0.02710	0.02675
CH-44	0.0	330.9	397.0	352.1	422.6	8.333	8.333	0.0	683.0	0.02518	0.02366
CH-44	13.0	353.5	424.2	329.5	395.4	8.902	7.798	1.105	683.0	0.02518	0.02366
CH-44	3.0	336.1	403.3	346.9	416.3	8.464	8.210	0.255	683.0	0.02518	0.02366
CH-44	-3.0	325.7	390.8	357.3	428.8	8.202	8.456	-0.255	683.0	0.02518	0.02366
CH-44	-45.0	252.6	303.1	430.4	516.5	6.362	10.185	-3.824	683.0	0.02518	0.02366
CH-44	-50.0	243.9	292.7	439.1	526.9	6.143	10.391	-4.248	683.0	0.02518	0.02366
CH-44	59.4	434.2	521.0	248.8	298.6	10.935	5.888	5.047	683.0	0.02518	0.02366

DELTA T SETPT PENALTY RATE FOR AO < -45% IS 2.20%/%
DELTA T SETPT PENALTY RATE FOR AO > 3% IS 2.66%/%

TABLE 5-2

```
                                   TROJAN NUCLEAR PLANT
                          PET-2 APPENDIX A CALIBRATION SHEET 2

                   TROJAN MAPS 122,123,124,50%;121A,25%;C,35%;D,75%;125,100% MAIN 8/30/82

            FN          G           H                          EOUT      DELTA EIN41  DELTA EIN42  DELTA EIN43  DELTA EIN44

   N41   0.064841    2.570390    0.770092                      1.000       -3.890       -4.191       -4.243       -5.098
   N42   0.069853    2.385972    0.838233                      2.000       -1.945       -2.096       -2.121       -2.549
   N43   0.070717    2.356824    0.840599                      3.000        0.000        0.000        0.000        0.000
   N44   0.084968    1.961516    1.019618                      4.000        1.945        2.096        2.121        2.549
                                                               5.000        3.890        4.191        4.243        5.098

 AO             N41                          N42                          N43                          N44

         EIN      EO       FGO       EIN      EO       FGO       EIN      EO       FGO       EIN      EO       FGO

   0.0   0.0     3.000    1.000      0.0     3.000    1.000      0.0     3.000    1.000      0.0     3.000    1.000
  13.0   0.343   3.433    1.709      0.908   3.433    1.709      0.919   3.433    1.709      1.105   3.433    1.709
   3.0   0.195   3.100    1.000      0.210   3.100    1.000      0.212   3.100    1.000      0.255   3.100    1.000
  -3.0  -0.195   2.900    1.000     -0.210   2.900    1.000     -0.212   2.900    1.000     -0.255   2.900    1.000
 -45.0  -2.918   1.500    1.000     -3.143   1.500    1.000     -3.182   1.500    1.000     -3.824   1.500    1.000
 -50.0  -3.242   1.333    1.293     -3.493   1.333    1.293     -3.536   1.333    1.293     -4.248   1.333    1.293
  59.4   3.852   4.980    5.001      4.149   4.980    5.001      4.201   4.980    5.001      5.047   4.980    5.001
  60.0   3.890   5.000    5.043      4.191   5.000    5.043      4.243   5.000    5.043      5.098   5.000    5.043
 -60.0  -3.890   1.000    1.880     -4.191   1.000    1.880     -4.243   1.000    1.880     -5.098   1.000    1.880


 INCORE/EXCORE SLOPE CALCULATION

 BASIS: IN-AO   EX-AO(41-44)   FOR INFORMATION ONLY
        20.0      6.9      9.6      7.9      7.1
         2.4      0.0      2.2      0.3     -1.5
                  2.54     2.35     2.33     2.05

 COMPUTER ADDRESSES K0554     K0552     K0551     K0553
 FOR USE IN P250      2.57      2.39      2.36      1.96
```

TABLE 5-2

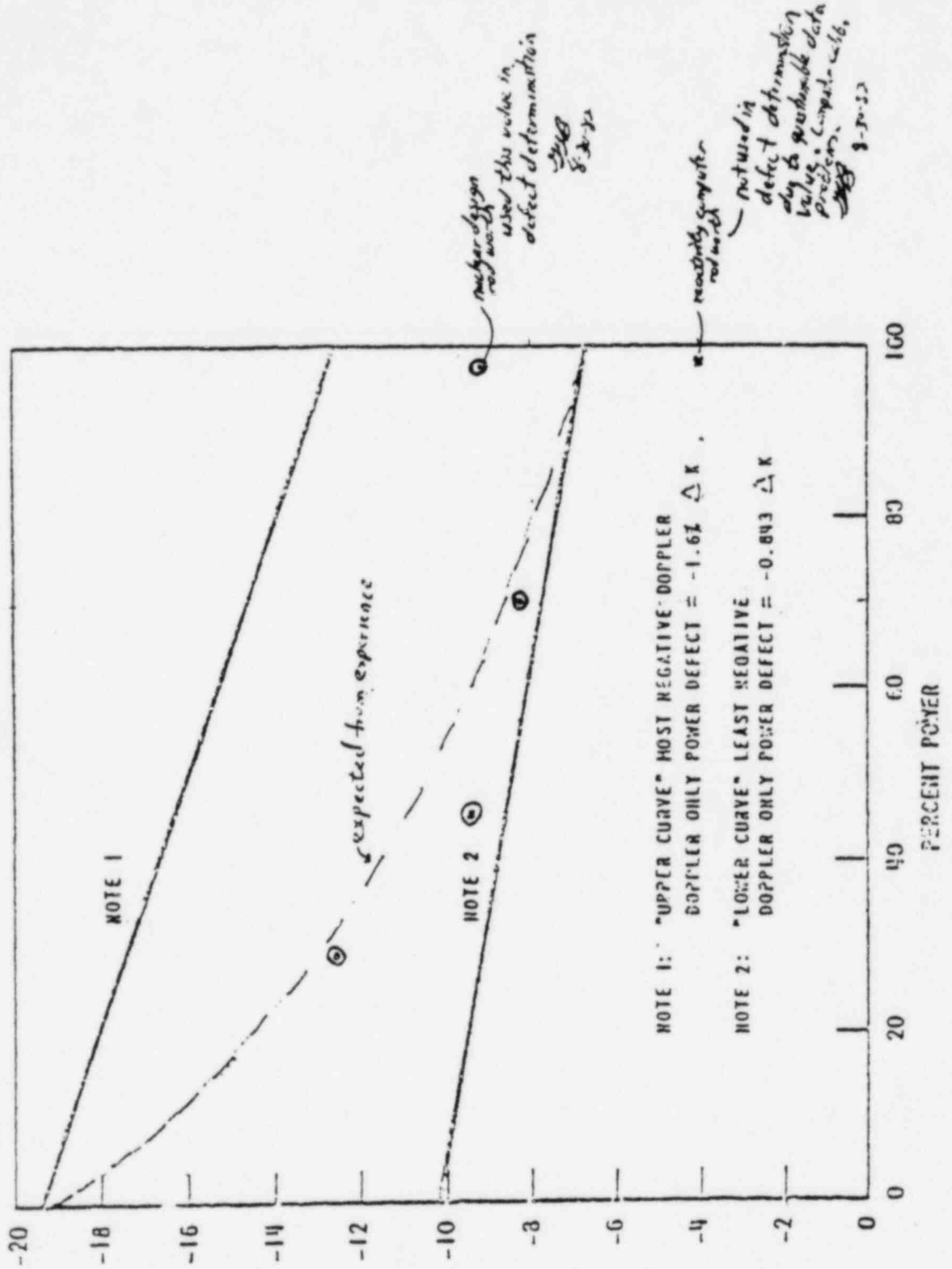
Sheet 4 of 4

```
                              TROJAN NUCLEAR PLANT
       TROJAN MAPS 122,123,124,50%I121A,25%IC,35%ID,75%I125,100% PAIR 8/30/82




                  .......NIS INTERMEDIATE RANGE CHANNEL CALCULATIONS..........

N35 FULL POWER MICROAMPS = 379.                      N36 FULL POWER MICROAMPS = 449.

N35 22% TRIP CURRENT MICROAMPS =  83. (+- 8.)        N36 22% TRIP CURRENT MICROAMPS =  99. (+- 9.)

N35 30% OVERCURRENT MICROAMPS = 114.                 N36 30%  OVERCURRENT MICROAMPS = 135.

N35 16% RESET CURRENT MICROAMPS =  61. (+- 8.)       N36 16% RESET CURRENT MICROAMPS =  72. (+- 9.)


N35 22% TRIP VOLTAGE =  8.651 (+0.047 -0.052)        N36 22% TRIP VOLTAGE =  8.744 (+0.047 -0.052)

N35 30% OVERVOLTAGE =  8.819                         N36 30% OVERVOLTAGE =  8.912

N35 16% RESET VOLTAGE =  8.478 (+0.064 -0.072)       N36 16% RESET VOLTAGE =  8.571 (+0.064 -0.072)
```

FIGURE 5-1

DOPPLER COEFFICIENT

6937-244



expected from experience

nuclear design rod worth

used this value in defect determination 8-30-82

reactivity computer rod worth

not used in defect determination due to questionable data values. Computer calib. problem. 8-30-82

Figure 15.0-5 Doppler Power Coefficient Used In Accident Analysis

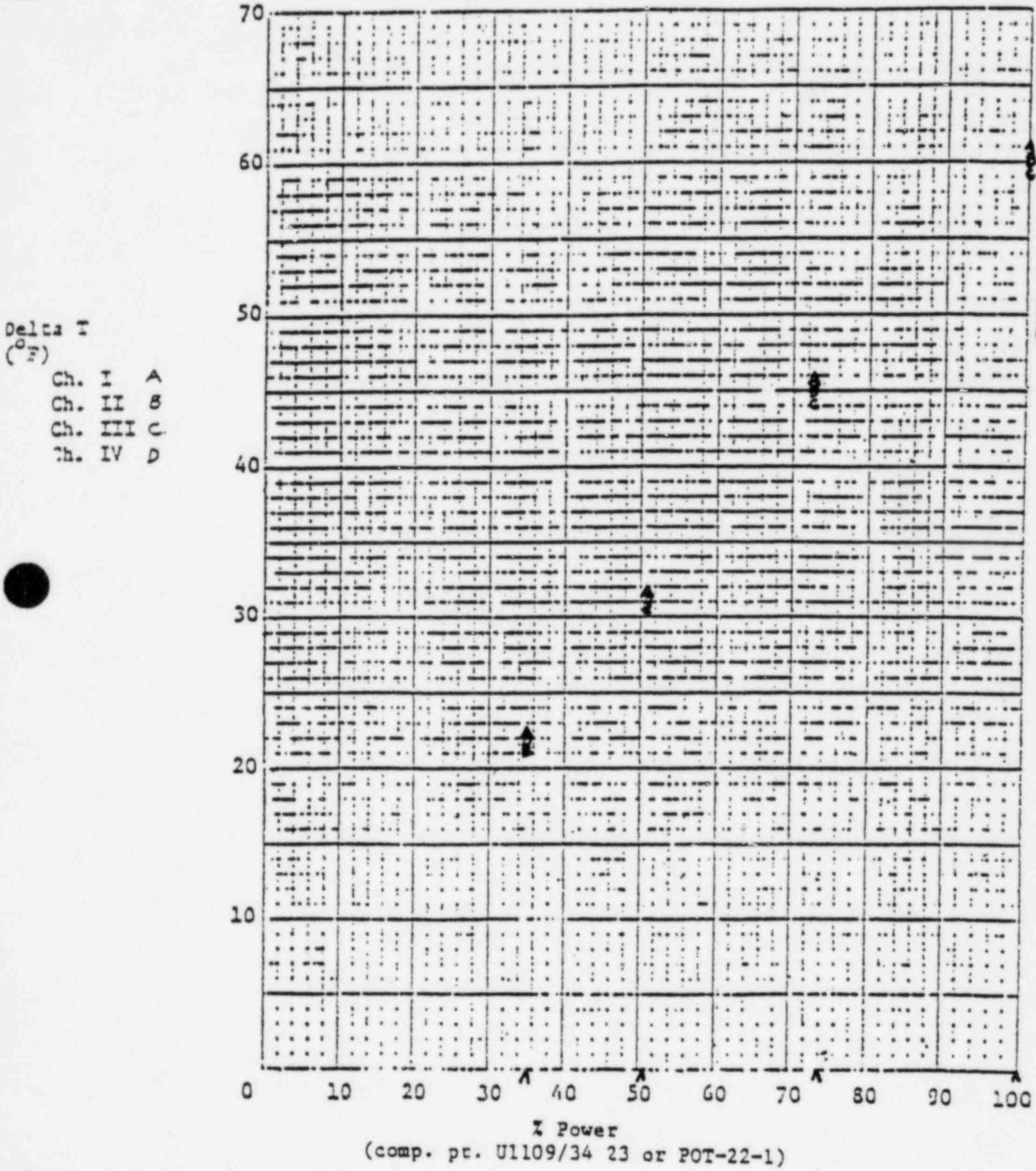
use nuclear design rod worth for high power data point because reactivity computer data questionable at this point.

