

MASTER

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DUQUESNE LIGHT COMPANY

SHIPPINGPORT ATOMIC POWER STATION

TEST RESULTS

DLCS 1510108

T-550132

DETERMINATION OF COEFFICIENTS OF REACTIVITY

5532.3 EFPH

CORE I SEED 1

Section 1 of 2 Sections

First Issue, October 17, 1960

602 001

RELEASE APPROVED — AUTHORIZATION ON
FILE IN RECEIVING SECTION. H

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TEST RESULTS
DLCS 1510108
T-550132
DETERMINATION OF COEFFICIENTS OF REACTIVITY
5532.3 EFPH

Purpose

To determine the temperature and pressure coefficients of reactivity at zero power after 5532.3 EFPH of Core I, Seed 1 operation.

Conclusions

The value of the temperature coefficient at a temperature of 500 F and a pressure of 1800 psig was found to be $-0.97 \times 10^{-4} \frac{\Delta\rho}{\Delta T}$.

The value of the pressure coefficient over the pressure range from 1350 to 1850 psig and at a temperature of 480 F was found to be $+0.87 \times 10^{-6} \frac{\Delta\rho}{\Delta P}$.

Description of Test Equipment and Test Procedure

The Plant was brought from ambient conditions to operating temperature and pressure by the heat input from the reactor coolant pumps and by reactor power operation. The heat input from all four reactor coolant pumps operating on slow speed was used to increase reactor coolant temperature from 167 F to 222 F. The 1D reactor coolant pump was then shutdown and the reactor taken critical into the power range. Reactor heat output was used to increase reactor coolant temperature to 480 F. At this temperature the reactor was shutdown and the 1A, 1B, and 1C reactor coolant pumps were placed on fast speed. The heat input from these three coolant pumps was then used to increase reactor coolant temperature to 520 F. Test data were obtained only during the time when the reactor coolant pumps were used to heat up the Reactor Coolant System.

Reactivity measurements were determined by measuring start-up rates using scalers and digital print-outs. The scaler inputs were from specially installed fission counters. During reactor power operation, it was necessary to remove the fission counters in order to prevent damage due to the high neutron flux field.

During Plant warm-up, using the reactor coolant pumps, reactivity measurements were made and a temperature coefficient of reactivity was calculated for various temperatures. After a reactor coolant temperature and pressure of 480 F and 1340 psig was attained, the temperature was held constant and the pressure was increased in 100 psi increments to 1840 psig. At approximately each 100 psi increment, reactivity measurements were made in order to determine a pressure coefficient of reactivity.

Reactor coolant temperatures were obtained from recording Mueller resistance bridges connected to each reactor coolant loop T_c calibrating resistance thermometer.

TEST RESULTS DLCS 1510108

T-550132

DETERMINATION OF COEFFICIENTS OF REACTIVITY 5532.3 EFPH

Results

DLCS 1510108 was started at 0112 hours on September 13, 1959 and completed at 1409 hours on September 14, 1959.

Temperature Coefficient Results.

The value of the temperature coefficient determined at a Plant operating temperature of 500 F and a pressure of 1800 psig was $-0.97 \times 10^{-4} \frac{\Delta\rho}{\Delta T}$ as obtained from the temperature coefficients vs temperature curve shown in Figure 1. All values of the temperature coefficient from 175 F to 515 F are listed in Table VI and are plotted in Figure 1. These values were determined as outlined on Figure 2.

The pressure coefficient ($1.29 \times 10^{-6} \frac{\Delta\rho}{\Delta P}$) used to correct the temperature coefficient was obtained from DLCS 1510107.

Reactor heat was required to raise the reactor coolant temperature from approximately 222 F to where the pumps could be operated on fast speed (480 F). No test data were obtained during this interval.

The history of the temperature coefficient is shown in Figure 3. The value of the temperature coefficient at 1693 EFPH and 500 F previously reported as $-1.42 \times 10^{-4} \frac{\Delta\rho}{\Delta T}$ in DLCS 1510105, has been found to be in error; the correct value is $-1.92 \times 10^{-4} \frac{\Delta\rho}{\Delta T}$.

Pressure Coefficient Results.

The value of the pressure coefficient was found to be $+0.87 \times 10^{-6} \frac{\Delta\rho}{\Delta P}$ at an operating temperature of 480 F. The data used in the calculation of the pressure coefficient are also listed in Table I. The reactivity values are plotted against average coolant pressure in Figure 4.

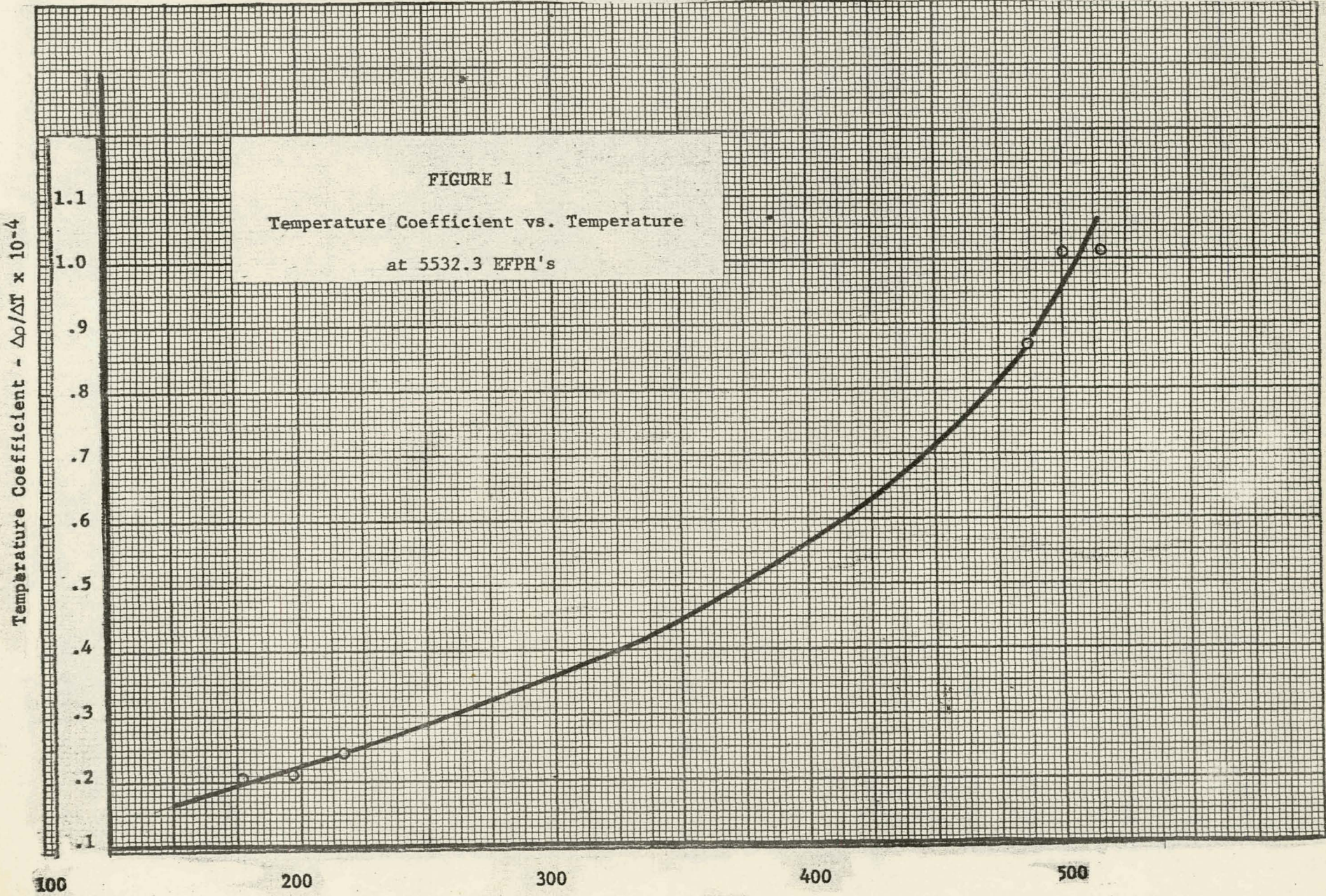
The correction factors used in determining the pressure coefficient were obtained by using the temperature coefficient from Figure 1.

The pressure coefficient has shown a drop from that calculated in the 7th performance ($1.29 \times 10^{-6} \frac{\Delta\rho}{\Delta P}$) at 500 F and is approximately one third that obtained during the 0-300 EFPH stage of core life.

APPENDIX

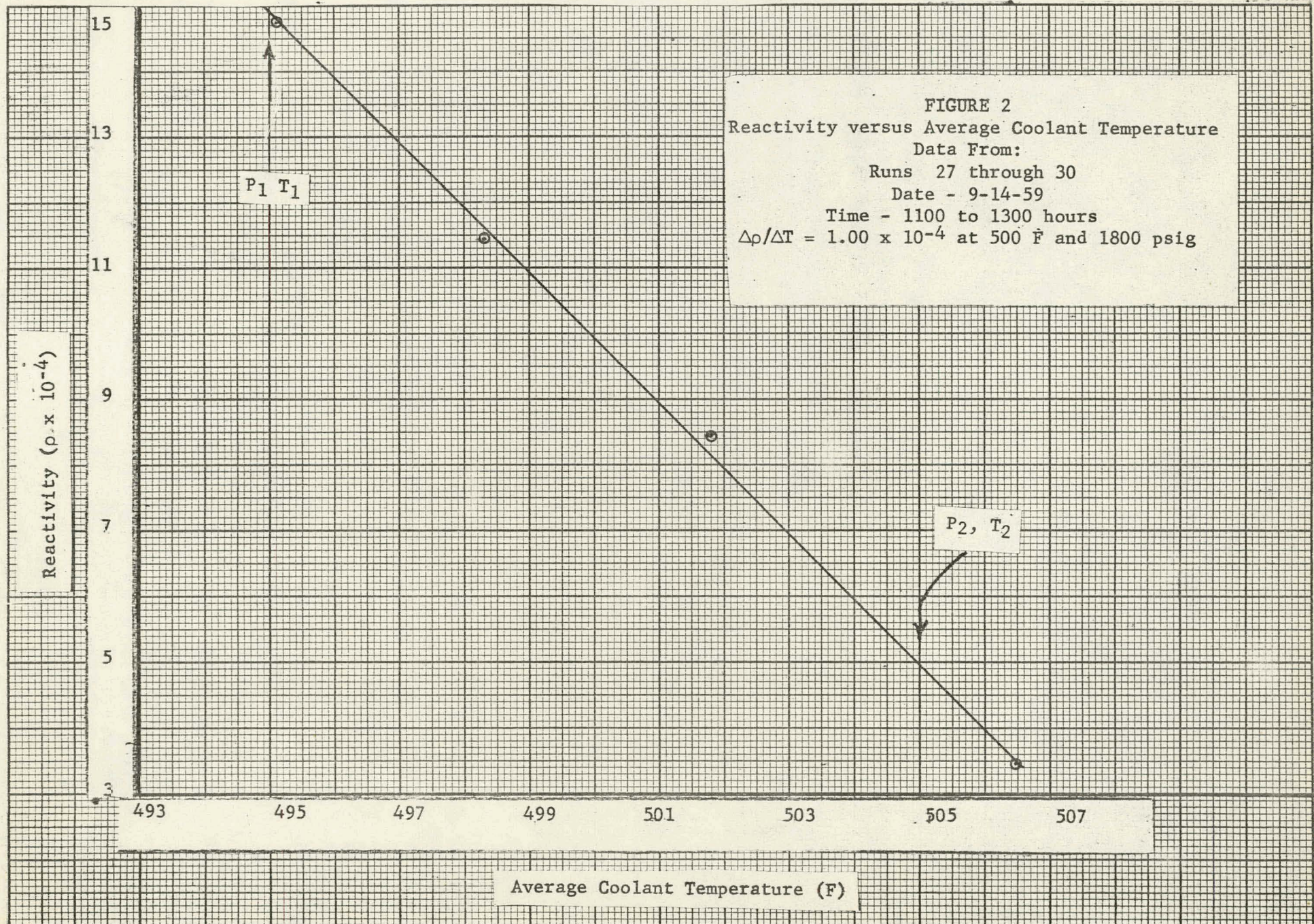
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|-----------|--|
| Figure 1 | Temp. Coefficient vs. Average Coolant Temp. |
| Figure 2 | Reactivity vs. Average Coolant Temperature |
| Figure 3 | Temp. Coefficient History |
| Figure 4 | Reactivity vs. Average Coolant Pressure |
| Figure 5 | Variation of Pressure Coefficient with Temperature |
| Table I | Scaler Information and Reactivity Values |
| Table II | Loop Pressures |
| Table III | Loop Temperatures |
| Table IV | Loop Flows |
| Table V | Control Rod Positions |
| Table VI | Temp. Coefficients and Corrections |
| Table VII | Log of Events |