By W.D. Nicholson Date 8/29/82

Engineering Supervisor Alan S. Cobley Date 8/31/82

FIGURE 5-2

LOOP DELTA-T (T-HOT MINUS T-COLD) VS POWER

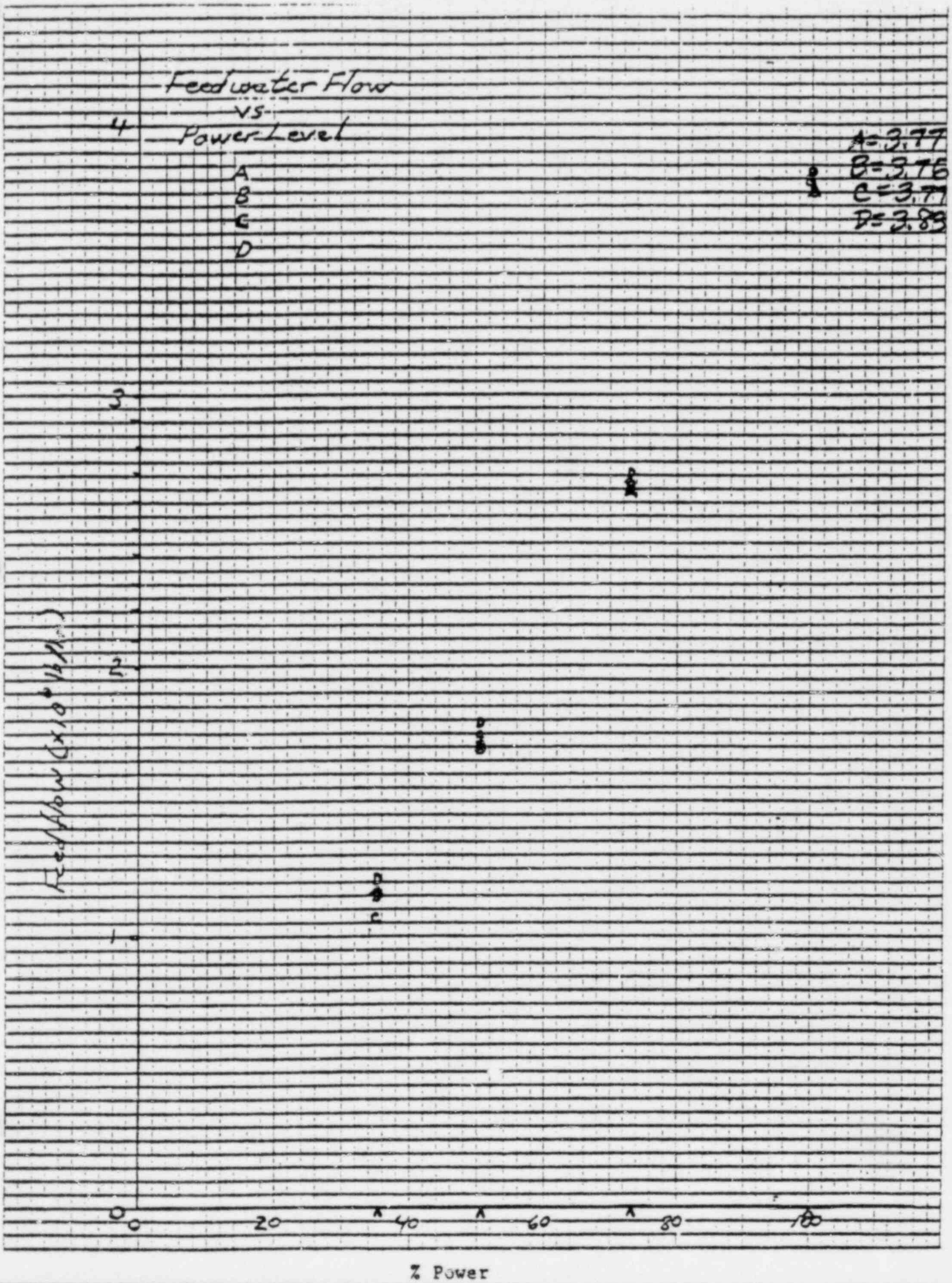


A=61.1
B=60.2
C=58.9
D=60.3

60°F
FPΔT

FIGURE 5-3

FEEDWATER FLOW VS POWER LEVEL



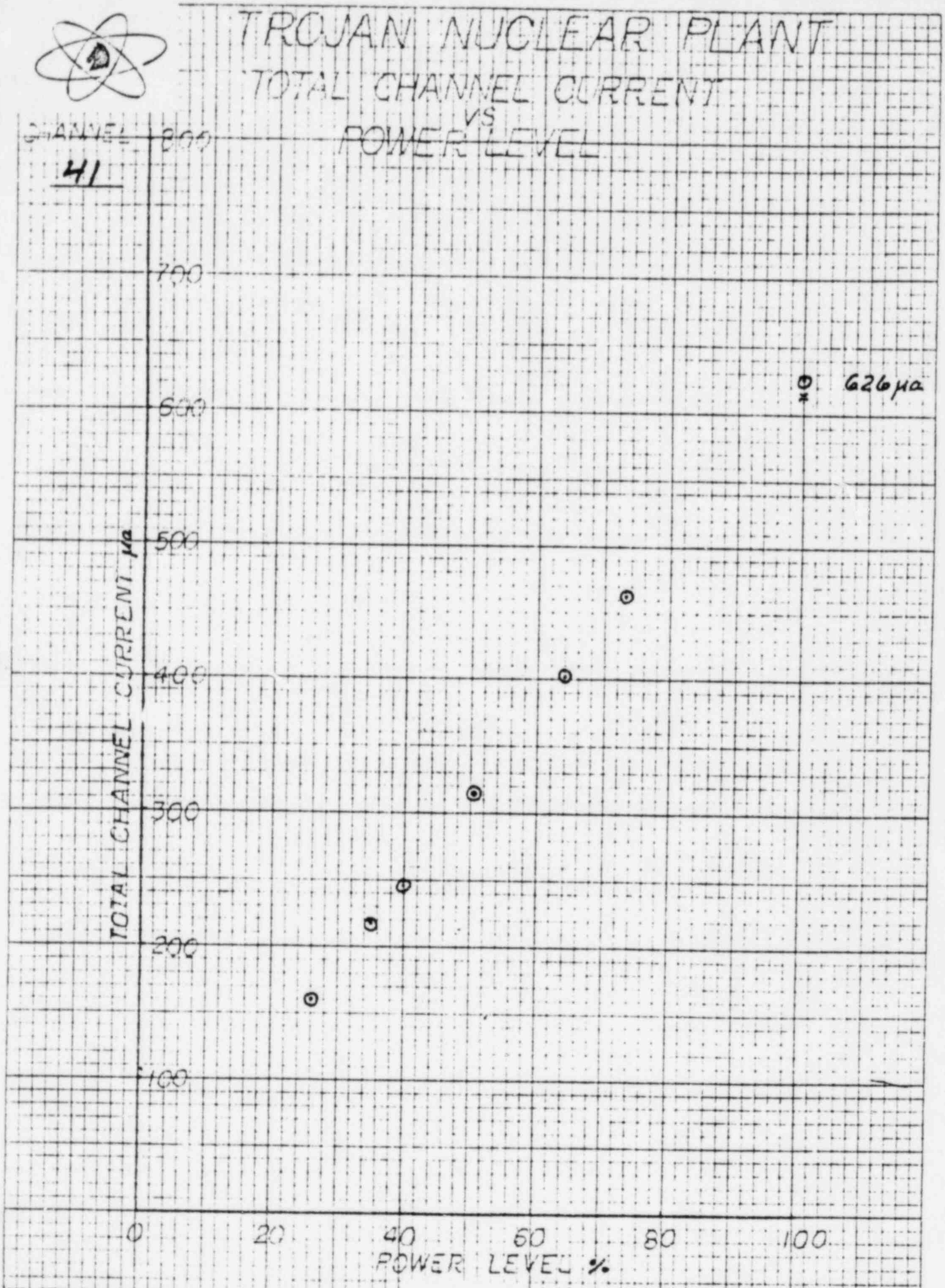


FIGURE 5-4

BY

DATE 8-31-82

TROJAN NUCLEAR PLANT

TOTAL CHANNEL CURRENT VS POWER LEVEL

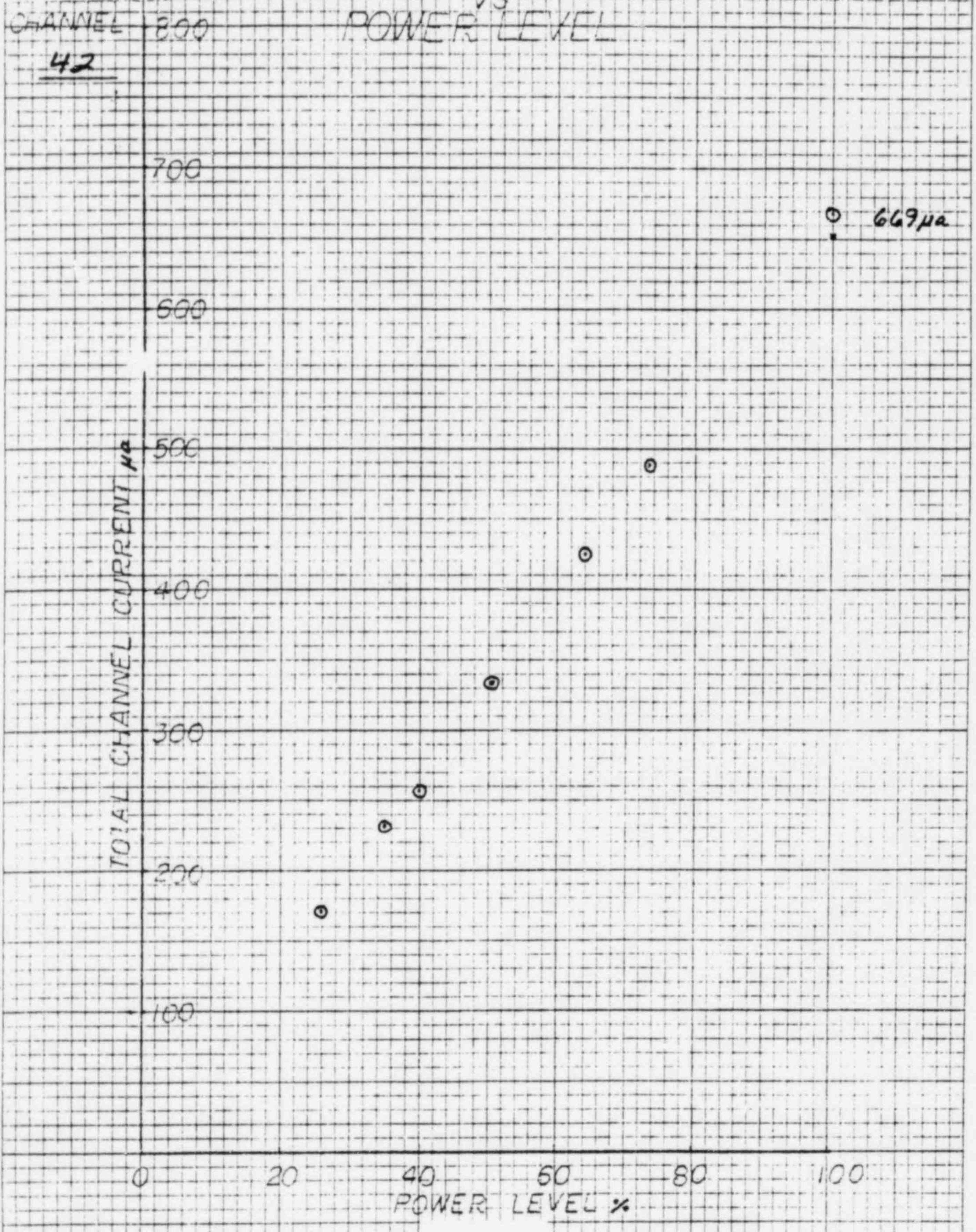


FIGURE 5-5

BY Gary Bain DATE 8-31-82

TROJAN NUCLEAR PLANT
TOTAL CHANNEL CURRENT VS POWER LEVEL

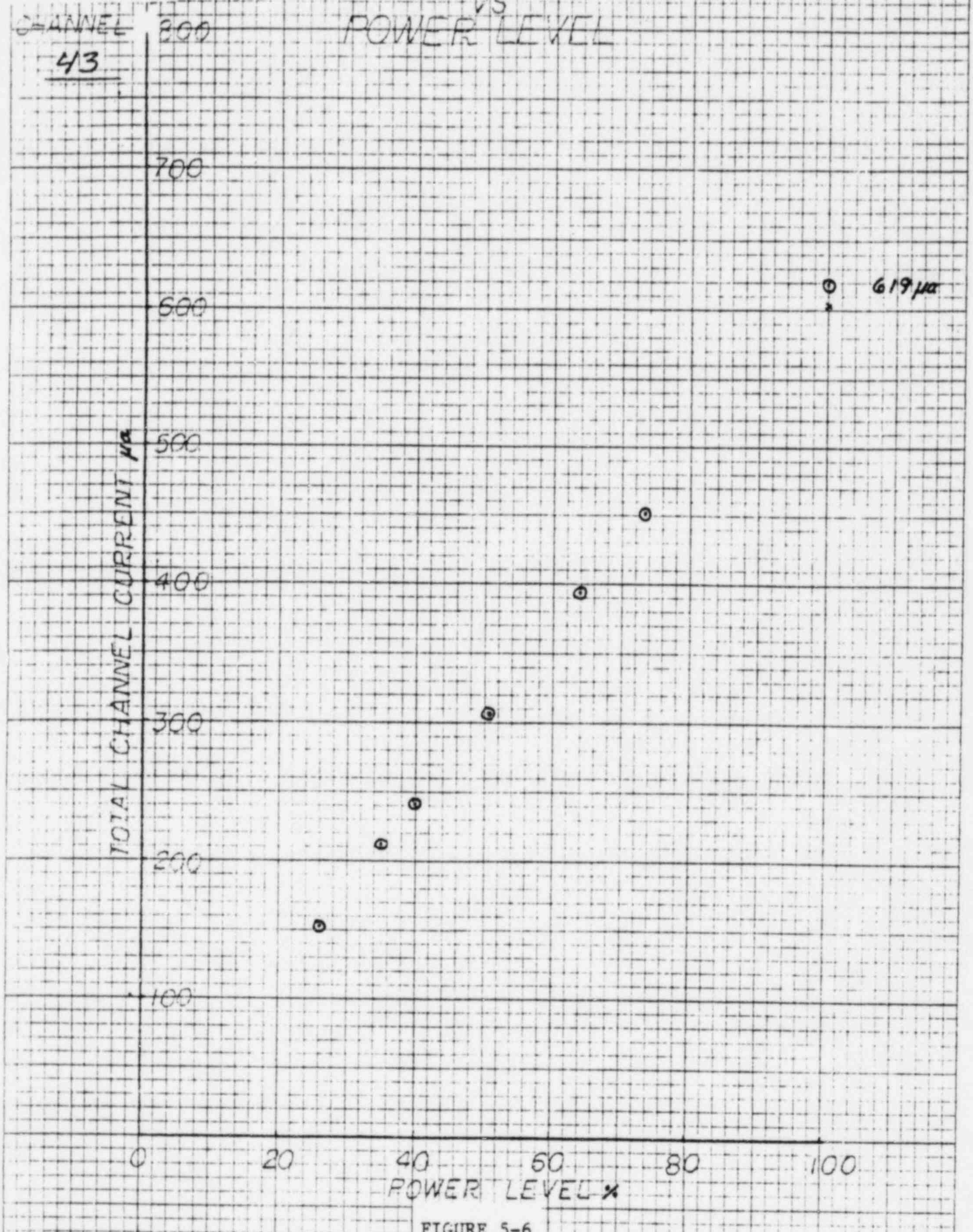


FIGURE 5-6

BY Gary Bain DATE 8-31-82

TROJAN NUCLEAR PLANT

TOTAL CHANNEL CURRENT VS POWER LEVEL

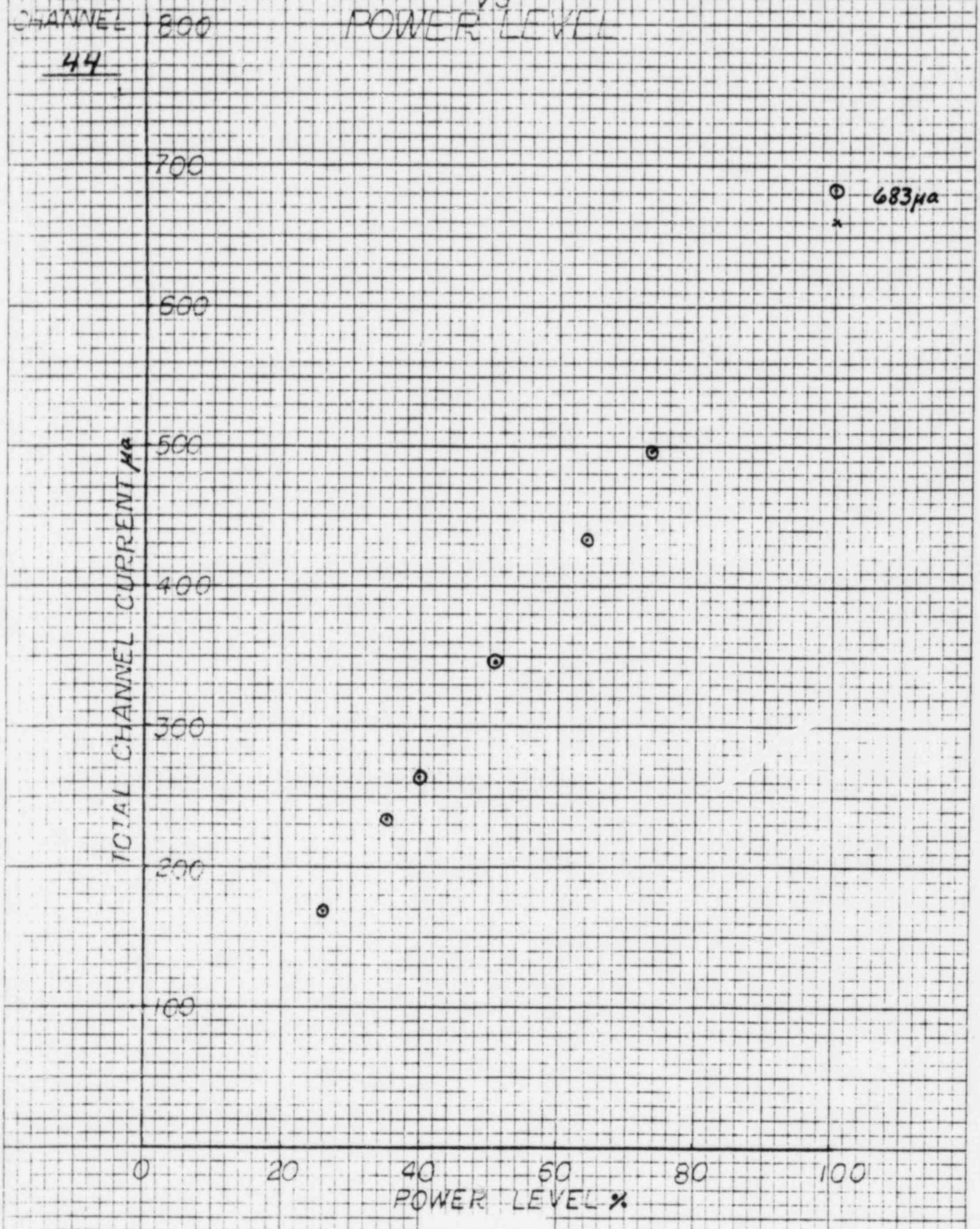


FIGURE 5-7

BY

DATE 8-31-82

TROJAN NUCLEAR PLANT
NORMALIZED EXCORE F.P. CURRENT VS INCORE AXIAL OFFSET

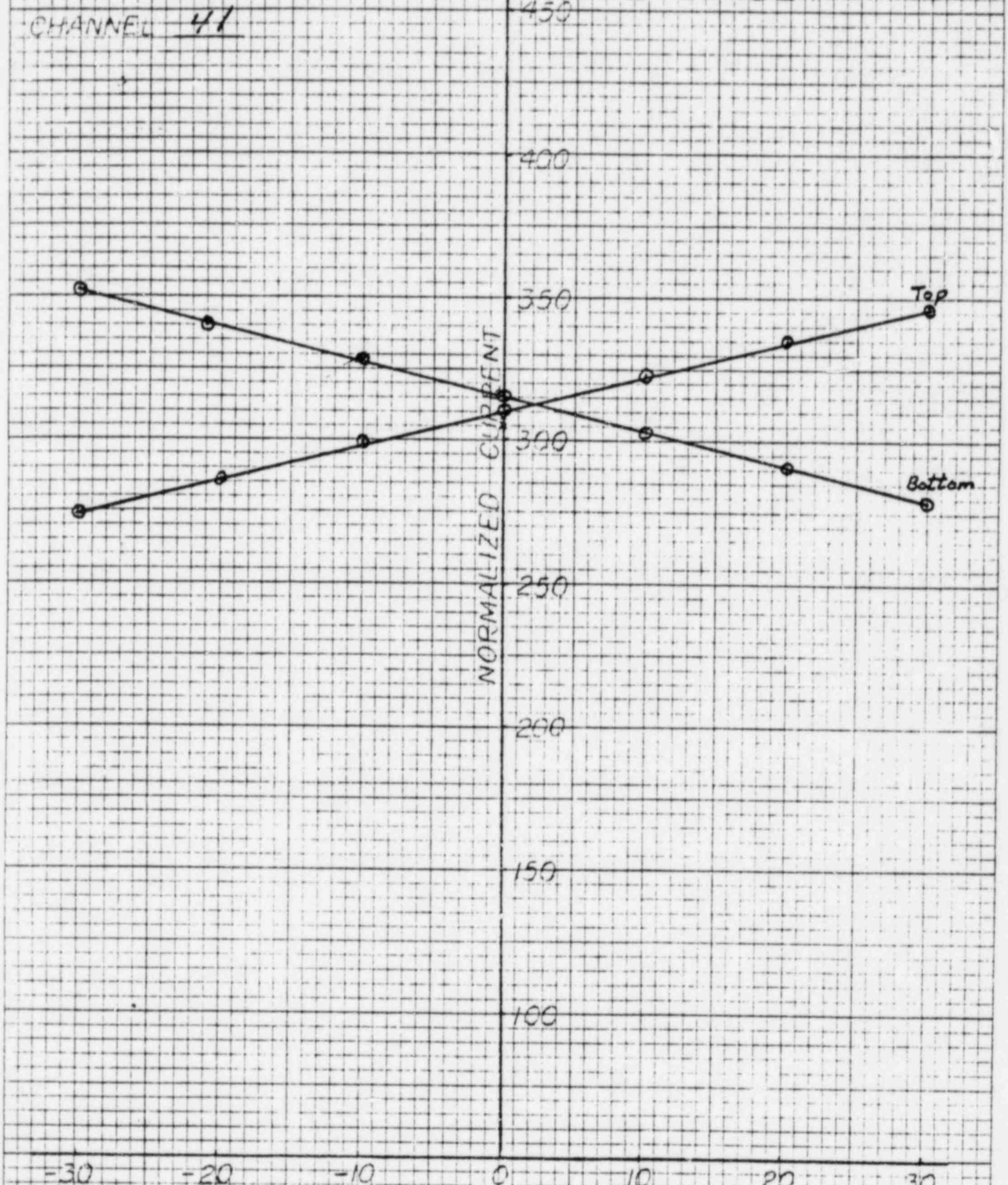


FIGURE 5-8

BY Gary Bain

DATE 8-31-82

TROJAN NUCLEAR PLANT
NORMALIZED EXCORE F.P. CURRENT VS INCORE AXIAL OFFSET

CHANNEL 42

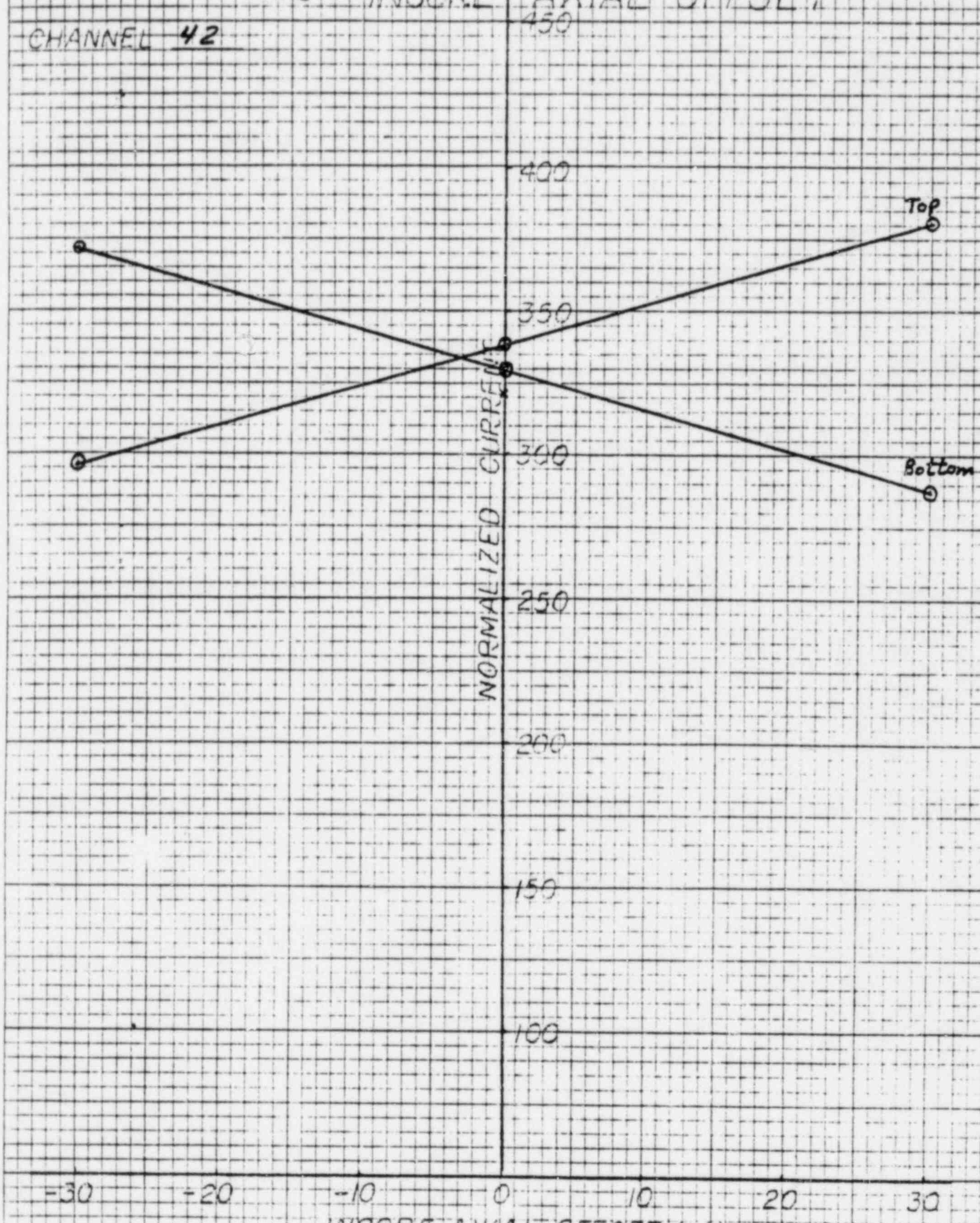


FIGURE 5-9

BY Gary Ravi

DATE 8-31-82

TROJAN NUCLEAR PLANT

NORMALIZED EXCORE P.R. CURRENT vs INCORE AXIAL OFFSET

CHANNEL 43

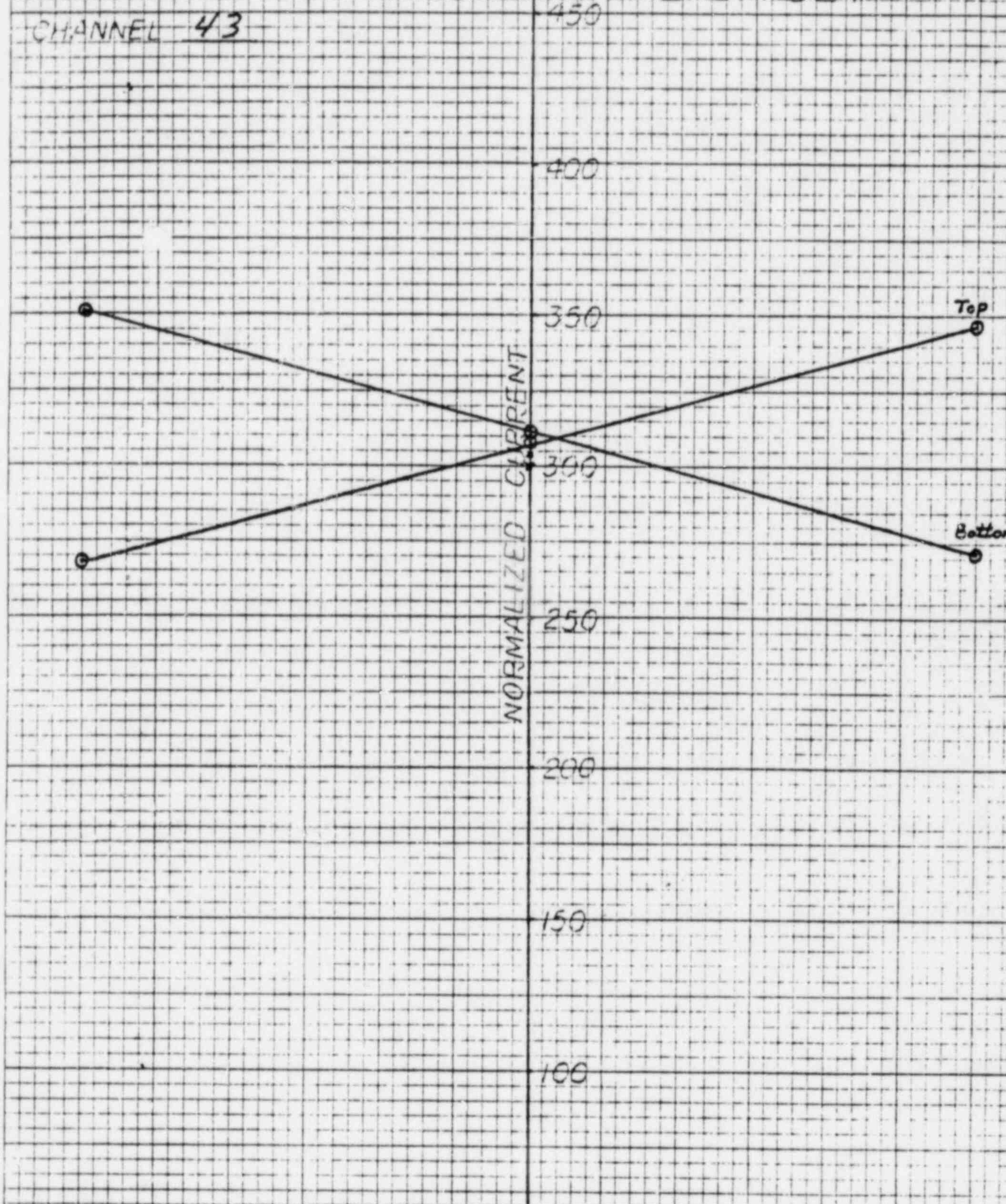


FIGURE 5-10

BY

DATE 8-31-82

TROJAN NUCLEAR PLANT
NORMALIZED EXCORE P.R. CURRENT VS INCORE AXIAL OFFSET

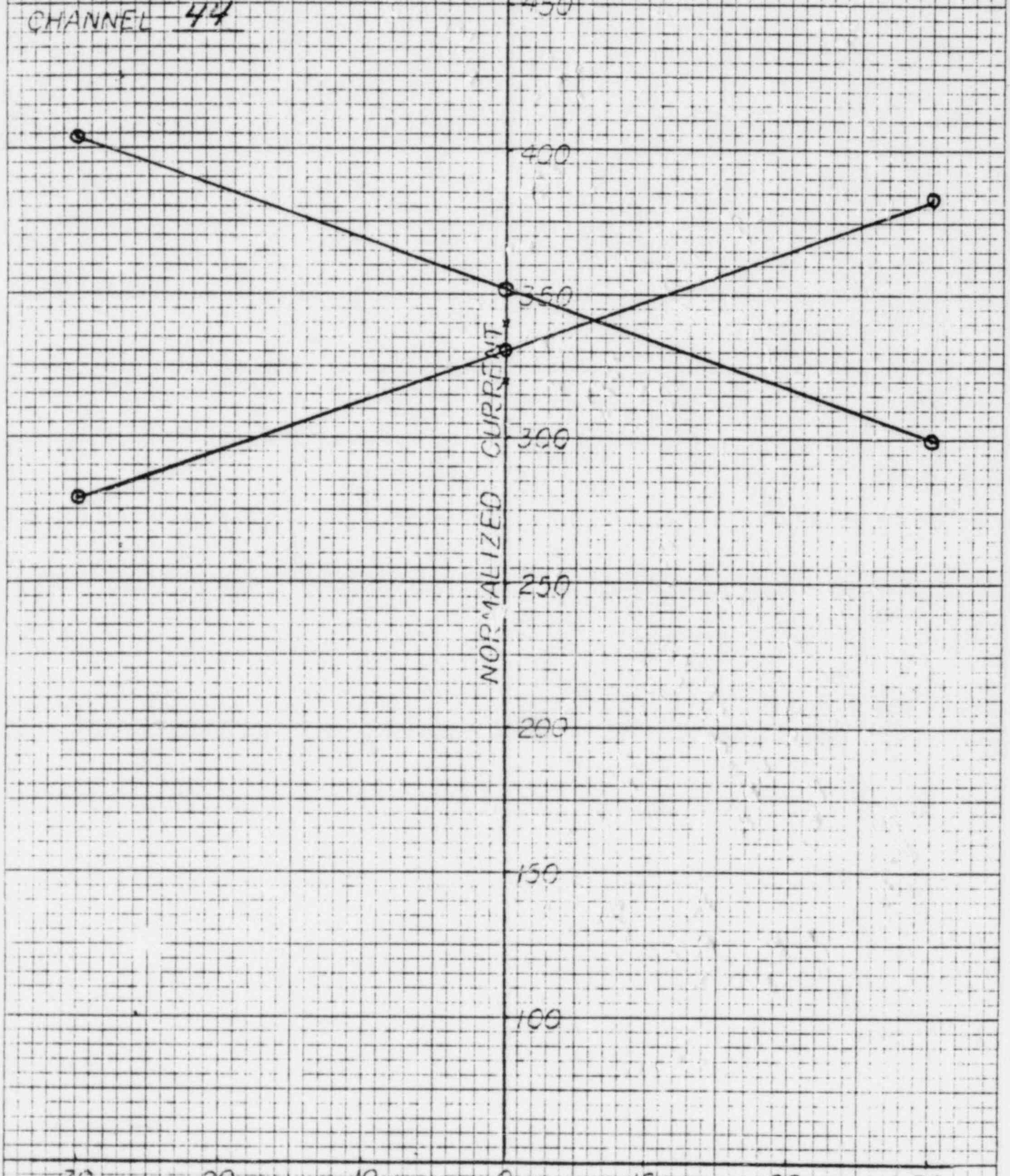


FIGURE 5-11

BY

DATE 8-31-82

TROJAN NUCLEAR PLANT

INCORE vs EXCORE OFFSETS

CHANNEL 41

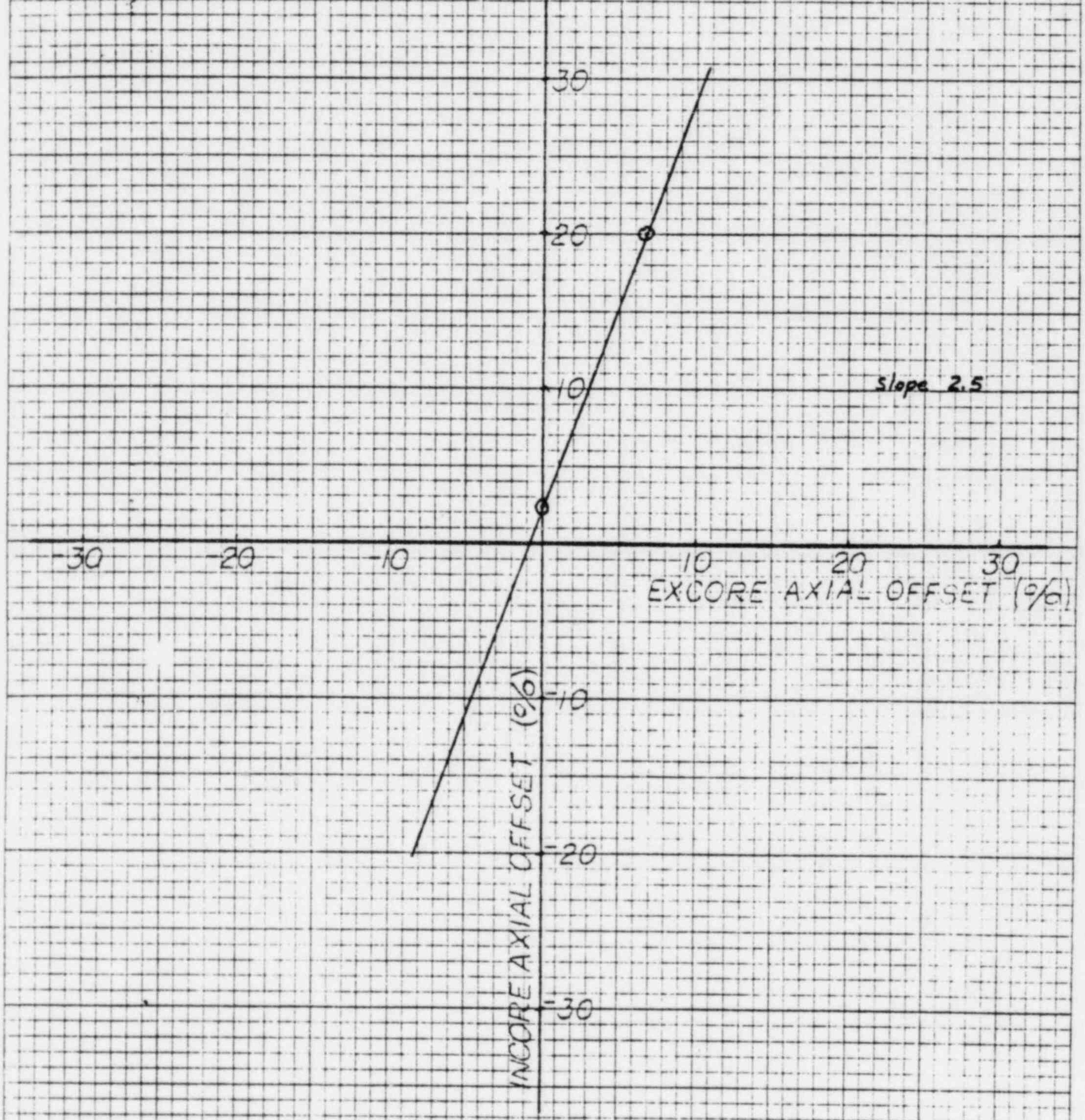


FIGURE 5-12

BY

DATE 8-31-82

TROJAN NUCLEAR PLANT

INCORE vs EXCORE OFFSETS

CHANNEL 42

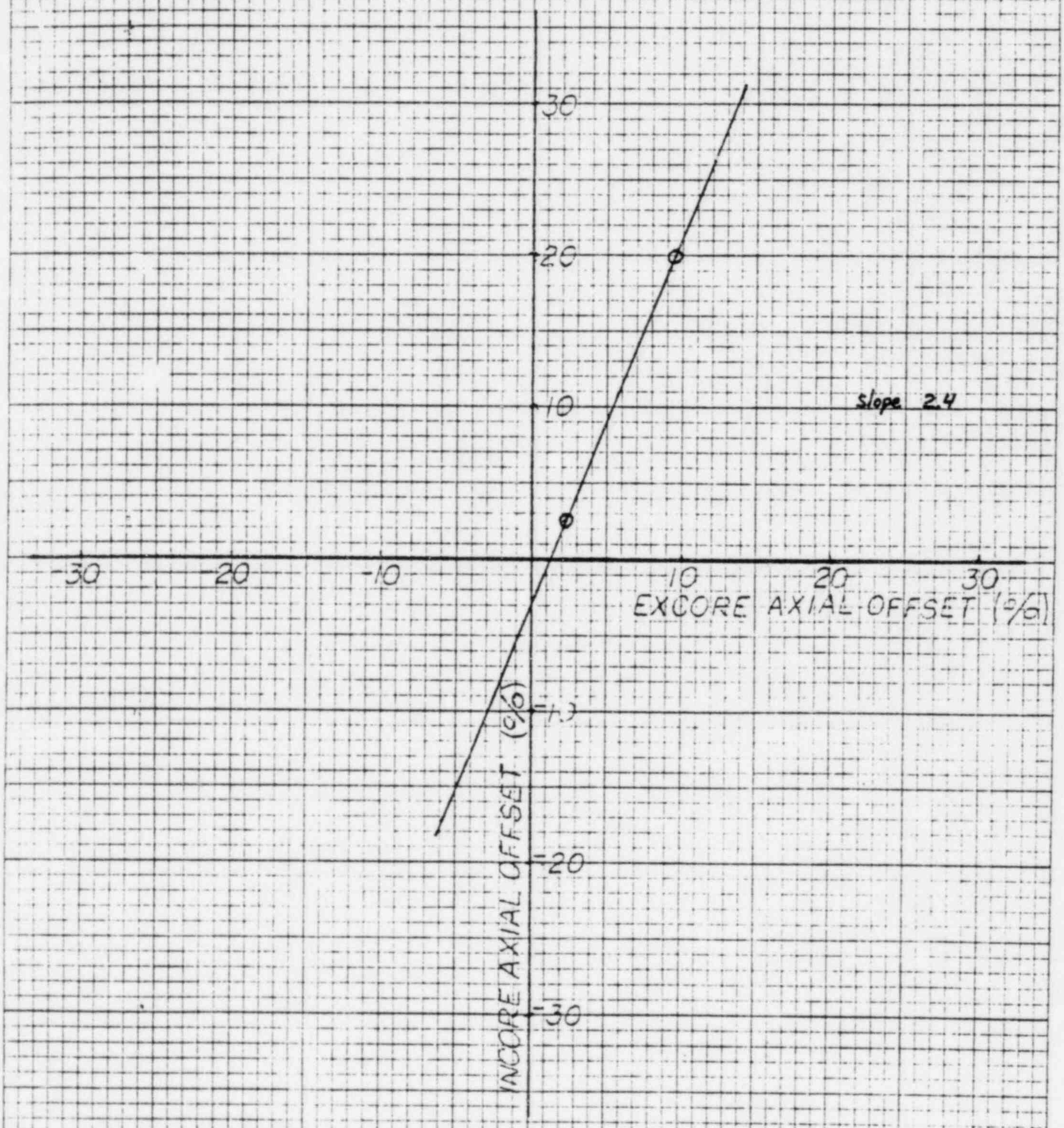


FIGURE 5-13

BY Gary Bain DATE 8-31-82

TROJAN NUCLEAR PLANT

INCORE vs EXCORE OFFSETS

CHANNEL 43

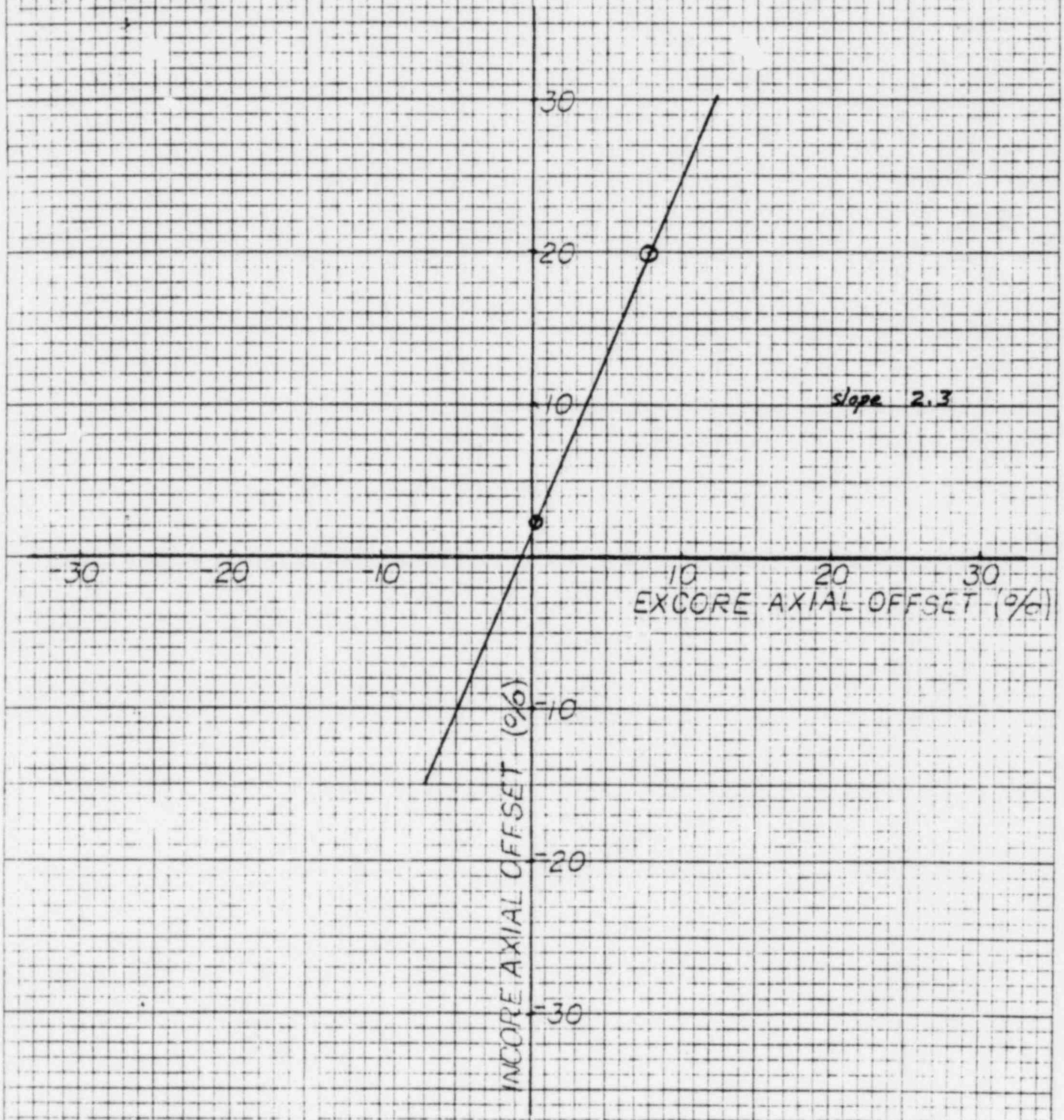


FIGURE 5-14

BY

DATE 8-31-82

TROJAN NUCLEAR PLANT

INCORE vs EXCORE OFFSETS

CHANNEL 44

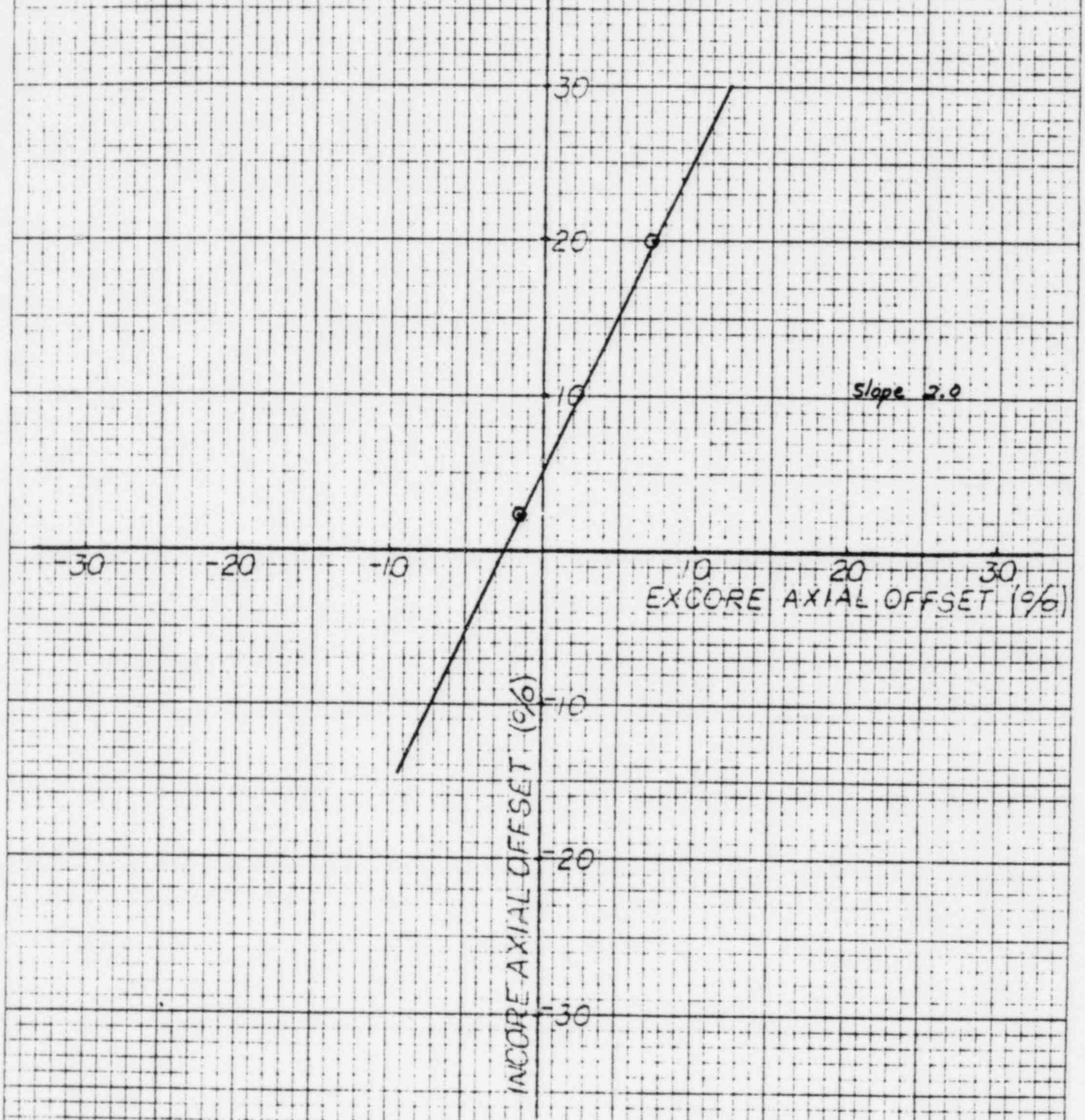


FIGURE 5-15

BY: DATE 8-31-82

FIGURE 5-16

Sheet 1 of 9

FLUX MAP 122 (50 PERCENT POWER)

```
          TROJAN FLUX MAP #122  08/26/82  50% HU(25   ) CYS D=201 MIDDLE AO  -HAIR
CALCULATED POWER TILTS (NORMALIZED TO 1.000)

 . 1.0085.0.9878 .                        .                       .               .
   .     .     .                          .                         .  0.9981   .
     .   .   .                     1.0099 . 0.9903                    .       .
1.0112 . . . 0.9929                       .                             .   .
  . . . . . . . . .             . . . . . . . . . . .             1.0094  .  0.9960
1.0076 . . . 0.9991                       .                             .   .
     .   .   .                     1.0023 . 0.9975                    .       .
   .     .     .                          .                         .  0.9965   .
 . 0.9970.0.9960 .                        .                       .               .


POSITIVE "Y" VS. NEGATIVE "Y" TILT
 1.0001             0.9999


POSITIVE "X" VS. NEGATIVE "X" TILT
 0.9939             1.0061
```

FIGURE 5-16

```
        TROJAN FLUX MAP #122  08/26/82  50% RU(25    ) CYS D=201 MIDDLE AO  -HAIR

THE FOLLOWING CALCULATIONS ARE BASED ON A DIVISION

OF THE CORE INTO *OCTANTS*, THAT IS, QUADRANTS

DIVIDED INTO TWO AXIAL REGIONS OF EQUAL VOLUME.

RELATIVE POWER IN            RELATIVE POWER IN             PERCENT AXIAL OFFSET      CORE AVERAGE
UPPER HALF OF CORE           LOWER HALF OF CORE            TOWARD TOP OF CORE        AXIAL OFFSET

(-,+)    .    (+,+)          (-,+)    .    (+,+)           (-,+)    .    (+,+)
         .                            .                             .
 1.0831  .  1.0618            0.9366  .  0.9189              7.252  .    7.215              7.297
         .                            .                             .
.  .  .  .  .  .  .  .       .  .  .  .  .  .  .  .        .  .  .  .  .  .  .  .
         .                            .                             .
 1.0789  .  1.0681            0.9256  .  0.9270              7.645  .    7.074
         .                            .                             .
(-,-)    .    (+,-)          (-,-)    .    (+,-)           (-,-)    .    (+,-)


POWER TILT IN                POWER TILT IN
UPPER HALF OF CORE           LOWER HALF OF CORE

(-,+)    .    (+,+)          (-,+)    .    (+,+)           (-,+)    .    (+,+)
         .                            .                             .
 1.0094  .  0.9896            1.0104  .  0.9912             THESE   .  EDITS
         .                            .                             .
.  .  .  .  .  .  .  .       .  .  .  .  .  .  .  .        .  .  .  .  .  .  .  .
         .                            .                             .
 1.0055  .  0.9955            0.9985  .  0.9999             ADDED   .  JAN.,1969
         .                            .                             .
(-,-)    .    (+,-)          (-,-)    .    (+,-)           (-,-)    .    (+,-)
```

FIGURE 5-16

```
                    TROJAN FLUX MAP #122  08/26/82  50% BU(25   3 CYS D=201 MIDDLE AO  -BAIR

  TOP TWENTY NUCLEAR F-DELTA-H                        TOP TWENTY NUCLEAR FQ


313J 2EN              FDHN=1.3543           313J 2EN              FQN=1.6953
253M 5MD              FDHN=1.3519           314J 2EL              FQN=1.6898
314J 2EL              FDHN=1.3498           213P 9NM              FQN=1.6641
276L 4DM              FDHN=1.3458           209P 7NE              FQN=1.6636
213P 9NM              FDHN=1.3430           253M 5MD              FQN=1.6626
362G 2LM              FDHN=1.3423           362G 2LM              FQN=1.6556
364G 2MN              FDHN=1.3420           210P 7LE              FQN=1.6555
209P 7NE              FDHN=1.3400           364G 2MN              FQN=1.6550
210P 7LE              FDHN=1.3387           276L 4DM              FQN=1.6548
363G 2ML              FDHN=1.3374           214P 9LM              FQN=1.6531
214P 9LM              FDHN=1.3355           436D 7MF              FQN=1.6522
333J14ED              FDHN=1.3335           437D 7MD              FQN=1.6516
487H 9DM              FDHN=1.3292           363G 2ML              FQN=1.6500
488H 9FM              FDHN=1.3250           487H 9DM              FQN=1.6455
433D 5ED              FDHN=1.3237           222N 3ML              FQN=1.6432
257M 7ED              FDHN=1.3227           257M 7ED              FQN=1.6417
256M 7DE              FDHN=1.3227           256M 7DE              FQN=1.6417
334J14EF              FDHN=1.3222           440D 9ML              FQN=1.6410
244N13MF              FDHN=1.3207           244N13MF              FQN=1.6407
297K 5MN              FDHN=1.3197           488H 9FM              FQN=1.6406


NOTE= VALUES ARE BEST ESTIMATE AND DO NOT INCLUDE ENGINEERING OR NUCLEAR UNCERTAINTY.