FIGURE 1
Temperature Coefficient vs. Temperature
at 5532.3 EFPH's

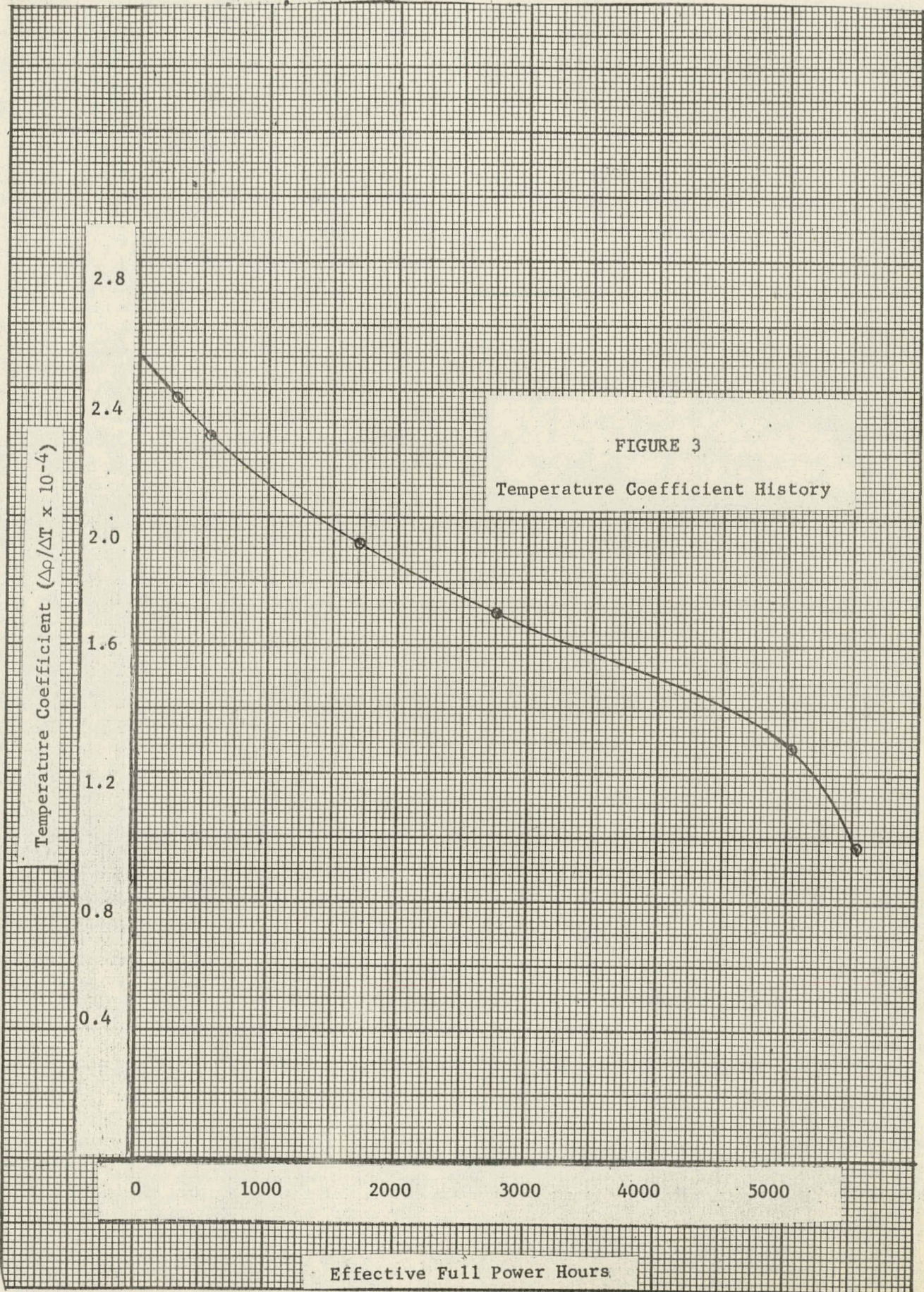


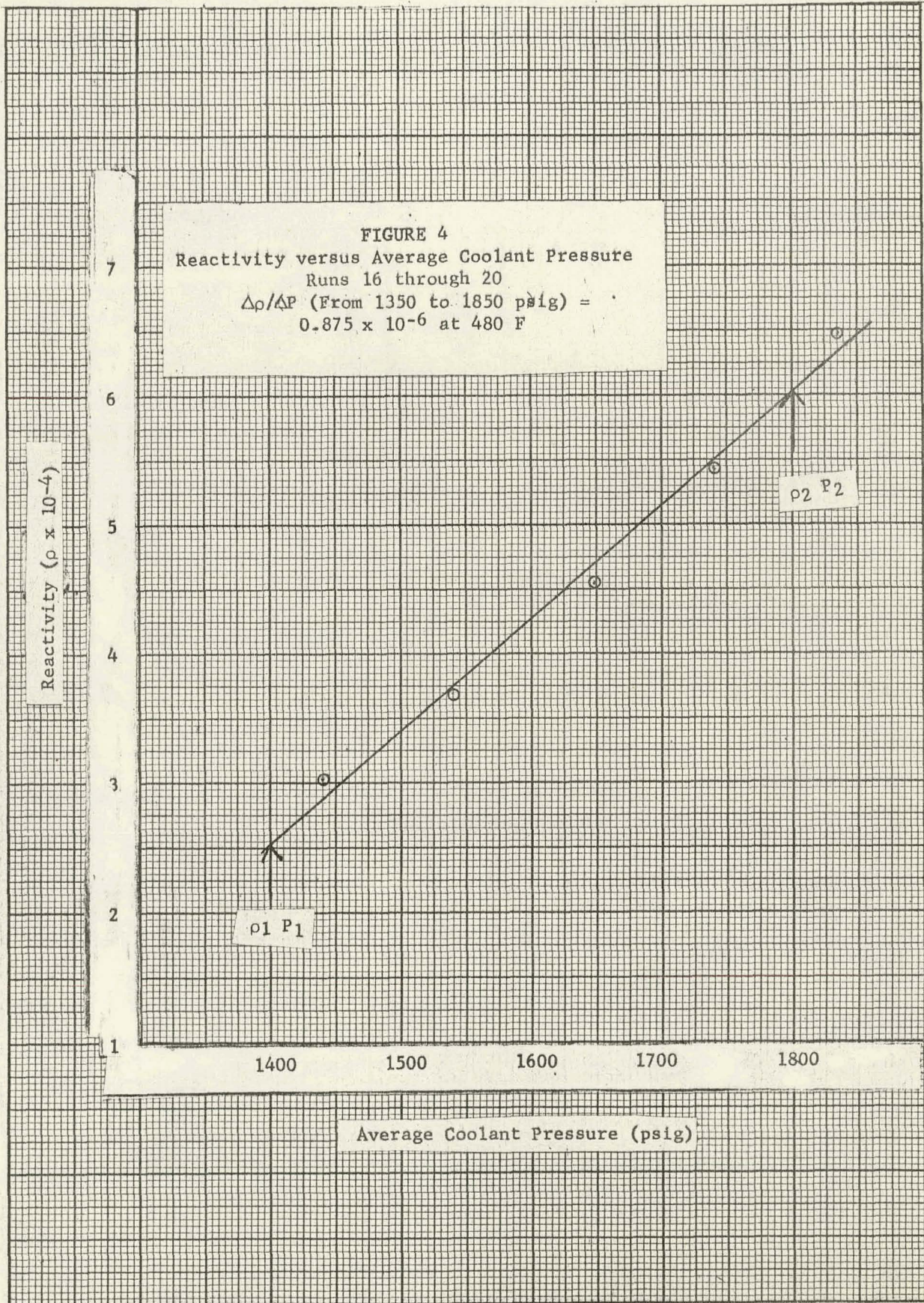
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Average Coolant Temperature (F)