```

FIGURE 5-16

LOCA FQ ENVELOPE LIMIT AXIALLY

AXIAL POINT	FQ(Z) LIMIT	MEAS. FQ(Z)	SOURCE NO.ID
1	1.9952	0.6703	297K 5MN
2	2.4035	0.8700	297K 5MN
3	2.8026	1.0640	297K 5MN
4	3.2862	1.2116	297K 5MN
5	3.6053	1.3263	297K 5MN
6	4.0043	1.3536	297K 5MN
7	4.1760	1.3950	304K 9DM
8	4.3802	1.5565	304K 9DM
9	4.3894	1.6253	297K 5MN
10	4.4034	1.6705	297K 5MN
11	4.4080	1.7113	440D 9ML
12	4.4266	1.7369	436D 7MF
13	4.4358	1.7605	313J 2EN
14	4.4499	1.7606	313J 2EN
15	4.4590	1.6931	257M 7ED
16	4.4730	1.7194	333J14ED
17	4.4822	1.7825	213P 9NM
18	4.4962	1.8036	313J 2EN
19	4.5101	1.8161	313J 2EN
20	4.5194	1.8238	313J 2EN
21	4.5286	1.8334	313J 2EN
22	4.5426	1.7974	313J 2EN
23	4.5565	1.7788	313J 2EN
24	4.5658	1.6060	213P 9NM
25	4.5797	1.7345	244N13MF
26	4.5890	1.7574	244N13MF
27	4.6029	1.7661	244N13MF
28	4.6168	1.7695	244N13MF
29	4.6261	1.7558	222N 3ML
30	4.6354	1.7441	222N 3ML

FIGURE 5-16

```
        LOCA FQ ENVELOPE LIMIT AXIALLY
AXIAL        FQ(Z)       MEAS.       SOURCE
POINT        LIMIT       FQ(Z)       NO.ID
 31         4.6400      1.7199      222N 3ML
 32         4.6400      1.6486      222N 3ML
 33         4.6400      1.6265      244N13MF
 34         4.6400      1.6753      244N13MF
 35         4.6400      1.6823      244N13MF
 36         4.6400      1.6848      244N13MF
 37         4.6400      1.6787      244N13MF
 38         4.6400      1.6607      244N13MF
 39         4.6400      1.6379      244N13MF
 40         4.6400      1.5930      222N 3ML
 41         4.6400      1.4548      443B12ED
 42         4.6400      1.5435      244N13MF
 43         4.6400      1.5556      244N13MF
 44         4.6400      1.5495      244N13MF
 45         4.6400      1.5249      244N13MF
 46         4.6400      1.5092      244N13MF
 47         4.6400      1.4718      244N13MF
 48         4.6400      1.4332      244N13MF
 49         4.6400      1.3594      473C13EF
 50         4.6400      1.2514      244N13MF
 51         4.6400      1.3025      253M 5MD
 52         4.6400      1.2914      253M 5MD
 53         4.6400      1.2549      253M 5MD
 54         4.6400      1.2060      253M 5MD
 55         4.6400      1.1421      253M 5MD
 56         4.6400      1.0668      253M 5MD
 57         4.6400      0.9638      253M 5MD
 58         4.6400      0.8443      433D 5ED
 59         4.6400      0.7062      434D 5EN
 60         4.6400      0.5241      434D 5EN
```

FIGURE 5-16

```
MEASURED AND PERCENT. DIFF. OF FDHH  TROJAN FLUX MAP #122  08/26/82  50% HU(25  ) CYS D#201 MIDDLE AO  -HAIR
      R      P      N      M   . .L . . .K . . .J . . .H . . .G . . .F . . .E . .  D      C      B      A
                               . 0.730. 0.828. 0.532. 0.701. 0.535. 0.844. 0.746.
1                              .   1.9.   2.4.   2.7.   3.1.   5.0.   6.6.   6.6.
                 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
                 . 0.771. 1.042. 1.147. 1.041. 1.196. 0.823. 1.188. 1.032. 1.119. 0.948. 0.746.
2                .   5.2.   5.2.   1.9.   2.3.   2.0.   2.0.   2.8.   4.1.   2.1.  -2.0.   4.1.
          . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
          . 0.757. 1.188. 0.914. 1.055. 1.044. 1.009. 0.961. 0.992. 1.015. 1.008. 0.851. 1.172. 0.790.
3         .   3.4.   3.3.   2.4.   1.9.   1.9.  -0.1.  -0.8.  -0.2.   1.6.  -0.2.  -2.0.   4.1.  10.2.
          . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