602 006





VARIATION OF PRESSURE COEFFICIENT WITH TEMPERATURE CHANGE

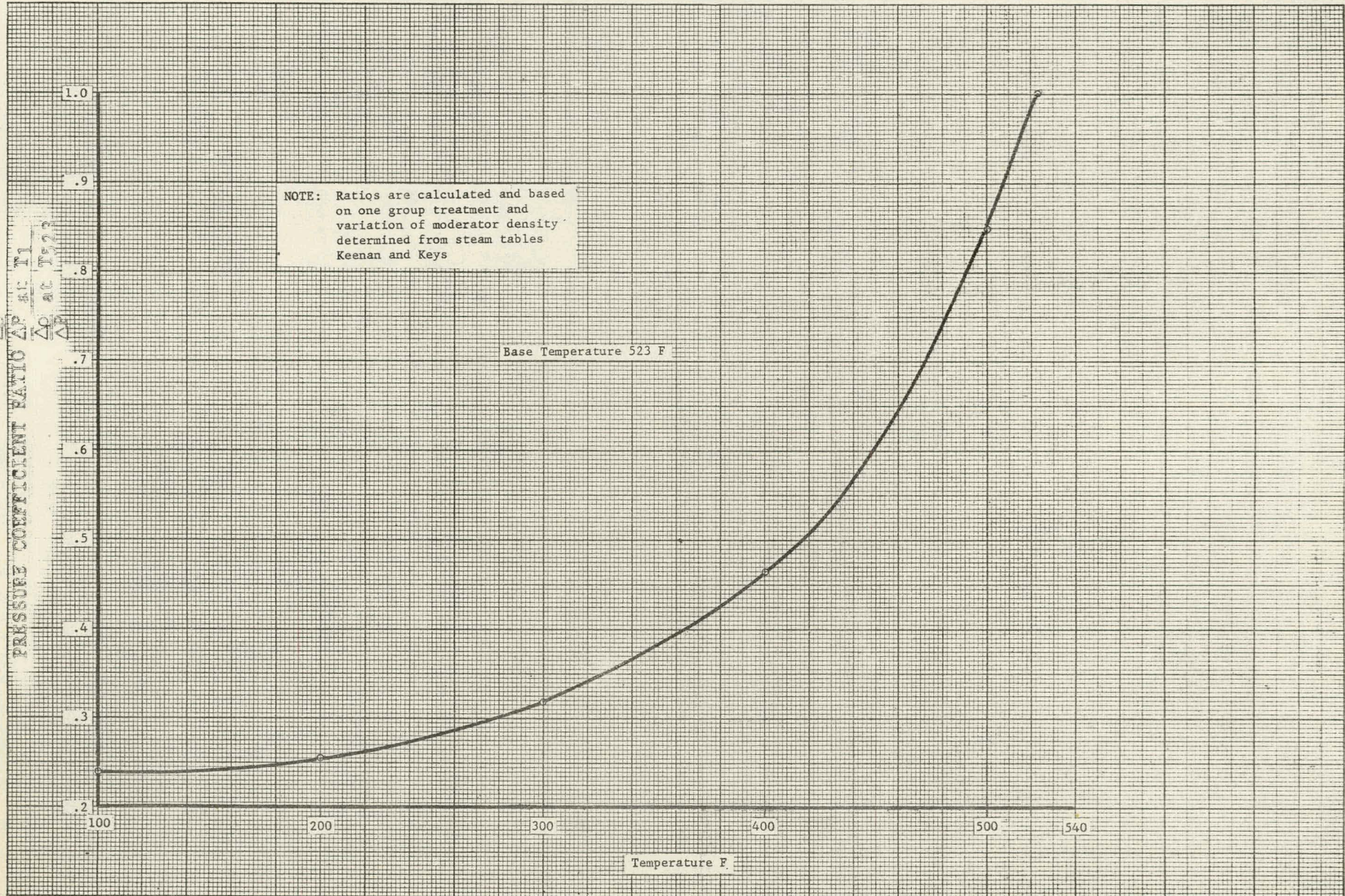


FIGURE 5

602 009

TABLE I
 Measurement of Temp. Coefficient

| Run No. | Date | Time | Temperature - (F) | | | | Ch. A Ratio | Ch. B Ratio | Ratio Avg. | Pressure - (psig) | | | | Avg. Press. (psig) | Start up rate dec/min x 10 ⁻⁴ | Uncor-rected Rod Height ρ (inches) | Pressure Reactivity Correction | | Cor-rected ρ x 10 ⁻⁴ | Time Base | γ | | | | | |
|---------|---------|---------|-------------------|-------------------|-------------------|-------------------|-------------|-------------|------------|-------------------|------|-----|-----|--------------------|--|------------------------------------|--------------------------------|--------|---------------------------------|-----------|-------|--------|----|------|--|--|
| | | | 1A T _c | 1B T _c | 1C T _c | 1D T _c | | | | 1A | 1B | 1C | 1D | | | | Δρ | Corr. | | | | | | | | |
| 1 | 9-13-59 | 0112:22 | 167.1 | 166.3 | 166.9 | 166.6 | 14919 | 1.57 | 13987 | 1.62 | 1.59 | 410 | 400 | 400 | 390 | 400 | 0.603 | 11.545 | 31.25 | 0 | 0 | 11.545 | 20 | 43.2 | | |
| | | | 23493 | 1.59 | 22708 | 1.60 | | | | | | | | | | | | | | | | | | | | |
| | | | 37466 | 1.59 | 36425 | 1.59 | | | | | | | | | | | | | | | | | | | | |
| | | | 59774 | 1.58 | 57997 | 1.60 | | | | | | | | | | | | | | | | | | | | |
| | | | 94695 | | 92558 | 1.59 | | | | | | | | | | | | | | | | | | | | |
| | | | Avg. | 166.7 | | | | 147612 | | | | | | | | | | | | | | | | | | |
| 2 | 9-13-59 | 0135:42 | 169.7 | 168.9 | 169.4 | 169.2 | 14409 | 1.57 | 13840 | 1.61 | 1.59 | 380 | 370 | 370 | 360 | 370 | 1.206 | 17.491 | 31.75 | -30 | +116 | 17.607 | 10 | 21.6 | | |
| | | | 22667 | 1.59 | 22221 | 1.60 | | | | | | | | | | | | | | | | | | | | |
| | | | 36123 | 1.58 | 35512 | 1.58 | | | | | | | | | | | | | | | | | | | | |
| | | | 56979 | 1.58 | 56009 | 1.59 | | | | | | | | | | | | | | | | | | | | |
| | | | 89668 | | 88885 | | | | | | | | | | | | | | | | | | | | | |
| | | | Avg. | 169.3 | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 9-13-59 | 0205:30 | 173.1 | 172.4 | 172.8 | 172.6 | 10454 | 1.52 | 11002 | 1.50 | 1.54 | 360 | 350 | 340 | 340 | 348 | 1.123 | 16.814 | 31.75 | -52 | +202 | 17.016 | 10 | 23.2 | | |
| | | | 15889 | 1.54 | 16501 | 1.58 | | | | | | | | | | | | | | | | | | | | |
| | | | 24394 | 1.55 | 26006 | 1.54 | | | | | | | | | | | | | | | | | | | | |
| | | | 37886 | 1.53 | 40034 | 1.56 | | | | | | | | | | | | | | | | | | | | |
| | | | 57860 | 1.53 | 62575 | 1.52 | | | | | | | | | | | | | | | | | | | | |
| | | | Avg. | 172.7 | | 88549 | | 95264 | | | | | | | | | | | | | | | | | | |
| 4 | 9-13-59 | 0254:40 | 178.2 | 177.6 | 178.2 | 177.7 | 12908 | 1.48 | 10466 | 1.49 | 1.48 | 370 | 380 | 370 | 370 | 373 | 1.022 | 15.941 | 31.75 | -30 | +116 | 16.057 | 10 | 25.5 | | |
| | | | 19147 | 1.49 | 15598 | 1.48 | | | | | | | | | | | | | | | | | | | | |
| | | | 28473 | 1.48 | 23150 | 1.48 | | | | | | | | | | | | | | | | | | | | |
| | | | 42092 | 1.47 | 34277 | 1.48 | | | | | | | | | | | | | | | | | | | | |
| | | | 61861 | 1.47 | 50663 | 1.48 | | | | | | | | | | | | | | | | | | | | |
| | | | Avg. | 177.9 | | 90919 | | 75052 | | | | | | | | | | | | | | | | | | |
| 5 | 9-13-59 | 0326:48 | 181.8 | 181.1 | 181.3 | 181.2 | 11822 | 1.45 | 10899 | 1.43 | 1.44 | 400 | 400 | 400 | 400 | 400 | .951 | 15.294 | 31.75 | 0 | 0 | 15.294 | 10 | 27.4 | | |
| | | | 17088 | 1.44 | 15606 | 1.43 | | | | | | | | | | | | | | | | | | | | |
| | | | 24607 | 1.45 | 22291 | 1.45 | | | | | | | | | | | | | | | | | | | | |
| | | | 35629 | 1.44 | 32347 | 1.45 | | | | | | | | | | | | | | | | | | | | |
| | | | 51149 | 1.44 | 46917 | 1.44 | | | | | | | | | | | | | | | | | | | | |
| | | | Avg. | 181.4 | | 73766 | | 67437 | 1.43 | | | | | | | | | | | | | | | | | |
| | | | | | | | | 96260 | | | | | | | | | | | | | | | | | | |
| 6 | 9-13-59 | 0403:06 | 185.5 | 184.5 | 185.2 | 184.9 | 10468 | 1.94 | 10621 | 1.93 | 1.96 | 460 | 460 | 460 | 460 | 460 | .874 | 14.537 | 31.75 | +60 | -.237 | 14.320 | 20 | 29.8 | | |
| | | | 20268 | 1.99 | 20551 | 1.96 | | | | | | | | | | | | | | | | | | | | |
| | | | 40332 | 1.97 | 40277 | 1.98 | | | | | | | | | | | | | | | | | | | | |
| | | | 79588 | 1.96 | 79895 | 1.97 | | | | | | | | | | | | | | | | | | | | |
| | | | 156146 | | 157681 | | | | | | | | | | | | | | | | | | | | | |
| | | | Avg. | 185.0 | | | | | | | | | | | | | | | | | | | | | | |
| 7 | 9-13-59 | 0428:12 | 188.4 | 187.7 | 188.1 | 187.9 | 16784 | 1.92 | 17423 | 1.94 | 1.93 | 410 | 410 | 410 | 400 | 408 | .857 | 14.385 | 31.75 | +8 | -.032 | 14.353 | 20 | 30.4 | | |
| | | | 32222 | 1.93 | 33861 | 1.93 | | | | | | | | | | | | | | | | | | | | |
| | | | 62060 | 1.93 | 65269 | 1.94 | | | | | | | | | | | | | | | | | | | | |
| | | | 119945 | | 126561 | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | Avg. | 188.0 | | | | | | | | | | | | | | | | | | | |
| 8 | 9-13-59 | 0457:47 | 191.4 | 190.5 | 191.1 | 190.7 | 10815 | 1.84 | 12463 | 1.87 | 1.83 | 420 | 420 | 410 | 400 | 413 | .790 | 13.688 | 31.75 | +13 | -.051 | 13.627 | 20 | 33.0 | | |
| | | | 19895 | 1.80 | 23251 | 1.81 | | | | | | | | | | | | | | | | | | | | |
| | | | 35737 | 1.83 | 41989 | 1.84 | | | | | | | | | | | | | | | | | | | | |
| | | | 65389 | 1.80 | 77357 | 1.81 | | | | | | | | | | | | | | | | | | | | |
| | | | 117789 | | 139772 | | | | | | | | | | | | | | | | | | | | | |
| | | | Avg. | 190.9 | | | | | | | | | | | | | | | | | | | | | | |
| 9 | 9-13-59 | 0522:49 | 193.8 | 193.1 | 193.7 | 193.3 | 12493 | 1.81 | 15612 | 1.80 | 1.77 | 370 | 370 | 370 | 350 | 365 | .745 | 13.201 | 31.75 | -35 | +138 | 13.339 | 20 | 35.0 | | |
| | | | 22614 | 1.74 | 28174 | 1.75 | | | | | | | | | | | | | | | | | | | | |
| | | | 39299 | 1.75 | 49310 | 1.79 | | | | | | | | | | | | | | | | | | | | |
| | | | 68605 | 1.74 | 88031 | 1.74 | | | | | | | | | | | | | | | | | | | | |
| | | | 119634 | | 153353 | | | | | | | | | | | | | | | | | | | | | |
| | | | Avg. | 193.5 | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 9-13-59 | 0558:12 | 197.3 | 196.6 | 197.0 | 196.6 | 13970 | 1.69 | 11584 | 1.68 | 1.68 | 390 | 390 | 380 | 380 | 385 | .679 | 12.455 | 31.75 | -15 | +061 | 12.516 | 20 | 38.4 | | |
| | | | 23557 | 1.68 | 19404 | 1.70 | | | | | | | | | | | | | | | | | | | | |
| | | | 39659 | 1.66 | 33078 | 1.67 | | | | | | | | | | | | | | | | | | | | |
| | | | 65767 | 1.68 | 55128 | 1.67 | | | | | | | | | | | | | | | | | | | | |
| | | | 110242 | 1.65 | 91968 | 1.67 | | | | | | | | | | | | | | | | | | | | |
| | | | Avg. | 196.9 | | 182154 | | 154027 | | | | | | | | | | | | | | | | | | |

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TABLE I (cont'd)
Measurement of Temp. Coefficient

| Run No. | Date | Time | Temperature - (F) | | | | Ch. A Ratio | | Ch. B Ratio | | Ratio Avg. | Pressure - (psig) | | | | Avg. Press. (psig) | Start up rate dec/min | Uncor-rected ρ $\times 10^{-4}$ | Rod Height (inches) | Pressure Reactivity Correction | | Cor-rected ρ $\times 10^{-4}$ | Time Base | γ | | | |
|---------|---------|---------|-------------------|-------------------|-------------------|-------------------|-------------|------|-------------|------|------------|-------------------|------|--------------|-----------------------------------|--------------------|-----------------------|--------------------------------------|---------------------|--------------------------------|-------|------------------------------------|-----------|----------|--|--|--|
| | | | 1A T _c | 1B T _c | 1C T _c | 1D T _c | A | B | 1A | 1B | | 1C | 1D | $\Delta\rho$ | Corr. $\Delta\rho \times 10^{-4}$ | | | | | | | | | | | | |
| 11 | 9-13-59 | 0641:39 | 201.6 | 201.1 | 201.5 | 201.2 | 11749 | 1.58 | 11171 | 1.59 | 1.59 | 370 | 370 | 370 | 370 | 370 | .603 | 11.545 | 31.75 | -30 | +121 | 11.666 | 20 | 43.2 | | | |
| | | | Avg. 201.4 | | | | 30172 | 1.56 | 28524 | 1.60 | | | | | | | | | | | | | | | | | |
| | | | | | | | 46964 | 1.58 | 45596 | 1.59 | | | | | | | | | | | | | | | | | |
| | | | | | | | 73970 | 1.56 | 72651 | 1.58 | | | | | | | | | | | | | | | | | |
| | | | | | | | 115167 | 1.56 | 114699 | 1.59 | | | | | | | | | | | | | | | | | |
| | | | | | | | 179982 | | 182484 | | | | | | | | | | | | | | | | | | |
| 12 | 9-13-59 | 0737:39 | 207.1 | 206.3 | 206.9 | 206.5 | 14563 | 1.78 | 17257 | 1.82 | 1.79 | 390 | 380 | 380 | 370 | 380 | .505 | 10.254 | 31.75 | -20 | +081 | 10.335 | 30 | 51.6 | | | |
| | | | Avg. 206.7 | | | | 25951 | 1.80 | 31355 | 1.79 | | | | | | | | | | | | | | | | | |
| | | | | | | | 46652 | 1.80 | 56186 | 1.81 | | | | | | | | | | | | | | | | | |
| | | | | | | | 84053 | 1.77 | 101461 | 1.80 | | | | | | | | | | | | | | | | | |
| | | | | | | | 149008 | 1.78 | 181582 | | | | | | | | | | | | | | | | | | |
| | | | | | | | 265033 | | | | | | | | | | | | | | | | | | | | |
| 13 | 9-13-59 | 0916:35 | 216.3 | 215.6 | 215.8 | 215.8 | 17213 | 1.74 | 11960 | 1.78 | 1.74 | 340 | 340 | 325 | 325 | 332 | .360 | 8.068 | 31.75 | -68 | +279 | 8.347 | 40 | 72.4 | | | |
| | | | Avg. 215.9 | | | | 29982 | 1.72 | 21297 | 1.79 | | | | | | | | | | | | | | | | | |
| | | | | | | | 51661 | 1.73 | 38226 | 1.75 | | | | | | | | | | | | | | | | | |
| | | | | | | | 89402 | 1.72 | 66795 | 1.73 | | | | | | | | | | | | | | | | | |
| | | | | | | | 153644 | 1.73 | 115613 | 1.73 | | | | | | | | | | | | | | | | | |
| | | | | | | | 265410 | | 201125 | 1.73 | | | | | | | | | | | | | | | | | |
| 14 | 9-13-59 | 1024:20 | 222.4 | 221.6 | 221.8 | 221.7 | 10282 | 1.61 | 10564 | 1.54 | 1.56 | 460 | 460 | 450 | 450 | 455 | .290 | 6.852 | 31.75 | +55 | -.228 | 6.624 | 40 | 90.0 | | | |
| | | | Avg. 221.9 | | | | 16158 | 1.55 | 16306 | 1.58 | | | | | | | | | | | | | | | | | |
| | | | | | | | 25035 | 1.57 | 25819 | 1.57 | | | | | | | | | | | | | | | | | |
| | | | | | | | 39191 | 1.56 | 40580 | 1.57 | | | | | | | | | | | | | | | | | |
| | | | | | | | 61100 | 1.57 | 63672 | 1.54 | | | | | | | | | | | | | | | | | |
| | | | | | | | 95658 | 1.55 | 98212 | 1.57 | | | | | | | | | | | | | | | | | |
| 21 | 9-14-59 | 0905:55 | 480.7 | 480.1 | 480.3 | | 23357 | 2.04 | 19051 | 2.01 | 2.01 | 1820 | 1840 | 1810 | 1845 | 1824 | .911 | 14.915 | 45.75 | +45 | -.510 | 14.405 | 20 | 28.6 | | | |
| | | | Avg. 480.4 | | | | 47647 | 2.02 | 38351 | 2.00 | | | | | | | | | | | | | | | | | |
| | | | | | | | 96389 | 1.99 | 76582 | 1.99 | | | | | | | | | | | | | | | | | |
| | | | | | | | 191743 | | 152758 | | | | | | | | | | | | | | | | | | |
| | | | | | | | 20501 | 1.74 | | | 1.78 | 1820 | 1830 | 1800 | 1845 | 1824 | 1.506 | 19.675 | 46.25 | +24 | -.272 | 19.403 | 10 | 17.3 | | | |
| | | | | | | | 35570 | 1.82 | | | | | | | | | | | | | | | | | | | |
| | | | | 64811 | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | 9-14-59 | 0951:32 | 481.7 | 481.3 | 481.6 | | 15471 | 1.64 | 10135 | 1.66 | 1.66 | 1830 | 1850 | 1825 | 1850 | 1837 | 1.323 | 18.381 | 46.25 | +37 | -.424 | 17.957 | 10 | 19.7 | | | |
| | | | Avg. 481.5 | | | | 25354 | 1.71 | 16796 | 1.68 | | | | | | | | | | | | | | | | | |
| | | | | | | | 43315 | 1.63 | 28203 | 1.65 | | | | | | | | | | | | | | | | | |
| | | | | | | | 70484 | | 46545 | 1.65 | | | | | | | | | | | | | | | | | |
| | | | | | | 76633 | | | | | | | | | | | | | | | | | | | | | |
| 24 | 9-14-59 | 1012:03 | 485.4 | 485.2 | 485.4 | | 12886 | 1.46 | 10887 | 1.46 | 1.45 | 1850 | 1860 | 1850 | 1860 | 1855 | .969 | 15.459 | 46.25 | +55 | -.644 | 14.815 | 10 | 26.9 | | | |
| | | | Avg. 485.3 | | | | 18817 | 1.45 | 15914 | 1.45 | | | | | | | | | | | | | | | | | |
| | | | | | | | 27367 | 1.45 | 23008 | 1.44 | | | | | | | | | | | | | | | | | |
| | | | | | | | 39592 | 1.45 | 33027 | 1.44 | | | | | | | | | | | | | | | | | |
| | | | | | | | 57522 | 1.43 | 47372 | 1.44 | | | | | | | | | | | | | | | | | |
| | | | | | | | 82532 | | 68343 | 1.43 | | | | | | | | | | | | | | | | | |
| | | | | | | 97974 | | | | | | | | | | | | | | | | | | | | | |
| 25 | 9-14-59 | 1037:21 | 489.9 | 489.3 | 489.6 | | 17953 | 1.98 | 14100 | 2.00 | 1.96 | 1820 | 1830 | 1810 | 1830 | 1823 | .583 | 11.289 | 46.25 | +23 | -.278 | 11.011 | 30 | 44.7 | | | |
| | | | Avg. 489.6 | | | | 35458 | 1.97 | 28203 | 1.93 | | | | | | | | | | | | | | | | | |
| | | | | | | | 69743 | 1.97 | 54595 | 1.96 | | | | | | | | | | | | | | | | | |
| | | | | | | | 137168 | 1.93 | 106933 | 1.92 | | | | | | | | | | | | | | | | | |
| | | | | | | | 265392 | | 205181 | | | | | | | | | | | | | | | | | | |