          . 1.018. 0.912. 1.055. 1.245. 1.070. 1.226. 1.024. 1.215. 1.035. 1.229. 1.029. 0.899. 1.024.
4         .   2.0.   2.2.  -1.0.  -1.5.  -1.5.  -3.0.  -3.2.  -2.0.  -1.3.  -0.9.  -1.3.   2.8.   5.4.
   . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   . 0.753. 1.151. 1.054. 1.262. 0.954. 1.251. 0.928. 1.183. 0.907. 1.207. 0.932. 1.240. 1.031. 1.113. 0.712.
5  .   5.4.   2.6.   1.5.  -0.7.  -1.5.  -1.5.  -3.2.  -3.9.  -3.9.  -2.9.  -2.2.  -0.9.   0.9.   0.9.   1.4.
   . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   . 0.851. 1.038. 1.026. 1.081. 1.245. 1.152. 1.198. 1.068. 1.168. 1.123. 1.218. 1.062. 1.009. 0.995. 0.851.
6  .   5.5.   2.6.  -0.0.  -0.5.  -0.9.  -1.6.  -2.0.  -2.7.  -3.0.  -2.8.  -2.5.  -1.2.   0.0.   0.1.   1.4.
   . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   . 0.529. 1.185. 1.004. 1.236. 0.927. 1.222. 0.929. 0.961. 0.905. 1.207. 0.927. 1.240. 0.994. 1.144. 0.509.
7  .   3.4.   1.1.  -0.6.  -0.8.  -0.9.  -1.8.  -2.0.  -2.2.  -2.4.  -2.3.  -0.8.  -0.4.  -0.0.  -0.4.   0.9.
   . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   . 0.697. 0.818. 0.983. 1.053. 1.151. 0.934. 1.172. 0.835. 1.102. 0.915. 1.190. 1.060. 0.963. 0.790. 0.684.
8  .   2.9.   1.4.   0.9.  -1.1.  -0.8.  -1.8.  -2.0.  -2.4.  -2.6.  -2.7.  -1.4.  -1.0.  -0.3.   0.1.   2.1.
   . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   . 0.526. 1.184. 1.023. 1.226. 0.928. 1.221. 0.917. 0.951. 0.904. 1.201. 0.933. 1.236. 1.000. 1.171. 0.523.
9  .   3.1.   1.7.   1.5.  -2.1.  -2.2.  -2.4.  -2.5.  -2.8.  -2.6.  -2.8.  -1.5.  -1.3.  -0.5.   0.8.   2.2.
   . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   . 0.837. 1.052. 1.069. 1.036. 1.214. 1.119. 1.181. 1.067. 1.175. 1.127. 1.226. 1.049. 0.994. 1.052. 0.840.
10.    5.1.   5.1.   4.9.  -4.2.  -4.2.  -3.8.  -3.0.  -3.1.  -3.2.  -3.4.  -3.2.  -3.1.  -2.5.   4.3.   4.3.
   . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
   . 0.745. 1.170. 1.069. 1.200. 0.922. 1.204. 0.927. 1.214. 0.937. 1.237. 0.933. 1.216. 0.997. 1.176. 0.749.
11.    5.3.   5.3.   5.3.  -4.3.  -4.1.  -3.7.  -3.1.  -2.9.  -2.8.  -3.2.  -3.8.  -3.8.  -3.8.   4.9.   4.9.
   . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
          . 1.028. 0.921. 1.042. 1.207. 1.030. 1.219. 1.048. 1.235. 1.056. 1.205. 1.012. 0.893. 1.045.
12        .   4.9.   4.6.  -0.8.  -3.5.  -3.5.  -3.4.  -3.2.  -3.1.  -3.2.  -4.5.  -4.5.   0.6.   5.8.
          . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
          . 0.757. 1.189. 0.903. 1.001. 1.015. 1.003. 0.977. 1.003. 1.021. 1.029. 0.880. 1.166. 0.776.
13        .   4.7.   4.7.   2.6.  -2.2.  -0.1.  -0.8.  -0.8.  -2.0.  -0.9.   0.0.  -0.3.   2.1.   6.7.
          . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
                 . 0.759. 1.017. 1.148. 1.042. 1.173. 0.813. 1.163. 1.023. 1.148. 1.026. 0.768.
14               .   4.7.   3.9.   3.0.   3.6.   0.3.  -0.1.  -1.3.   0.7.   2.6.   4.5.   5.6.
                 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .     . . . .
                               . 0.703. 0.850. 0.523. 0.695. 0.518. 0.813. 0.733.             . MEAS .
15                             .   7.4.   6.0.   1.8.   1.5.  -0.2.   0.7.   2.6.             . DIFF .
                               . . . . . . . . . . . . . . . . . . . . . . . . . .             . . . .
```