TABLE I (cont'd)
 Measurement of Temp. Coefficient

| Run No. | Date | Time | Temperature - (F) | | | | Ch. A Ratio | Ch. B Ratio | Ratio Avg. | Pressure - (psig) | | | | Avg. Press. (psig) | Start up rate dec/min $\times 10^{-4}$ | Uncor-rected ρ | Rod Height (inches) | Pressure Reactivity Correction | | Cor-rected $\rho \times 10^{-4}$ | Time | Base γ | | | |
|---------|---------|---------|-------------------|-------------------|-------------------|-------------------|-------------|-------------|------------|-------------------|--------|--------|--------|--------------------|--|---------------------|---------------------|--------------------------------|-----------------------------------|----------------------------------|--------|---------------|--------|--------|--------|
| | | | 1A T _c | 1B T _c | 1C T _c | 1D T _c | | | | 1A | 1B | 1C | 1D | | | | | $\Delta\rho$ (psig) | Corr. $\Delta\rho \times 10^{-4}$ | | | | | | |
| 26 | 9-14-59 | 1116:00 | 493.8 | 493.4 | 493.5 | 13825 | 1.83 | 10148 | 1.75 | 1.74 | 1850 | 1850 | 1845 | 1855 | 1850 | .360 | 8.068 | 46.25 | +50 | -.616 | 7.452 | 40 | 72.4 | | |
| | | | Avg. 493.6 | 25246 | 1.75 | 17732 | 1.77 | 44185 | 1.77 | 31323 | 1.73 | 78414 | 1.73 | 54202 | 1.73 | 135892 | 1.72 | 93654 | 1.71 | 233462 | 1.71 | 159984 | 1.70 | 399184 | 271490 |
| | | | 14178 | 1.43 | 12149 | 1.47 | 1.45 | 1850 | 1860 | 1850 | 1870 | 1857 | .969 | 15.459 | 47.25 | +57 | -.710 | 14.749 | 10 | 26.9 | | | | | |
| | | | 20210 | 1.46 | 17855 | 1.45 | 29534 | 1.47 | 25949 | 1.44 | 43373 | 1.45 | 37419 | 1.44 | 62865 | 1.45 | 53829 | 91162 | | | | | | | |
| | | | 12295 | 2.30 | 11649 | 2.27 | 2.19 | 1880 | 1890 | 1860 | 1890 | 1880 | .680 | 12.476 | 47.25 | +80 | -1.024 | 11.452 | 30 | 38.3 | | | | | |
| | | | 28221 | 2.27 | 26452 | 2.17 | 64067 | 2.18 | 57456 | 2.13 | 139400 | 2.14 | 122184 | 2.08 | 297924 | 253816 | | | | | | | | | |
| 28 | 9-14-59 | 1155:40 | 498.5 | 498.1 | 498.4 | 12295 | 2.30 | 11649 | 2.27 | 2.19 | 1880 | 1890 | 1860 | 1890 | 1880 | .680 | 12.476 | 47.25 | +80 | -1.024 | 11.452 | 30 | 38.3 | | |
| | | | Avg. 498.3 | 64067 | 2.18 | 57456 | 2.13 | 139400 | 2.14 | 122184 | 2.08 | 297924 | 253816 | | | | | | | | | | | | |
| | | | 12579 | 2.01 | 10216 | 2.01 | 1.93 | 1850 | 1860 | 1845 | 1855 | 1853 | .429 | 9.150 | 47.25 | +53 | -.693 | 8.457 | 40 | 60.8 | | | | | |
| | | | 25293 | 1.97 | 20553 | 1.93 | 49834 | 1.92 | 39751 | 1.89 | 95882 | 1.91 | 75208 | 1.88 | 183033 | 1.89 | 141699 | 1.87 | 345517 | 264777 | | | | | |
| | | | 11689 | 1.28 | 12619 | 1.21 | 1.24 | 1820 | 1830 | 1800 | 1845 | 1824 | .140 | 3.795 | 47.25 | +24 | -.323 | 3.472 | 40 | 186.0 | | | | | |
| | | | 14914 | 1.29 | 15308 | 1.22 | 19182 | 1.27 | 18678 | 1.22 | 24346 | 1.23 | 22696 | 1.23 | 29903 | 1.24 | 27842 | 37146 | 1.24 | 45923 | 1.22 | 56046 | 1.21 | 67854 | |
| 29 | 9-14-59 | 1222:18 | 502.0 | 501.6 | 501.9 | 12579 | 2.01 | 10216 | 2.01 | 1.93 | 1850 | 1860 | 1845 | 1855 | 1853 | .429 | 9.150 | 47.25 | +53 | -.693 | 8.457 | 40 | 60.8 | | |
| | | | Avg. 501.8 | 25293 | 1.97 | 20553 | 1.93 | 49834 | 1.92 | 39751 | 1.89 | 95882 | 1.91 | 75208 | 1.88 | 183033 | 1.89 | 141699 | 1.87 | 345517 | 264777 | | | | |
| | | | 11689 | 1.28 | 12619 | 1.21 | 1.24 | 1820 | 1830 | 1800 | 1845 | 1824 | .140 | 3.795 | 47.25 | +24 | -.323 | 3.472 | 40 | 186.0 | | | | | |
| | | | 14914 | 1.29 | 15308 | 1.22 | 19182 | 1.27 | 18678 | 1.22 | 24346 | 1.23 | 22696 | 1.23 | 29903 | 1.24 | 27842 | 37146 | 1.24 | 45923 | 1.22 | 56046 | 1.21 | 67854 | |
| | | | 12132 | 1.45 | 10938 | 1.45 | 1.45 | 1830 | 1840 | 1830 | 1850 | 1838 | .969 | 15.459 | 48.75 | +38 | -.520 | 14.939 | 10 | 26.9 | | | | | |
| | | | 17631 | 1.47 | 27030 | 1.45 | 25874 | 1.45 | 23028 | 1.45 | 37595 | 1.45 | 33467 | 1.45 | 54335 | 1.46 | 82144 | 79296 | 70425 | | | | | | |
| 31 | 9-14-59 | 1310:42 | 508.6 | 508.3 | 508.5 | 12132 | 1.45 | 10938 | 1.45 | 1.45 | 1830 | 1840 | 1830 | 1850 | 1838 | .969 | 15.459 | 48.75 | +38 | -.520 | 14.939 | 10 | 26.9 | | |
| | | | Avg. 508.5 | 17631 | 1.47 | 27030 | 1.45 | 25874 | 1.45 | 23028 | 1.45 | 37595 | 1.45 | 33467 | 1.45 | 54335 | 1.46 | 82144 | 79296 | 70425 | | | | | |
| | | | 11676 | 1.71 | 14489 | 1.67 | 1.68 | 1850 | 1860 | 1850 | 1870 | 1858 | .679 | 12.455 | 48.75 | +58 | -.811 | 11.644 | 20 | 98.4 | | | | | |
| | | | 19917 | 1.71 | 24200 | 1.70 | 34022 | 1.68 | 41174 | 1.66 | 57248 | 1.68 | 68173 | 1.66 | 96116 | 1.67 | 113405 | 1.64 | 160652 | 186441 | | | | | |
| | | | 15067 | 1.48 | 14105 | 1.45 | 1.45 | 1810 | 1820 | 1805 | 1830 | 1816 | .323 | 7.443 | 48.75 | +16 | -.231 | 7.212 | 30 | 80.7 | | | | | |
| | | | 22374 | 1.47 | 20497 | 1.47 | 32803 | 1.40 | 30073 | 1.44 | 48505 | 1.44 | 43229 | 1.44 | 69844 | 1.46 | 62227 | 1.42 | 101658 | 1.43 | 88361 | 1.43 | 145469 | 208179 | |
| 32 | 9-14-59 | 1335:14 | 512.0 | 511.5 | 511.9 | 11676 | 1.71 | 14489 | 1.67 | 1.68 | 1850 | 1860 | 1850 | 1870 | 1858 | .679 | 12.455 | 48.75 | +58 | -.811 | 11.644 | 20 | 98.4 | | |
| | | | Avg. 511.8 | 19917 | 1.71 | 24200 | 1.70 | 34022 | 1.68 | 41174 | 1.66 | 57248 | 1.68 | 68173 | 1.66 | 96116 | 1.67 | 113405 | 1.64 | 160652 | 186441 | | | | |
| | | | 15067 | 1.48 | 14105 | 1.45 | 1.45 | 1810 | 1820 | 1805 | 1830 | 1816 | .323 | 7.443 | 48.75 | +16 | -.231 | 7.212 | 30 | 80.7 | | | | | |
| | | | 22374 | 1.47 | 20497 | 1.47 | 32803 | 1.40 | 30073 | 1.44 | 48505 | 1.44 | 43229 | 1.44 | 69844 | 1.46 | 62227 | 1.42 | 101658 | 1.43 | 88361 | 1.43 | 145469 | 208179 | |
| | | | 11594 | 1.25 | 10796 | 1.18 | 1.18 | 1860 | 1870 | 1860 | 1880 | 1867 | .108 | 3.023 | 48.75 | +67 | -.993 | 2.030 | 40 | 241.6 | | | | | |
| | | | 14543 | 1.24 | 12779 | 1.19 | 17961 | 1.21 | 15193 | 1.16 | 21692 | 1.19 | 17584 | 1.13 | 25788 | 1.17 | 19796 | 30093 | 1.18 | 35582 | 1.15 | 40833 | 1.15 | 46928 | |
| 33 | 9-14-59 | 1408:39 | 516.2 | 515.9 | 516.1 | 11594 | 1.25 | 10796 | 1.18 | 1.18 | 1860 | 1870 | 1860 | 1880 | 1867 | .108 | 3.023 | 48.75 | +67 | -.993 | 2.030 | 40 | 241.6 | | |
| | | | Avg. 516.1 | 14543 | 1.24 | 12779 | 1.19 | 17961 | 1.21 | 15193 | 1.16 | 21692 | 1.19 | 17584 | 1.13 | 25788 | 1.17 | 19796 | 30093 | 1.18 | 35582 | 1.15 | 40833 | 1.15 | 46928 |
| | | | 11594 | 1.25 | 10796 | 1.18 | 1.18 | 1860 | 1870 | 1860 | 1880 | 1867 | .108 | 3.023 | 48.75 | +67 | -.993 | 2.030 | 40 | 241.6 | | | | | |
| | | | 14543 | 1.24 | 12779 | 1.19 | 17961 | 1.21 | 15193 | 1.16 | 21692 | 1.19 | 17584 | 1.13 | 25788 | 1.17 | 19796 | 30093 | 1.18 | 35582 | 1.15 | 40833 | 1.15 | 46928 | |
| | | | 11594 | 1.25 | 10796 | 1.18 | 1.18 | 1860 | 1870 | 1860 | 1880 | 1867 | .108 | 3.023 | 48.75 | +67 | -.993 | 2.030 | 40 | 241.6 | | | | | |
| | | | 14543 | 1.24 | 12779 | 1.19 | 17961 | 1.21 | 15193 | 1.16 | 21692 | 1.19 | 17584 | 1.13 | 25788 | 1.17 | 19796 | 30093 | 1.18 | 35582 | 1.15 | 40833 | 1.15 | 46928 | |
| 34 | 9-14-59 | 1435:45 | 520.6 | 520.1 | 520.5 | 11594 | 1.25 | 10796 | 1.18 | 1.18 | 1860 | 1870 | 1860 | 1880 | 1867 | .108 | 3.023 | 48.75 | +67 | -.993 | 2.030 | 40 | 241.6 | | |
| | | | Avg. 520.1 | 14543 | 1.24 | 12779 | 1.19 | 17961 | 1.21 | 15193 | 1.16 | 21692 | 1.19 | 17584 | 1.13 | 25788 | 1.17 | 19796 | 30093 | 1.18 | 35582 | 1.15 | 40833 | 1.15 | 46928 |
| | | | 11594 | 1.25 | 10796 | 1.18 | 1.18 | 1860 | 1870 | 1860 | 1880 | 1867 | .108 | 3.023 | 48.75 | +67 | -.993 | 2.030 | 40 | 241.6 | | | | | |
| | | | 14543 | 1.24 | 12779 | 1.19 | 17961 | 1.21 | 15193 | 1.16 | 21692 | 1.19 | 17584 | 1.13 | 25788 | 1.17 | 19796 | 30093 | 1.18 | 35582 | 1.15 | 40833 | 1.15 | 46928 | |
| | | | 11594 | 1.25 | 10796 | 1.18 | 1.18 | 1860 | 1870 | 1860 | 1880 | 1867 | .108 | 3.023 | 48.75 | +67 | -.993 | 2.030 | 40 | 241.6 | | | | | |
| | | | 14543 | 1.24 | 12779 | 1.19 | 17961 | 1.21 | 15193 | 1.16 | 21692 | 1.19 | 17584 | 1.13 | 25788 | 1.17 | 19796 | 30093 | 1.18 | 35582 | 1.15 | 40833 | 1.15 | 46928 | |

TABLE I (cont'd)

Measurement of Press. Coefficient of Reactivity

| Run No. | Date | Time | Temperature - (F) | | | | Ch. A Ratio | Ch. B Ratio | Ratio Avg. | Pressure - (psig) | | | | | Avg. Press. (psig) | Start up rate dec/min | Uncor-rected ρ x 10 ⁻⁴ | Rod Height (inches) | Temperature Reactivity Correction | | Cor-rected ρ x 10 ⁻⁴ | Time | Base |
|---------|---------|---------|-------------------|-------------------|-------------------|-------------------|-------------|-------------|------------|-------------------|------|------|------|----------------|--------------------|-----------------------|--|---------------------|---------------------------------------|-------|--------------------------------------|------|-------|
| | | | 1A T _c | 1B T _c | 1C T _c | 1D T _c | | | | 1A | 1B | 1C | 1D | ΔT (F) | | | | | Temp. $\Delta\rho$ x 10 ⁻⁴ | | | | |
| 15 | 9-14-59 | 0457:45 | 480.2 | 479.9 | 480.2 | 477.7 | 10888 | 1.13 | 10671 | 1.08 | 1.10 | 1340 | 1350 | 1325 | 1350 | 1341 | .0621 | 44.75 | -.10 | +.089 | 2.939 | 40 | 419.6 |
| | | | 12292 | 1.11 | 11509 | 1.10 | 2.850 | | | | | | | | | | | | | | | | |
| | | | 13687 | 1.11 | 12690 | 1.10 | | | | | | | | | | | | | | | | | |
| | | | Avg. 480.1 | 15252 | 1.11 | 13986 | 1.09 | | | | | | | | | | | | | | | | |
| | | | 16894 | 1.11 | 15226 | 1.10 | | | | | | | | | | | | | | | | | |
| | | | 18636 | 1.11 | 16687 | 1.10 | | | | | | | | | | | | | | | | | |
| 16 | 9-14-59 | 0530:05 | 480.1 | 479.8 | 480.0 | 477.7 | 10825 | 1.18 | 10904 | 1.16 | 1.18 | 1440 | 1450 | 1425 | 1450 | 1441 | .108 | 44.75 | 0 | 0 | 3.023 | 40 | 241.6 |
| | | | 12837 | 1.17 | 12633 | 1.17 | | | | | | | | | | | | | | | | | |
| | | | 15052 | 1.18 | 14763 | 1.16 | | | | | | | | | | | | | | | | | |
| | | | Avg. 480.0 | 17742 | 1.19 | 17135 | 1.13 | | | | | | | | | | | | | | | | |
| | | | 21136 | 1.16 | 19394 | 1.16 | | | | | | | | | | | | | | | | | |
| | | | 24466 | 1.16 | 22502 | 1.16 | | | | | | | | | | | | | | | | | |
| 17 | 9-14-59 | 0607:15 | 480.3 | 479.9 | 479.8 | 478.1 | 11195 | 1.25 | 10333 | 1.20 | 1.23 | 1540 | 1550 | 1520 | 1550 | 1540 | .135 | 44.75 | 0 | 0 | 3.673 | 40 | 193.2 |
| | | | 13971 | 1.21 | 12396 | 1.25 | | | | | | | | | | | | | | | | | |
| | | | 16905 | 1.26 | 15561 | 1.25 | | | | | | | | | | | | | | | | | |
| | | | Avg. 480.0 | 21373 | 1.24 | 19487 | 1.20 | | | | | | | | | | | | | | | | |
| | | | 26522 | 1.23 | 23372 | 1.23 | | | | | | | | | | | | | | | | | |
| | | | 32588 | 1.23 | 28842 | 1.23 | | | | | | | | | | | | | | | | | |
| 18 | 9-14-59 | 0638:05 | 480.5 | 480.1 | 480.0 | 475.8 | 10604 | 1.26 | 11585 | 1.29 | 1.29 | 1645 | 1660 | 1640 | 1645 | 1648 | .166 | 44.75 | -.2 | +.173 | 4.550 | 40 | 157.2 |
| | | | 13381 | 1.32 | 14976 | 1.28 | | | | | | | | | | | | | | | | | |
| | | | 17634 | 1.30 | 19183 | 1.30 | | | | | | | | | | | | | | | | | |
| | | | Avg. 480.2 | 22952 | 1.28 | 25013 | 1.30 | | | | | | | | | | | | | | | | |
| | | | 29484 | 1.30 | 32502 | 1.31 | | | | | | | | | | | | | | | | | |
| | | | 38305 | 1.30 | 42489 | 1.31 | | | | | | | | | | | | | | | | | |
| 19 | 9-14-59 | 0710:55 | 480.3 | 479.9 | 479.8 | 475.4 | 11643 | 1.41 | 12577 | 1.39 | 1.39 | 1745 | 1750 | 1725 | 1750 | 1743 | .214 | 44.75 | 0 | 0 | 5.407 | 40 | 121.5 |
| | | | 16478 | 1.41 | 17542 | 1.37 | | | | | | | | | | | | | | | | | |
| | | | 23187 | 1.42 | 24078 | 1.38 | | | | | | | | | | | | | | | | | |
| | | | Avg. 480.0 | 32873 | 1.39 | 33285 | 1.38 | | | | | | | | | | | | | | | | |
| | | | 45645 | 1.37 | 45851 | 1.36 | | | | | | | | | | | | | | | | | |
| | | | 62549 | 1.37 | 62273 | 1.36 | | | | | | | | | | | | | | | | | |
| 20 | 9-14-59 | 0731:10 | 480.1 | 479.9 | 479.8 | 476.4 | 11625 | 1.55 | 10589 | 1.54 | 1.52 | 1835 | 1840 | 1825 | 1840 | 1835 | .273 | 44.75 | +.10 | -.085 | 6.456 | 40 | 95.5 |
| | | | 18056 | 1.54 | 16308 | 1.52 | | | | | | | | | | | | | | | | | |
| | | | 27792 | 1.52 | 24783 | 1.50 | | | | | | | | | | | | | | | | | |
| | | | Avg. 479.9 | 42282 | 1.52 | 37290 | 1.50 | | | | | | | | | | | | | | | | |
| | | | 64185 | 1.52 | 56083 | 1.49 | | | | | | | | | | | | | | | | | |
| | | | 97393 | 1.52 | 83518 | 1.49 | | | | | | | | | | | | | | | | | |

TABLE II
 LOOP PRESSURE

| Date | Time | 1A psig | 1B psig | 1C psig | 1D psig | Avg. psig | Reactor psig |
|---------|------|------------|------------|------------|------------|--------------|-----------------|
| 9-13-59 | 0112 | 410 | 400 | 400 | 390 | 400 | ---- |
| | 0136 | 380 | 370 | 370 | 360 | 370 | ---- |
| | 0206 | 360 | 350 | 340 | 340 | 348 | 350 |
| | 0255 | 370 | 380 | 370 | 370 | 373 | ---- |
| | 0327 | 400 | 400 | 400 | 400 | 400 | 400 |
| | 0403 | 460 | 460 | 460 | 460 | 460 | 460 |
| | 0428 | 410 | 410 | 410 | 400 | 408 | 420 |
| | 0458 | 420 | 420 | 410 | 400 | 413 | 410 |
| | 0523 | 370 | 370 | 370 | 350 | 365 | 370 |
| | 0558 | 390 | 390 | 380 | 380 | 385 | 380 |
| | 0642 | 370 | 370 | 370 | 370 | 370 | 370 |
| | 0738 | 390 | 380 | 380 | 370 | 380 | 380 |
| | 0917 | 340 | 340 | 325 | 325 | 332 | 330 |
| | 1024 | 460 | 460 | 450 | 450 | 455 | 450 |
| 9-14-59 | 0458 | 1340 | 1350 | 1325 | 1350 | 1341 | 1310 |
| | 0530 | 1440 | 1450 | 1425 | 1450 | 1441 | 1410 |
| | 0607 | 1540 | 1550 | 1520 | 1550 | 1540 | 1500 |
| | 0638 | 1645 | 1660 | 1640 | 1645 | 1648 | 1610 |
| | 0711 | 1745 | 1750 | 1725 | 1750 | 1743 | 1710 |
| | 0731 | 1835 | 1840 | 1825 | 1840 | 1835 | 1800 |
| | 0906 | 1820 | 1840 | 1810 | 1845 | 1829 | 1790 |
| | 0936 | 1820 | 1830 | 1800 | 1845 | 1824 | 1790 |
| | 0952 | 1830 | 1850 | 1825 | 1850 | 1837 | 1795 |
| | 1012 | 1850 | 1860 | 1850 | 1860 | 1855 | 1810 |
| | 1037 | 1820 | 1830 | 1810 | 1830 | 1823 | 1790 |
| | 1116 | 1850 | 1850 | 1845 | 1855 | 1850 | 1810 |
| | 1130 | 1850 | 1860 | 1850 | 1870 | 1857 | 1810 |
| | 1156 | 1880 | 1890 | 1860 | 1890 | 1880 | 1850 |
| | 1222 | 1850 | 1860 | 1845 | 1855 | 1853 | 1810 |
| | 1257 | 1820 | 1830 | 1800 | 1845 | 1824 | 1790 |
| | 1311 | 1830 | 1840 | 1830 | 1850 | 1838 | 1795 |
| 1335 | 1850 | 1860 | 1850 | 1870 | 1858 | 1820 | |
| 1409 | 1810 | 1820 | 1805 | 1830 | 1816 | 1790 | |