FIGURE 5-16

Sheet 7 of 9

```
PERCENT. DIFF. OF EXPECT. AND MEAS. FDHN  TROJAN FLUX MAP #122  06/26/82  50% BU(25   ) CYS D=201 MIDDLE AO  -HAIR
     R     P     N     M    . .L . . .K . . .J . . .H . . .G . . .F . . .E . .  D     C     B     A
                          .     .     .  2.7.     .     .  6.6.     .
1                         .     .     .     .     .     .     .     .
              . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
              .  5.2.     .     .  2.3.     .  2.0.     .     .     .     .     .
2             .     .     .     .     .     .     .     .     .     .     .     .
        . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
        .     .     .     .     .     .     . -0.8.     .  1.6.     . -2.0.     . 10.2.
3       .     .     .     .     .     .     .     .     .     .     .     .     .     .
        . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
        .  2.6.  2.2.     .     .     .     . -3.2.     .     .     .     .     .     .
4       .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .     .     .     .     . -1.5.     .     .     . -3.9.     . -2.2.     .  0.9.     .     .
5 .     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .  5.5.     . -0.0.     .     . -1.6.     . -2.7.     .     .     .     .     .  0.1.     .
6 .     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .     .     .     . -0.8.     .     . -2.0.     .     . -2.3.     .     . -0.0.     .     .
7 .     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .  2.9.     .  0.3.     . -0.8.     . -2.0.     .     . -2.7.     . -1.0. -0.3.  0.1.     .
8 .     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .     .  1.7.     .     .     .     .     .     . -2.6.     . -1.5.     .     .     .  2.2.
9 .     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .     .     .     .     . -4.2.     . -3.0.     .     .     .     . -3.1.     .     .     .
10.     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
  .  5.3.     .     .     . -4.1.     .     . -2.9.     .     . -3.8.     .     .     .  4.9.
11.     .     .     .     .     .     .     .     .     .     .     .     .     .     .     .
  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
        .     .     .     .     . -3.5.     .     . -3.1.     .     . -4.5.     .     .
12      .     .     .     .     .     .     .     .     .     .     .     .     .     .
        . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
        .     .  4.7.     . -2.2.     .     .     . -0.8.     .     .     .     .     .  6.7.
13      .     .     .     .     .     .     .     .     .     .     .     .     .     .
        . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
              .  4.7.     .     .     .  0.3.     .     .  0.7.     .  4.5.     .
14            .     .     .     .     .     .     .     .     .     .     .     .
              . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
                          .  7.4.     .     .  1.5.     .     .     .
15                        .     .     .     .     .     .     .     .
                          . . . . . . . . . . . . . . . . . . . . . .
```

FIGURE 5-16

```
TROJAN FLUX MAP #122  08/26/82  50% HU(25   ) CYS D#201 MIDDLE AO  -HAIR

   POINT      SOURCE      NUCLEAR FXY                    POINT      SOURCE      NUCLEAR FXY

     1      297 K 5MN       1.5746                         31     222 N 3ML        1.3747
     2      297 K 5MN       1.5753                         32     222 N 3ML        1.3467
     3      297 K 5MN       1.5491                         33     244 N13MF        1.4463
     4      297 K 5MN       1.5148                         34     244 N13MF        1.3874
     5      297 K 5MN       1.4856                         35     244 N13MF        1.3897
     6      297 K 5MN       1.4372                         36     244 N13MF        1.3475
     7      304 K 9DM       1.4553                         37     244 N13MF        1.4013
     8      304 K 9DM       1.4046                         38     244 N13MF        1.3997
     9      297 K 5MN       1.3827                         39     244 N13MF        1.3984
    10      297 K 5MN       1.3683                         40     222 N 3ML        1.3941
    11      440 D 9ML       1.3617                         41     493 R12ED        1.4022
    12      436 D 7MF       1.3554                         42     244 N13MF        1.4357
    13      313 J 2EN       1.3576                         43     244 N13MF        1.4031
    14      313 J 2EN       1.3595                         44     244 N13MF        1.4055
    15      257 M 7ED       1.3931                         45     244 N13MF        1.4011
    16      333 J14ED       1.3941                         46     244 N13MF        1.4009
    17      213 P 9NM       1.3568                         47     244 N13MF        1.3877
    18      313 J 2EN       1.3602                         48     244 N13MF        1.3801
    19      313 J 2EN       1.3647                         49     473 C13EF        1.3835
    20      313 J 2EN       1.3677                         50     244 N13MF        1.3968
    21      313 J 2EN       1.3782                         51     253 M 5MD        1.3636
    22      313 J 2EN       1.3617                         52     253 M 5MD        1.3705
    23      313 J 2EN       1.3823                         53     253 M 5MD        1.3741
    24      213 P 9NM       1.3701                         54     253 M 5MD        1.3772
    25      244 N134F       1.3679                         55     253 M 5MD        1.3765
    26      244 N13MF       1.3601                         56     253 M 5MD        1.3880
    27      244 N13MF       1.3664                         57     253 M 5MD        1.3933
    28      244 N13MF       1.3724                         58     433 D 5ED        1.4175
    29      222 N 3ML       1.3695                         59     434 D 5EN        1.4924
    30      222 N 3ML       1.3737                         60     434 D 5EN        1.4986

NOTE= VALUES ARE BEST ESTIMATE AND DO NOT INCLUDE ENGINEERING OR NUCLEAR UNCERTAINTY.
```

FIGURE 5-16

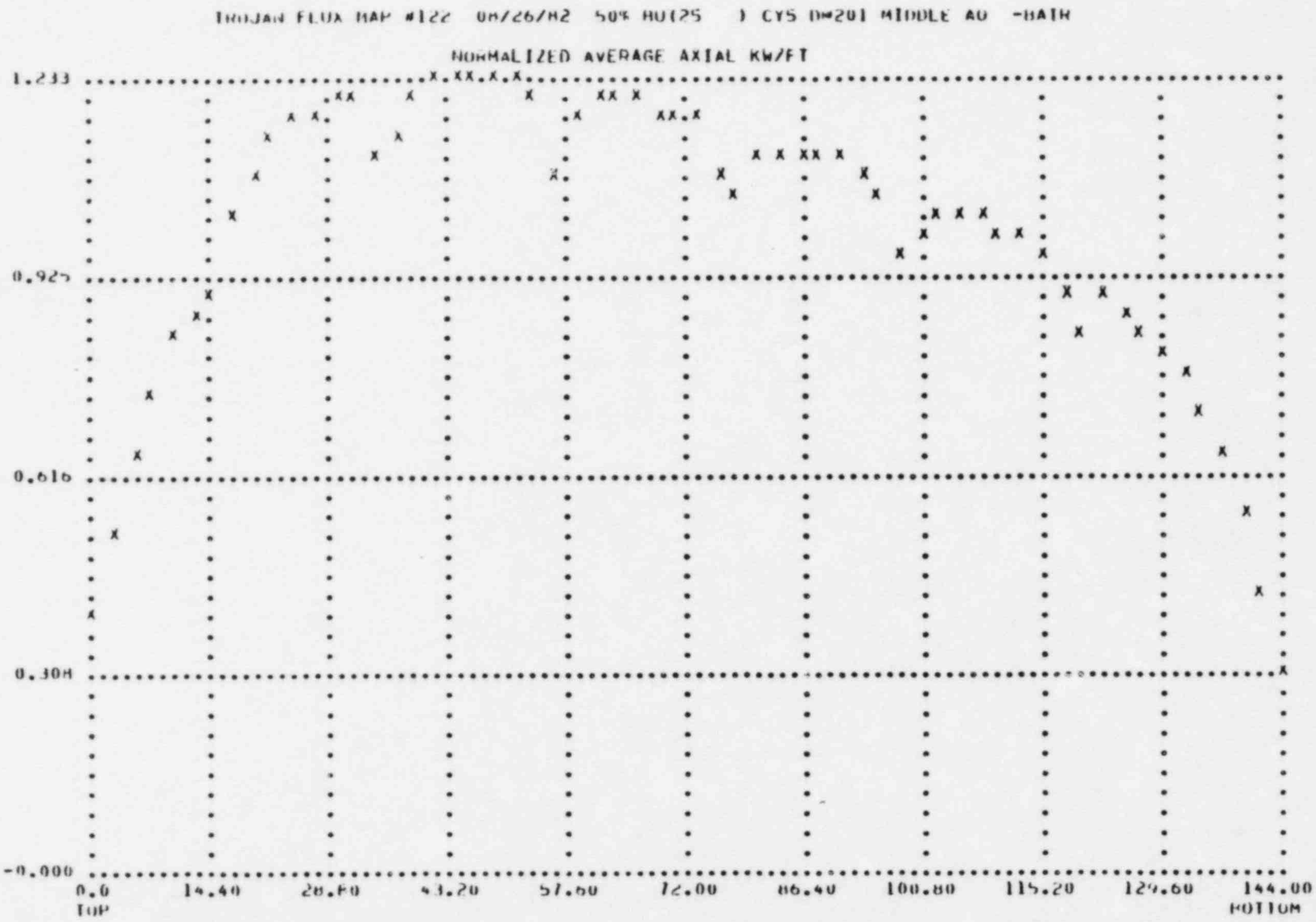

TROJAN FLUX MAP #122 08/26/82 50% HU(25) CYS D=201 MIDDLE AO -BATH
NORMALIZED AVERAGE AXIAL KW/FT
1.233
0.925
0.616
0.308
-0.000
0.0
TOP
14.40
28.80
43.20
57.60
72.00
86.40
100.80
115.20
129.60
144.00
BOTTOM

FIGURE 5-17

Sheet 1 of 9

FLUX MAP 125 (100 PERCENT POWER)

```
          TROJAN FLUX MAP #125  06/28/82 100% BU(75   ) CYS D=208            -HAIR
CALCULATED POWER TILTS (NORMALIZED TO 1.000)


     . 1.0022.0.9961 .                                                   .              .
       .    .    .                    .                                   .  0.9991    .
         .    .    .                  .                                     .        .
   1.0071 . . . 0.9864         1.0047 . 0.9912                                 .    .
    . . . . . . . . .                 .                               1.0085  .  0.9961
   1.0099 . . . 1.0057       . . . . . . . . . .                               .    .
         .    .    .                  .                                     .        .
       .    .    .             1.0013 . 1.0028                           .  0.9963    .
     . 0.9927.0.9998 .                .                                .              .
                                      .


      POSITIVE "Y" VS. NEGATIVE "Y" TILT
       0.9980           1.0020


      POSITIVE "X" VS. NEGATIVE "X" TILT
       0.9970           1.0030
```

FIGURE 5-17

Sheet 2 of 9

```
      TROJAN FLUX MAP #125  08/28/82 100% HD(75   ) CYS D=208            -HAIR

  THE FOLLOWING CALCULATIONS ARE BASED ON A DIVISION
  OF THE CORE INTO *OCTANTS*, THAT IS, QUADRANTS
  DIVIDED INTO TWO AXIAL REGIONS OF EQUAL VOLUME.

  RELATIVE POWER IN          RELATIVE POWER IN          PERCENT AXIAL OFFSET     CORE AVERAGE
  UPPER HALF OF CORE         LOWER HALF OF CORE         TOWARD TOP OF CORE       AXIAL OFFSET

  (-,+)    .    (+,+)        (-,+)    .    (+,+)        (-,+)    .    (+,+)
           .                          .                          .
   0.9883  .  0.9731          1.0210  .  1.0094         -1.626   .  -1.831          -1.837
           .                          .                          .
  . . . . . . . . . .        . . . . . . . . . .        . . . . . . . . . .
           .                          .                          .
   0.9827  .  0.9823          1.0199  .  1.0232         -1.855   .  -2.037
           .                          .                          .
  (-,-)    .    (+,-)        (-,-)    .    (+,-)        (-,-)    .    (+,-)


  POWER TILT IN              POWER TILT IN
  UPPER HALF OF CORE         LOWER HALF OF CORE

  (-,+)    .    (+,+)        (-,+)    .    (+,+)      . (-,+)    .    (+,+)
           .                          .                          .
   1.0058  .  0.9913          1.0026  .  0.9912          THESE   .  EDITS
           .                          .                          .
  . . . . . . . . . .        . . . . . . . . . .        . . . . . . . . . .
           .                          .                          .
   1.0011  .  1.0007          1.0015  .  1.0047          ADDED   .  JAN.,1969
           .                          .                          .
  (-,-)    .    (+,-)        (-,-)    .    (+,-)        (-,-)    .    (+,-)
```

FIGURE 5-17

Sheet 3 of 9

```
                    TROJAN FLUX MAP #125  04/28/82 100% BU(75   ) CYS 0*208            -BAIR

  TOP TWENTY NUCLEAR F-DELTA-H                           TOP TWENTY NUCLEAR FQ


 323J 8DF             FDHN=1.3691            452C 3EL             FQN=1.5949
 214P 9LM             FDHN=1.3445            453C 3GI             FQN=1.5769
 210P 7LF             FDHN=1.3418            210P 7LE             FQN=1.5762
 301K 7ED             FDHN=1.3414            214P 9LM             FQN=1.5693
 300K 7EM             FDHN=1.3387            487H 9DM             FQN=1.5671
 313J 2EM             FDHN=1.3383            313J 2EN             FQN=1.5628
 213P 9NM             FDHN=1.3365            448H 9FM             FQN=1.5620
 253M 5MD             FDHN=1.3351            213P 9NM             FQN=1.5606
 314J 2FL             FDHN=1.3340            314J 2EL             FQN=1.5578
 286L12DF             FDHN=1.3335            204P 7NE             FQN=1.5533
 204P 7DF             FDHN=1.3296            253M 5MD             FQN=1.5501
 276L 4DM             FDHN=1.3294            323J 8DE             FQN=1.5500
 395F 9MJ             FDHN=1.3283            244N13MF             FQN=1.5483
 487H 9DM             FDHN=1.3280            362G 2LM             FQN=1.5444
 398F11LD             FDHN=1.3277            364G 2MN             FQN=1.5439
 440D 9ML             FDHN=1.3253            473C13EF             FQN=1.5429
 320J 6DF             FDHN=1.3251            276L 4DM             FQN=1.5428
 441D 9MN             FDHN=1.3249            363G 2ML             FQN=1.5394
 418F10DM             FDHN=1.3243            493H12ED             FQN=1.5392
 379G12FM             FDHN=1.3240            491H11ED             FQN=1.5343


 NOTE= VALUES ARE BEST ESTIMATE AND DO NOT INCLUDE ENGINEERING OR NUCLEAR UNCERTAINTY.
```