TABLE III

COOLANT LOOP TEMPERATURES

| Date | Time | LA | | LB | | 1C | | 1D | | Avg. F. |
|---------|--------|--------|-------|--------|--------|--------|-------|-------|--------|------------|
| | | Ohms | F. | Ohms | F. | Ohms | F. | Ohms | F. | |
| 9-13-59 | 0115 | 32.40 | 167.1 | 32.35 | 166.3 | 32.38 | 166.9 | 32.33 | 166.6 | 166.7 |
| | 0136 | 32.54 | 169.7 | 32.49 | 168.9 | 32.52 | 169.4 | 32.47 | 169.2 | 169.3 |
| | 0206 | 32.73 | 173.2 | 32.68 | 172.4 | 32.70 | 172.8 | 32.65 | 172.6 | 172.7 |
| | 0255 | 33.00 | 178.2 | 32.96 | 177.6 | 32.99 | 178.2 | 32.93 | 177.7 | 177.9 |
| | 0327 | 33.19 | 181.8 | 33.15 | 181.1 | 33.16 | 181.3 | 33.12 | 181.2 | 181.4 |
| | 0403 | 33.39 | 185.5 | 33.34 | 184.6 | 33.37 | 185.2 | 33.32 | 184.9 | 185.1 |
| | 0428 | 33.53 | 188.4 | 33.49 | 187.7 | 33.51 | 188.1 | 33.46 | 187.9 | 188.0 |
| | 0458 | 33.69 | 191.4 | 33.64 | 190.5 | 33.67 | 191.1 | 33.61 | 190.7 | 190.9 |
| | 0523 | 33.82 | 193.8 | 33.78 | 193.1 | 33.81 | 193.7 | 33.75 | 193.3 | 193.5 |
| | 0558 | 34.01 | 197.3 | 33.97 | 196.6 | 33.99 | 197.0 | 33.93 | 196.6 | 196.9 |
| | 0642 | 34.24 | 201.6 | 34.21 | 201.1 | 34.23 | 201.5 | 34.18 | 201.2 | 201.4 |
| | 0738 | 34.54 | 207.1 | 34.49 | 206.3 | 34.52 | 206.9 | 34.46 | 206.5 | 206.7 |
| | 0915 | 35.03 | 216.3 | 34.99 | 215.6 | 35.00 | 215.8 | 34.96 | 215.8 | 215.8 |
| | 1025 | 35.36 | 222.4 | 35.31 | 221.6 | 35.32 | 221.8 | 35.28 | 221.7 | 221.8 |
| 9-14-59 | 0458 | 48.885 | 480.2 | 48.87 | 479.9 | 48.89 | 480.2 | 48.72 | 477.7 | 479.5 |
| | 0530 | 48.88 | 480.1 | 48.865 | 479.8 | 48.88 | 480.0 | 48.72 | 477.7 | 479.4 |
| | 0607 | 48.89 | 480.3 | 48.87 | 479.9 | 48.87 | 479.8 | 48.74 | 478.1 | 479.5 |
| | 0638 | 48.90 | 480.5 | 48.88 | 480.1 | 48.88 | 480.0 | 48.62 | 475.8 | 479.1 |
| | 0711 | 48.89 | 480.3 | 48.87 | 479.9 | 48.87 | 479.8 | 48.60 | 475.4 | 478.9 |
| | 0731 | 48.88 | 480.1 | 48.87 | 479.9 | 48.87 | 479.8 | 48.65 | 476.4 | 479.1 |
| | 0906 | 48.909 | 480.7 | 48.881 | 480.1 | 48.90 | 480.3 | 00S | 00S | 480.37 |
| | 0936 | 48.86 | 479.7 | 48.836 | 479.3 | 48.868 | 479.9 | 00S | 00S | 479.62 |
| | 0951 | 48.962 | 481.7 | 48.94 | 481.3 | 48.961 | 481.6 | 00S | 00S | 481.53 |
| | 1012 | 49.15 | 485.4 | 49.14 | 485.2 | 49.155 | 485.4 | 00S | 00S | 485.33 |
| | 1037 | 49.38 | 489.9 | 49.35 | 489.3 | 49.37 | 489.6 | 00S | 00S | 489.60 |
| | 1116 | 49.58 | 493.8 | 49.56 | 493.4 | 49.573 | 493.5 | 00S | 00S | 493.57 |
| | 1130 | 49.66 | 495.3 | 49.64 | 495.0 | 49.65 | 495.1 | 00S | 00S | 495.13 |
| | 1156 | 49.82 | 498.5 | 49.80 | 498.1 | 49.82 | 498.4 | 00S | 00S | 498.33 |
| | 1222 | 50.00 | 502.0 | 49.98 | 501.6 | 50.00 | 501.9 | 00S | 00S | 501.85 |
| | 1257 | 50.25 | 506.5 | 50.25 | 506.6 | 50.25 | 506.4 | 00S | 00S | 506.5 |
| | 1311 | 50.34 | 508.6 | 50.32 | 508.3 | 50.34 | 508.5 | 00S | 00S | 508.47 |
| 1335 | 50.51 | 512.0 | 50.49 | 511.5 | 50.51 | 511.9 | 00S | 00S | 511.80 | |
| 1409 | 50.725 | 516.2 | 50.71 | 515.9 | 50.725 | 516.1 | 00S | 00S | 516.07 | |
| 1436 | 50.95 | 520.6 | 50.93 | 520.1 | 50.95 | 520.5 | 00S | 00S | 520.40 | |

TABLE IV

Coolant Loop Flows (lbs/hr x 10⁶)

| Date | Time | 1A | 1B | 1C | 1D | Total |
|---------|------|------|------|------|-------|-------|
| 9-13-59 | 0112 | 3.87 | 3.86 | 3.90 | 3.90 | 15.53 |
| | 0136 | 3.87 | 3.87 | 3.90 | 3.90 | 15.54 |
| | 0206 | 3.87 | 3.87 | 3.90 | 3.91 | 15.55 |
| | 0255 | 3.87 | 3.87 | 3.89 | 3.90 | 15.53 |
| | 0327 | 3.88 | 3.87 | 3.91 | 3.91 | 15.57 |
| | 0403 | 3.88 | 3.87 | 3.91 | 3.90 | 15.56 |
| | 0428 | 3.88 | 3.87 | 3.91 | 3.90 | 15.56 |
| | 0458 | 3.87 | 3.87 | 3.91 | 3.90 | 15.55 |
| | 0523 | 3.87 | 3.87 | 3.91 | 3.90 | 15.55 |
| | 0558 | 3.87 | 3.85 | 3.91 | 3.90 | 15.53 |
| | 0642 | 3.87 | 3.86 | 3.90 | 3.90 | 15.53 |
| | 0738 | 3.89 | 3.86 | 3.90 | 3.90 | 15.55 |
| | 0917 | 3.90 | 3.90 | 3.90 | 3.40 | 15.09 |
| | 1024 | 3.90 | 3.90 | 3.90 | 3.40 | 15.09 |
| 9-14-59 | 0504 | 7.72 | 7.37 | 7.62 | 0* | 22.71 |
| | 0524 | 7.72 | 7.38 | 7.62 | 0 | 22.72 |
| | 0602 | 7.74 | 7.38 | 7.62 | 0 | 22.74 |
| | 0633 | 7.74 | 7.38 | 7.62 | 0 | 22.74 |
| | 0707 | 7.72 | 7.38 | 7.63 | 0 | 22.73 |
| | 0727 | 7.74 | 7.38 | 7.63 | 0 | 22.75 |
| | 0905 | 7.75 | 7.38 | 7.65 | 0 | 22.78 |
| | 0936 | 7.75 | 7.38 | 7.65 | 0 | 22.78 |
| | 0950 | 7.75 | 7.38 | 7.64 | 0 | 22.77 |
| | 1010 | 7.75 | 7.38 | 7.61 | 0 | 22.74 |
| | 1034 | 7.72 | 7.38 | 7.60 | 0 | 22.70 |
| | 1111 | 7.71 | 7.38 | 7.59 | 0 | 22.68 |
| | 1131 | 7.70 | 7.36 | 7.58 | 0 | 22.64 |
| | 1153 | 7.70 | 7.36 | 7.56 | 0 | 22.62 |
| | 1218 | 7.69 | 7.34 | 7.54 | 0 | 22.57 |
| | 1254 | 7.65 | 7.32 | 7.52 | 0 | 22.49 |
| 1309 | 7.66 | 7.32 | 7.52 | 0 | 22.50 | |
| 1332 | 7.62 | 7.31 | 7.50 | 0 | 22.43 | |
| 1406 | 7.60 | 7.29 | 7.49 | 0 | 22.38 | |
| 1430 | 7.61 | 7.29 | 7.48 | 0 | 22.38 | |

* Pump removed from service.

TABLE V
 CONTROL ROD POSITIONS (in.)
 Sept. 13-1959

| Run No. Time Rod No. | 1 0112 | 2 0136 | 3 0206 | 4 0255 | 5 0327 | 6 0403 | 7 0428 | 8 0458 | 9 0523 | 10 0558 | 11 0642 | 12 0738 | 13 0917 | 14 1024 | 15 0458 | 16 0530 | 17 0607 |
|----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|
| 11 | 31.25 | 31.75 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.75 | ---- | ---- |
| 12 | 31.27 | 31.77 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.76 | ---- | ---- |
| 13 | 31.24 | 31.73 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.72 | ---- | ---- |
| 14 | 31.21 | 31.71 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.70 | ---- | ---- |
| 21 | 31.27 | 31.77 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.69 | ---- | ---- |
| 22 | 31.19 | 31.69 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.73 | ---- | ---- |
| 23 | 31.25 | 31.75 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.79 | ---- | ---- |
| 24 | 31.24 | 31.73 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.78 | ---- | ---- |
| 31 | 31.30 | 31.80 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.71 | ---- | ---- |
| 32 | 31.25 | 31.76 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.79 | ---- | ---- |
| 33 | 31.26 | 31.77 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.81 | ---- | ---- |
| 34 | 31.21 | 31.72 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.75 | ---- | ---- |
| 41 | 31.32 | 31.82 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.70 | ---- | ---- |
| 42 | 31.26 | 31.76 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.75 | ---- | ---- |
| 43 | 31.24 | 31.74 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.74 | ---- | ---- |
| 44 | 31.25 | 31.75 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.75 | ---- | ---- |
| 51 | 30.95 | 31.70 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.74 | ---- | ---- |
| 52 | 30.93 | 31.68 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.72 | ---- | ---- |
| 53 | 31.01 | 31.76 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.80 | ---- | ---- |
| 54 | 31.06 | 31.80 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.72 | ---- | ---- |
| 61 | 31.26 | 31.77 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.75 | ---- | ---- |
| 62 | 31.29 | 31.79 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.78 | ---- | ---- |
| 63 | 31.25 | 31.75 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.74 | ---- | ---- |
| 64 | 31.32 | 31.82 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.68 | ---- | ---- |
| 71 | 31.26 | 31.75 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.80 | ---- | ---- |
| 72 | 31.32 | 31.82 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.74 | ---- | ---- |
| 73 | 31.29 | 31.79 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.71 | ---- | ---- |
| 74 | 31.31 | 31.81 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.72 | ---- | ---- |
| 81 | 31.32 | 31.82 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.67 | ---- | ---- |
| 82 | 31.26 | 31.87 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.71 | ---- | ---- |
| 83 | 31.32 | 31.83 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.80 | ---- | ---- |
| 84 | 31.28 | 31.77 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | 44.75 | ---- | ---- |