FIGURE 5-17

LOCA FQ ENVELOPE LIMIT AXIALLY

AXIAL POINT	FQ(Z) LIMIT	MEAS. FQ(Z)	SOURCE NO.ID
1	0.9976	0.6182	345F 9MN
2	1.2018	0.7857	301K 7FD
3	1.4013	0.9505	301K 7ED
4	1.6031	1.0878	301K 7FD
5	1.8026	1.2009	301K 7ED
6	2.0022	1.2485	323J 8DE
7	2.0880	1.2684	301K 7FD
8	2.1901	1.4192	323J 8DE
9	2.1947	1.4949	323J 8DE
10	2.2017	1.5443	323J 8DE
11	2.2040	1.5771	323J 8DF
12	2.2133	1.6011	323J 8DF
13	2.2179	1.6223	323J 8DE
14	2.2249	1.6205	323J 8DE
15	2.2295	1.5464	323J 8DE
16	2.2365	1.5321	301K 7FD
17	2.2411	1.6470	323J 8DE
18	2.2481	1.6645	323J 8DE
19	2.2550	1.6727	323J 8DE
20	2.2597	1.6759	323J 8DF
21	2.2643	1.6762	323J 8DE
22	2.2713	1.6724	323J 8DE
23	2.2782	1.6392	323J 8DE
24	2.2829	1.5384	333J14ED
25	2.2898	1.6328	210P 7LE
26	2.2945	1.6782	214P 9LM
27	2.3014	1.6893	210P 7LE
28	2.3084	1.7020	210P 7LE
29	2.3130	1.7046	210P 7LE
30	2.3177	1.6986	210P 7LE

FIGURE 5-17

```
          LOCA FQ ENVELOPE LIMIT AXIALLY
AXIAL        FQ(Z)       MEAS.        SOURCE
POINT        LIMIT       FQ(Z)         NO.ID
31          2.3200      1.6876       210P  7LF
32          2.3200      1.6248       452C  3FL
33          2.3200      1.6049       333J14ED
34          2.3200      1.6702       210P  7LF
35          2.3200      1.6836       210P  7LE
36          2.3200      1.7036       452C  3EL
37          2.3200      1.7185       452C  3FL
38          2.3200      1.7249       452C  3EL
39          2.3200      1.7143       452C  3FL
40          2.3200      1.6930       452C  3FL
41          2.3200      1.5886       452C  3FL
42          2.3200      1.6241       333J14FD
43          2.3200      1.6717       452C  3EL
44          2.3200      1.6783       452C  3EL
45          2.3200      1.6823       452C  3EL
46          2.3200      1.6717       452C  3FL
47          2.3200      1.6558       452C  3EL
48          2.3200      1.6248       452C  3EL
49          2.3200      1.5737       452C  3EL
50          2.3200      1.5103       333J14ED
51          2.3200      1.5112       333J14ED
52          2.3200      1.4931       323J  8DE
53          2.3200      1.4722       409E  4NM
54          2.3200      1.4353       409E  4NM
55          2.3200      1.3910       409E  4NM
56          2.3200      1.3283       409E  4NM
57          2.3200      1.2287       409E  4NM
58          2.3200      1.1196       409E  4NM
59          2.3200      0.9602       317J  4FF
60          2.3200      0.8413       333J14ED
```

FIGURE 5-17

```
MEASURED AND PERCENT. DIFF. OF FDHN  TROJAN FLUX MAP #125  08/28/82 100% BU(75    ) CYS D=208            -HAIR
     R       P       N       M    . .L . . .K . . .J . . .H . . .G . . .F . . .E . .  D       C       B       A
                                    . 0.706.  0.823.  0.527.  0.701.  0.524.  0.823.  0.727.
1                                   .  -1.5.    1.7.    1.9.    3.2.    2.7.    3.9.    3.9.
                    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
                    . 0.739.  0.998.  1.108.  1.032.  1.182.  0.818.  1.168.  1.015.  1.122.  1.004.  0.743.
2                   .   0.9.    0.9.   -1.5.    1.4.    0.8.    1.4.    1.1.    2.3.    2.3.    3.9.    3.6.
            . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
            . 0.726.  1.140.  0.883.  1.020.  1.009.  0.997.  0.955.  0.985.  1.008.  1.018.  0.875.  1.167.  0.743.
3           .  -0.8.   -0.8.   -1.1.   -1.5.   -1.5.   -1.4.   -1.4.   -0.8.    0.8.    0.8.    0.8.    3.6.    3.6.
            . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
            . 0.976.  0.877.  1.041.  1.245.  1.070.  1.224.  1.039.  1.227.  1.051.  1.239.  1.027.  0.881.  0.980.
4           .  -1.6.   -1.8.   -2.3.   -1.5.   -1.5.   -2.8.   -1.7.   -1.0.    0.2.   -0.1.   -1.4.    0.8.    1.0.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
    . 0.725.  1.120.  1.025.  1.249.  0.955.  1.253.  0.936.  1.210.  0.929.  1.242.  0.944.  1.233.  1.003.  1.081.  0.688.
5 .     1.4.   -0.2.   -1.3.   -1.7.   -1.4.   -1.4.   -2.4.   -1.7.   -1.5.   -0.1.   -0.9.   -1.4.   -1.9.   -1.9.   -1.9.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
    . 0.831.  1.024.  1.019.  1.076.  1.242.  1.189.  1.241.  1.119.  1.192.  1.149.  1.233.  1.057.  0.989.  0.974.  0.775.
6 .     3.0.    1.2.   -0.6.   -0.9.   -1.1.    1.6.    1.6.    1.9.   -1.0.   -0.6.   -1.2.   -1.7.   -2.0.   -2.0.   -1.9.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
    . 0.531.  1.188.  1.002.  1.241.  0.933.  1.273.  0.965.  1.005.  0.923.  1.240.  0.939.  1.233.  0.986.  1.138.  0.504.
7 .     3.8.    1.4.   -0.9.   -0.4.   -0.2.    2.3.    1.8.    2.3.   -0.4.    0.3.    0.5.   -1.0.   -0.8.   -1.0.   -0.2.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
    . 0.706.  0.824.  0.978.  1.061.  1.164.  0.984.  1.248.  0.889.  1.146.  0.951.  1.214.  1.064.  0.962.  0.789.  0.682.
8 .     4.1.    2.2.    0.4.   -0.3.    0.4.    3.3.    4.3.    3.9.    1.3.    1.1.    0.5.   -0.6.   -0.4.    0.0.    1.8.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
    . 0.531.  1.192.  1.019.  1.229.  0.929.  1.236.  0.939.  0.986.  0.952.  1.258.  0.952.  1.247.  1.003.  1.170.  0.520.
9 .     4.0.    2.3.    1.1.   -1.9.   -2.1.   -1.2.   -0.2.    0.8.    2.6.    1.9.    0.5.   -0.4.   -0.2.    0.7.    1.8.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
    . 0.833.  1.046.  1.054.  1.054.  1.232.  1.138.  1.200.  1.099.  1.221.  1.171.  1.253.  1.071.  1.006.  1.028.  0.821.
10.     4.5.    4.4.    3.5.   -2.6.   -2.7.   -2.2.   -1.4.   -0.1.    0.6.    0.3.   -1.1.   -1.1.   -1.4.    2.0.    2.0.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
    . 0.746.  1.173.  1.071.  1.224.  0.937.  1.227.  0.938.  1.236.  0.955.  1.260.  0.941.  1.226.  1.002.  1.144.  0.728.
11.     5.5.    5.5.    5.5.   -2.4.   -2.5.   -2.3.   -2.0.   -1.1.   -1.0.   -1.4.   -2.9.   -3.0.   -3.4.    2.0.    2.0.
    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
            . 1.004.  0.877.  1.050.  1.239.  1.056.  1.227.  1.062.  1.252.  1.076.  1.213.  1.018.  0.891.  1.031.
12          .   2.5.   -0.4.    0.0.   -0.9.   -1.1.   -2.8.   -1.9.   -1.8.   -1.4.   -3.8.   -4.0.    0.4.    4.4.
            . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
            . 0.724.  1.137.  0.680.  1.009.  1.009.  0.991.  0.973.  1.000.  1.015.  1.016.  0.876.  1.162.  0.775.
13          .   0.1.    0.1.    0.0.   -1.4.   -0.7.   -1.9.   -1.3.   -2.2.   -1.5.   -1.3.   -0.7.    1.8.    6.6.
            . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
                    . 0.725.  0.981.  1.118.  1.012.  1.161.  0.806.  1.154.  0.992.  1.128.  1.021.  0.765.
14                  .   0.1.    0.2.    0.3.    0.6.   -0.8.   -0.9.   -2.1.   -2.4.    0.7.    3.9.    5.2.
                    . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .     . . . .
                                    . 0.715.  0.809.  0.517.  0.687.  0.513.  0.788.  0.719.                          . MEAS .
15                                  .   0.6.    0.8.    0.5.    0.4.   -1.2.   -2.4.    0.7.                          . DIFF .
                                    . . . . . . . . . . . . . . . . . . . . . . . . . . .                            . . . .
```

FIGURE 5-17

```
PERCENT. DIFF. OF EXPECT. AND MEAS. FDHN  TROJAN FLUX MAP #125  08/28/82 100% HU(75  ) CYS D*208          -MAIN
      R       P       N       M       L       K       J       H       G       F       E       D       C       B       A
                                                     1.9                     3.9
 1
                     0.9                     1.4             1.4
 2
                                                            -1.4             0.8                             3.6
 3
            -1.6    -1.8                                    -1.7
 4
                                    -1.4                            -1.5            -0.9            -1.9
 5
     3.0            -0.6                     1.6             1.9                                            -2.0
 6
                            -0.4                     1.8                     0.3                    -0.8
 7
     4.1             0.4             0.4             4.3                     1.1            -0.6    -0.4     0.0
 8
             2.3                                                     2.6             0.5                             1.8
 9
                                    -2.7            -1.4                                    -1.1
10
     5.5                            -2.5                    -1.1                    -2.9                             2.0
11
                                            -1.1                    -1.8                    -4.0
12
                     0.1            -1.4                    -1.3                                             0.6
13
                     0.1                            -0.8                    -2.4             3.9
14
                                     0.6                     0.4
15
```

FIGURE 5-17

Sheet 8 of 9

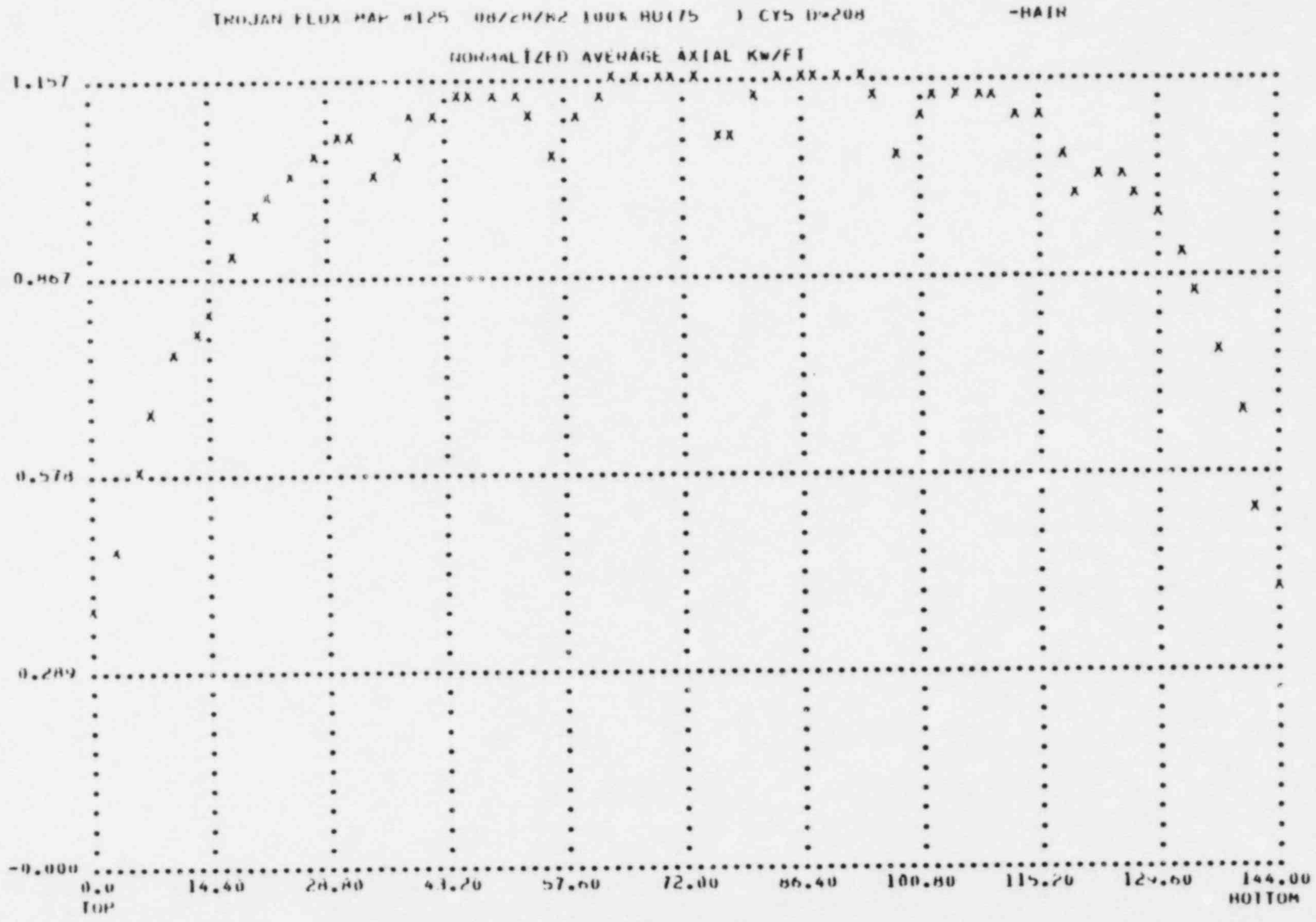
TROJAN FLUX MAP #125 08/28/82 100% HU(75) CYS D#208 -HAIR

POINT	SOURCE	NUCLEAR FXY
1	395 F 9MN	1.5695
2	301 K 7ED	1.5716
3	301 K 7ED	1.5473
4	301 K 7ED	1.5247
5	301 K 7ED	1.4989
6	323 J 8DE	1.4803
7	301 K 7ED	1.4684
8	323 J 8DE	1.4448
9	323 J 8DF	1.4433
10	323 J 8DF	1.4334
11	323 J 8DF	1.4226
12	323 J 8DF	1.4160
13	323 J 8DE	1.4151
14	323 J 8DE	1.4112
15	323 J 8DE	1.4330
16	301 K 7ED	1.3779
17	323 J 8DE	1.3968
18	323 J 8DE	1.3944
19	323 J 8DE	1.3849
20	323 J 8DE	1.3763
21	323 J 8DE	1.3726
22	323 J 8DF	1.3694
23	323 J 8DE	1.3724
24	333 J14ED	1.3843
25	210 P 7LE	1.3571
26	214 P 9LM	1.3624
27	210 P 7LE	1.3613
28	210 P 7LF	1.3638
29	210 P 7LF	1.3639
30	210 P 7LF	1.3613
31	210 P 7LE	1.3633
32	452 C 3EL	1.3417
33	333 J14ED	1.3457
34	210 P 7LE	1.3577
35	210 P 7LE	1.3583
36	452 C 3EL	1.3659
37	452 C 3EL	1.3739
38	452 C 3EL	1.3809
39	452 C 3EL	1.3779
40	452 C 3EL	1.3867
41	452 C 3EL	1.4160
42	333 J14ED	1.3774
43	452 C 3EL	1.3715
44	452 C 3EL	1.3770
45	452 C 3EL	1.3798
46	452 C 3EL	1.3773
47	452 C 3EL	1.3800
48	452 C 3EL	1.3758
49	452 C 3EL	1.4130
50	333 J14ED	1.4381
51	333 J14ED	1.3622
52	323 J 8DE	1.3632
53	409 F 4NM	1.3764
54	409 F 4NM	1.3878
55	409 E 4NM	1.4151
56	409 F 4NM	1.4527
57	409 F 4NM	1.4853
58	409 F 4NM	1.5561
59	317 J 4FE	1.6824
60	333 J14ED	1.9466

NOTE= VALUES ARE BEST ESTIMATE AND DO NOT INCLUDE ENGINEERING OR NUCLEAR UNCERTAINTY.

Sheet 9 of 9

FIGURE 5-17



6.0 CONCLUSIONS

The Cycle 5 startup test results were satisfactory and represent a significant improvement over the Cycle 3 results and continued improvement over Cycle 4 results. The more accurate treatment of individual fuel assembly burnups, along with other improvements to the nuclear design methods, have reduced substantially the amount of nuclear design prediction error.

The startup tests also showed that the modified stainless steel pin fuel assemblies, with and without 2 x 8 partial grids, do not have a significant impact on core power distribution and that they can be accounted for in normal fuel management schemes.

ATTACHMENT A

TROJAN EOC-4 ONSITE EXAMINATION

1.0 Summary of Examinations Performed

1.1 Binocular Examinations

Binocular examinations were performed on 180 assemblies during core unload to assess the overall fuel condition. Examinations were performed on 9 Region 1 assemblies, 1 Region 3 assembly, 62 Region 4 assemblies, 64 Region 5 assemblies and 44 Region 6 assemblies.

1.2 Leak Testing

1.2.1 Leak testing (sipping) was performed by Nuclear Assurance Corporation on 164 assemblies from Regions 1, 4, 5 and 6. 12 assemblies (A09, A45, D07, D58, E10, E16, E41, E43, F02, F11, F21, F30) failed leak testing.

1.3 TV Visual Examinations

1.3.1 Baffle Joint Fuel Assemblies

A total of 24 baffle joint assemblies from Region 6 were TV examined at high and low magnification on the critical (baffle joint) and adjacent faces respectively. Of these assemblies, 12 were adjacent to corner injection joints, 8 were adjacent to center injection joints and 4 were adjacent to both types of joints.

1.3.2 Fuel Assemblies Located at Baffle Joints in Cycle 3

12 Region 5 assemblies that were located adjacent to baffle joints in the previous Cycle 3 were TV examined at high and low magnification on the critical and adjacent faces respectively.

1.3.3 Other Assemblies (Non-Baffle Joint)

a) Assembly F33 face 2 which was adjacent to F/A F22 (suspect sipping failure).

b) Assemblies F30, E10, E16, E41, D07, D58, A09 and A45 all classified as sipping failures.

c) Assemblies A25, A49 and A65 heavily crudded from Cycle 1.

d) Assembly A64 used as channel spacing standard.

1.4 Channel Spacing Examination

38 fuel assemblies from Regions 5 and 6 were probed for rod spacing/movement measurements. The 16 Region 5 assemblies probed were originally adjacent to baffle joints in Cycle 3. 8 were adjacent to center injection

joints, 4 were adjacent to inside corner joints and 4 were adjacent to both center injection and inside corner joints. 22 Region 6 assemblies, consisting of 6 assemblies adjacent to center injection joints, 12 assemblies adjacent to inside corner joints and 4 assemblies adjacent to both types of baffle joints, were probed.

2.0 Examination Results

2.1 Of the 24 Region 6 baffle joint assemblies which were examined, 7 inside corner joint assemblies (F56, F18, F07, F05, F04, F03, F02) and 1 center injection joint assembly F19 exhibited severe fuel rod damage. The damaged area for 7 inside corner joint assemblies occurred between grid levels 5 to 8. For F19, the center injection joint assembly, the damage was between grids 1 and 2. Figure 1 shows the core locations for these assemblies. The remaining 16 baffle joint assemblies had no apparent baffle jetting related visual damage. However, F21 had one interior rod (#12 in the second row on non-baffle face 4) which was suspect since the lower end plug was slightly cocked and debris was sighted on the bottom nozzle in that area.

2.2 12 assemblies from Region 5 which were located adjacent to baffle joints in Cycle 3 (prior cycle) were TV examined on their critical faces (see Figure 2). Assembly E43, a sipping failure, was shown by TV examinations to have failed rod 2 and a suspected failure of rod 3. Assembly E47 exhibited a reduction in channel spacing during probing at the bottom of grid 2 between rods 1 and 2 on face 4. This channel reduction was present at EOC-3 and there was no change in this phenomenon after Cycle 4. Two assemblies E05 and E15 each containing three stainless steel rods were in good condition with the exception of light baffle spray on the grids on face for E15. Two additional assemblies E53 and E56 exhibited a reduction in channel spacing at grid span 1 on their critical face. For the remaining six assemblies (E02, E04, E08, E12, E29 and E51), the only anomalies detected were light baffle marks on the critical faces for assemblies E04, E29 and E51.

2.3 F33 was examined on face 2 for visual anomalies because this assembly was located adjacent to F22. Assembly F22 was classified as a suspect sipping failure early in the site exam but was later classified as a non-leaker by PGE. The TV examination of face 2 revealed no anomalies.

2.4 Assembly F30 (sipping failure) was TV examined at low magnification on all four faces and no anomalies were noted.

2.5 Three assemblies E10, E16 and E41, all classified as sipping failures, were TV examined at low magnification on all four faces for visual defects. Assembly E10 had visible pellet chips on face 1 and metallic debris on the bottom nozzle of face 2. Fuel assembly E16 had a failed peripheral fuel rod (#15) on face 1. No anomalies were observed on assembly E41.

2.6 Assemblies D07 and D58, slated for reuse in Cycle 5, failed leak testing. Both assemblies were TV examined at low magnification on all four faces. The only anomaly detected was F/Rs 2 and 3 on face 3 of D58 which were approximately 1/4" from the bottom nozzle. These assemblies were previously in baffle locations in Cycle 2 but were not located at joint locations.

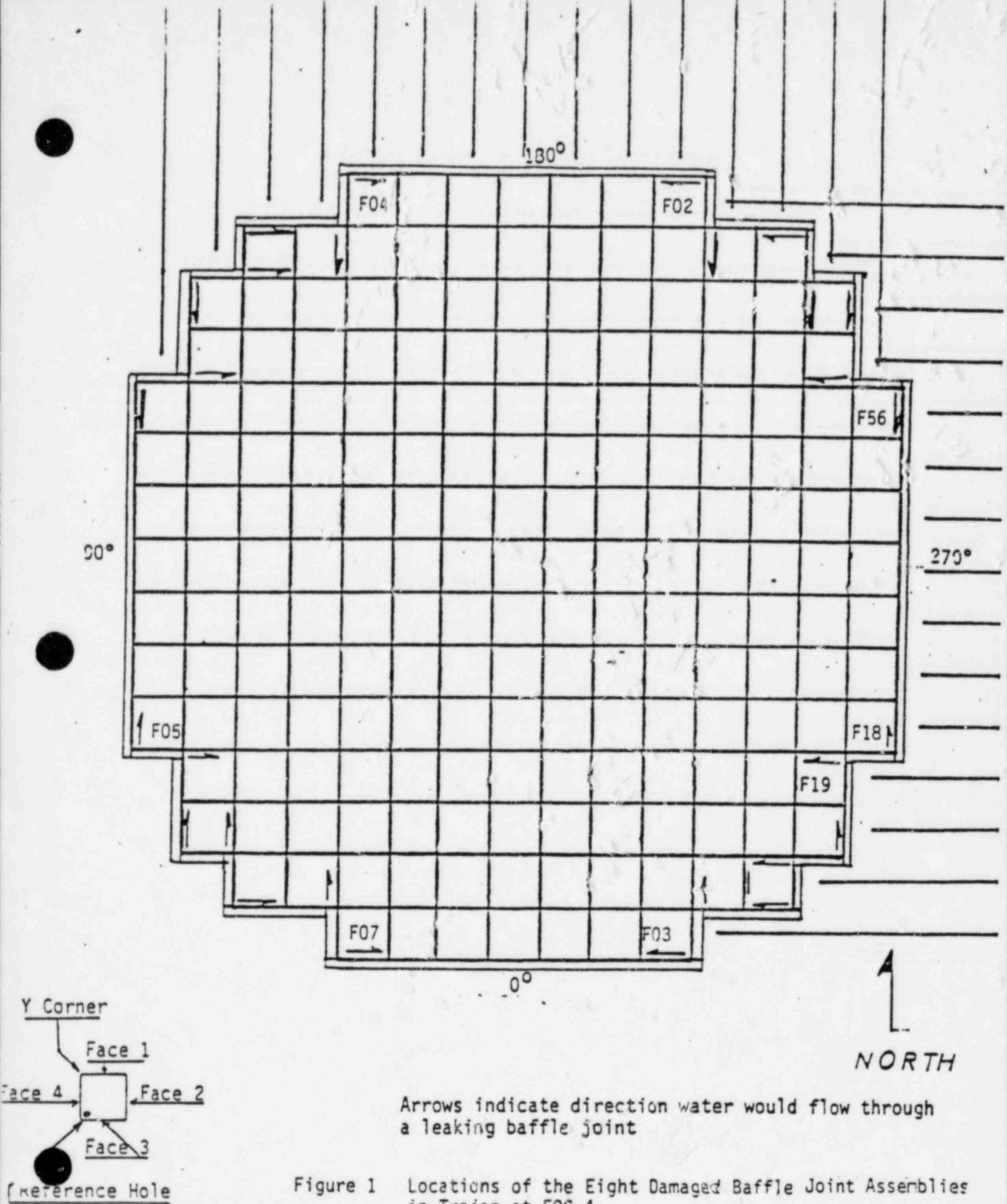
2.7 Assemblies A09 and A45 which were stored in the Spent Fuel Pit (SFP) were designated for Cycle 5 reinsertion prior to failing leak testing. Both assemblies were TV examined on all faces at low magnification and no visual anomalies were found except for some non-metallic debris (approx. 1/4" in length) on face 3 above grid 8 on assembly A09.

2.8 A65 from Region 1 was examined at the request of PGE. The assembly was TV examined at low magnification on all four faces. Other than being heavily crudded from Cycle 1, no visual anomaly was detected.

2.9 Assembly A64 which had been discharged at EOC-1 and was stored in the SFP was used as probe spacing standard at the beginning of the site exam. This assembly was TV examined at high and low magnification on faces 1 and 2. Some non-metallic debris was detected in the top nozzle on face 1. Other than being heavily crudded from Cycle 1, no apparent visual anomalies were found.

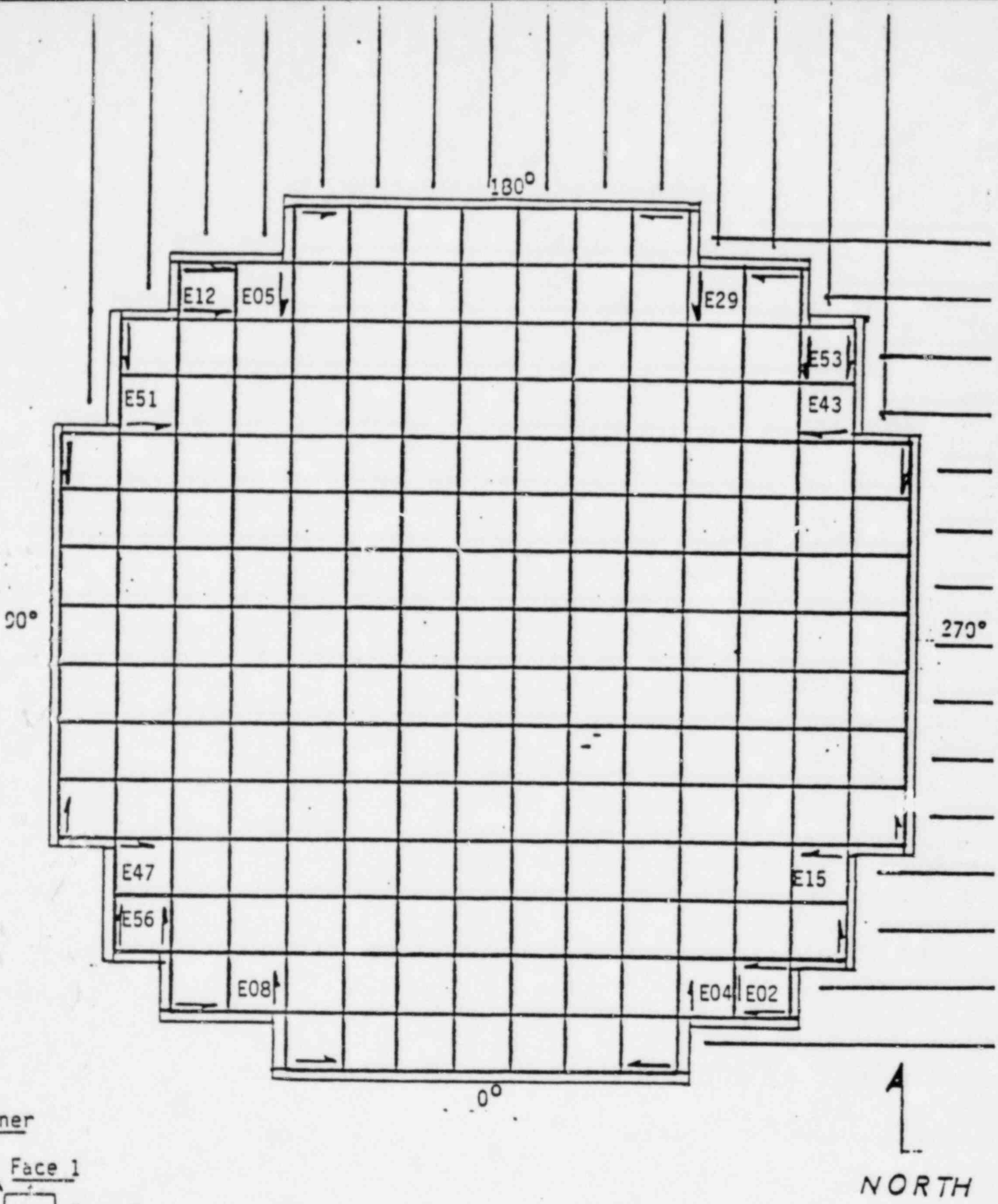
3.0 Channel Spacing

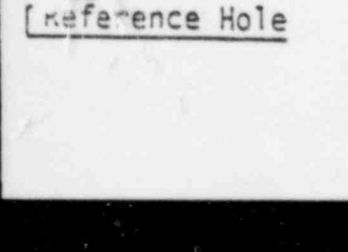
A probe was used for examining the spacing of fuel rods at the grid contact area. The purpose of the examination was to determine possible side way movement of fuel rods due to fretting. This examination was undertaken as a means of assessing the condition of the unfailed fuel. At the request of PGE, 8 damaged assemblies (F02, F03, F04, F05, F07, F18, F56) were also probed. The examination of 30 assemblies resulted in detection of no previously unsuspected failed assemblies.



Arrows indicate direction water would flow through a leaking baffle joint

Figure 1 Locations of the Eight Damaged Baffle Joint Assemblies in Trojan at EOC-4





Arrows indicate direction water would flow through a leaking baffle joint

Figure 2 Locations of the Twelve "E" Assemblies Adjacent to Baffle Joints in EOC-3