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DUQUESNE LIGHT COMPANY
 POWER STATIONS DEPARTMENT
 SHIPPINGPORT ATOMIC POWER STATION

DETERMINATION OF COEFFICIENTS OF REACTIVITY
 DLCS 1510108
 T-550132

TABLE V (cont'd)

CONTROL ROD POSITIONS (in.)
 Sept. 13-1959

| Run No. Time Rod No. | 18 0638 | 19 0711 | 20 0731 | 21 0906 | 22 0936 | 23 0952 | 24 1012 | 25 1037 | 26 1116 | 27 1130 | 28 1156 | 29 1222 | 30 1257 | 31 1311 | 32 1335 | 33 1409 | 34 1436 |
|----------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| 11 | ---- | ---- | ---- | 45.75 | 46.26 | ---- | ---- | ---- | ---- | 47.26 | ---- | 47.26 | ---- | 48.76 | ---- | ---- | ---- |
| 12 | ---- | ---- | ---- | 45.77 | 46.27 | ---- | ---- | ---- | ---- | 47.28 | ---- | 47.28 | ---- | 48.78 | ---- | ---- | ---- |
| 13 | ---- | ---- | ---- | 45.74 | 46.24 | ---- | ---- | ---- | ---- | 47.25 | ---- | 47.25 | ---- | 48.75 | ---- | ---- | ---- |
| 14 | ---- | ---- | ---- | 45.71 | 46.22 | ---- | ---- | ---- | ---- | 47.22 | ---- | 47.22 | ---- | 48.72 | ---- | ---- | ---- |
| 21 | ---- | ---- | ---- | 45.69 | 46.19 | ---- | ---- | ---- | ---- | 47.19 | ---- | 47.19 | ---- | 48.69 | ---- | ---- | ---- |
| 22 | ---- | ---- | ---- | 45.73 | 46.23 | ---- | ---- | ---- | ---- | 47.23 | ---- | 47.23 | ---- | 48.73 | ---- | ---- | ---- |
| 23 | ---- | ---- | ---- | 45.79 | 46.30 | ---- | ---- | ---- | ---- | 47.29 | ---- | 47.29 | ---- | 48.79 | ---- | ---- | ---- |
| 24 | ---- | ---- | ---- | 44.78 | 46.28 | ---- | ---- | ---- | ---- | 47.28 | ---- | 47.28 | ---- | 48.78 | ---- | ---- | ---- |
| 31 | ---- | ---- | ---- | 45.71 | 46.21 | ---- | ---- | ---- | ---- | 47.21 | ---- | 47.21 | ---- | 48.71 | ---- | ---- | ---- |
| 32 | ---- | ---- | ---- | 45.79 | 46.29 | ---- | ---- | ---- | ---- | 47.29 | ---- | 47.29 | ---- | 48.79 | ---- | ---- | ---- |
| 33 | ---- | ---- | ---- | 45.81 | 46.31 | ---- | ---- | ---- | ---- | 47.31 | ---- | 47.31 | ---- | 48.81 | ---- | ---- | ---- |
| 34 | ---- | ---- | ---- | 45.75 | 46.26 | ---- | ---- | ---- | ---- | 47.25 | ---- | 47.25 | ---- | 48.75 | ---- | ---- | ---- |
| 41 | ---- | ---- | ---- | 45.69 | 46.20 | ---- | ---- | ---- | ---- | 47.20 | ---- | 47.20 | ---- | 48.69 | ---- | ---- | ---- |
| 42 | ---- | ---- | ---- | 45.76 | 46.26 | ---- | ---- | ---- | ---- | 47.26 | ---- | 47.26 | ---- | 48.76 | ---- | ---- | ---- |
| 43 | ---- | ---- | ---- | 45.74 | 46.24 | ---- | ---- | ---- | ---- | 47.25 | ---- | 47.25 | ---- | 48.74 | ---- | ---- | ---- |
| 44 | ---- | ---- | ---- | 45.75 | 46.25 | ---- | ---- | ---- | ---- | 47.25 | ---- | 47.25 | ---- | 48.75 | ---- | ---- | ---- |
| 51 | ---- | ---- | ---- | 45.74 | 46.24 | ---- | ---- | ---- | ---- | 47.24 | ---- | 47.24 | ---- | 48.73 | ---- | ---- | ---- |
| 52 | ---- | ---- | ---- | 45.72 | 46.22 | ---- | ---- | ---- | ---- | 47.22 | ---- | 47.22 | ---- | 48.72 | ---- | ---- | ---- |
| 53 | ---- | ---- | ---- | 45.80 | 46.30 | ---- | ---- | ---- | ---- | 47.30 | ---- | 47.30 | ---- | 48.80 | ---- | ---- | ---- |
| 54 | ---- | ---- | ---- | 45.72 | 46.22 | ---- | ---- | ---- | ---- | 47.22 | ---- | 47.22 | ---- | 48.72 | ---- | ---- | ---- |
| 61 | ---- | ---- | ---- | 45.76 | 46.26 | ---- | ---- | ---- | ---- | 47.26 | ---- | 47.26 | ---- | 48.75 | ---- | ---- | ---- |
| 62 | ---- | ---- | ---- | 45.78 | 46.29 | ---- | ---- | ---- | ---- | 47.29 | ---- | 47.29 | ---- | 48.78 | ---- | ---- | ---- |
| 63 | ---- | ---- | ---- | 45.75 | 46.25 | ---- | ---- | ---- | ---- | 47.25 | ---- | 47.25 | ---- | 48.75 | ---- | ---- | ---- |
| 64 | ---- | ---- | ---- | 45.69 | 46.19 | ---- | ---- | ---- | ---- | 47.19 | ---- | 47.19 | ---- | 48.68 | ---- | ---- | ---- |
| 71 | ---- | ---- | ---- | 45.80 | 46.30 | ---- | ---- | ---- | ---- | 47.30 | ---- | 47.30 | ---- | 48.80 | ---- | ---- | ---- |
| 72 | ---- | ---- | ---- | 45.74 | 46.24 | ---- | ---- | ---- | ---- | 47.24 | ---- | 47.24 | ---- | 48.74 | ---- | ---- | ---- |
| 73 | ---- | ---- | ---- | 45.71 | 46.21 | ---- | ---- | ---- | ---- | 47.21 | ---- | 47.21 | ---- | 48.71 | ---- | ---- | ---- |
| 74 | ---- | ---- | ---- | 45.72 | 46.23 | ---- | ---- | ---- | ---- | 47.23 | ---- | 47.23 | ---- | 48.72 | ---- | ---- | ---- |
| 81 | ---- | ---- | ---- | 45.70 | 46.20 | ---- | ---- | ---- | ---- | 47.20 | ---- | 47.20 | ---- | 48.70 | ---- | ---- | ---- |
| 82 | ---- | ---- | ---- | 45.75 | 46.25 | ---- | ---- | ---- | ---- | 47.25 | ---- | 47.25 | ---- | 48.75 | ---- | ---- | ---- |
| 83 | ---- | ---- | ---- | 45.83 | 46.33 | ---- | ---- | ---- | ---- | 47.33 | ---- | 47.33 | ---- | 48.83 | ---- | ---- | ---- |
| 84 | ---- | ---- | ---- | 45.78 | 46.28 | ---- | ---- | ---- | ---- | 47.28 | ---- | 47.28 | ---- | 48.78 | ---- | ---- | ---- |

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DUQUESNE LIGHT COMPANY
POWER STATIONS DEPARTMENT
SHIPPINGPORT ATOMIC POWER STATION

DETERMINATION OF COEFFICIENTS OF REACTIVITY
DLCS 1510108
T-550132

TABLE VI

TEMPERATURE COEFFICIENT DATA

| Run No. | $\Delta\rho/\Delta T \times 10^{-4}$ | Rod Ht. in. | Base Press. psig. | Temp. F |
|---------|--------------------------------------|-------------|-------------------|---------|
| 2-6 | 0.210 | 31.75 | 400 | 175 |
| 7-11 | 0.215 | 31.75 | 400 | 195 |
| 12-14 | 0.245 | 31.75 | 400 | 215 |
| 22-26 | 0.860 | 46.25 | 1800 | 485 |
| 27-30 | 1.00 | 47.25 | 1800 | 500 |
| 31-34 | 1.03 | 48.75 | 1800 | 515 |

TABLE VII
 LOG OF EVENTS

| Date | Time | Comments |
|---------|------|--|
| 9-12-59 | 2215 | Started pulling rods. Temp. = 153 F. |
| 9-13-59 | 0045 | Rod bank at 30.00 in 8's pulled to 30.00 in (cannot go critical) 8's down to 20.00 in. |
| | 0100 | Rod bank at 31.25 in. |
| | 0108 | 8's raised to 31.25 in. Start-up Rate = .616 Lowering 8's |
| | 0115 | Rod bank at 31.75 in. |
| | 0138 | 8's raised to 31.75 in. Start-up Rate = 1.206 |
| | 0200 | 8's raised to 31.75 in. Start-up Rate = 1.123 |
| | 0300 | 8's raised to 31.75 in. Start-up Rate = 1.02 |
| | 0330 | 8's raised to 31.75 in. Start-up Rate = .951 |
| | 0400 | 8's raised to 31.75 in. Start-up Rate = .874 |
| | 0425 | 8's raised to 31.75 in. Start-up Rate = .857 |
| | 0450 | 8's raised to 31.75 in. Start-up Rate = .790 |
| | 0525 | 8's raised to 31.75 in. Start-up Rate = .745 |
| | 0600 | 8's raised to 31.75 in. Start-up Rate = .679 |
| | 0640 | 8's raised to 31.75 in. Start-up Rate = .603 |
| | 0735 | 8's raised to 31.75 in. Start-up Rate = .505 |
| 9-14-59 | 0300 | Rod bank at 40.00 in. 8's raised to 40.00 in. (cannot go critical) |
| | 0310 | Rod bank at 42.00 in. 8's raised to 42.00 in. (cannot go critical) Waiting until loop temperature and pressure stabilize |
| | 0325 | Starting on pressure coefficient |
| | 0907 | All rods at 45.75 in. S.U.R. = .900 |
| | 0915 | All rods at 46.25 in. Power level too high |
| | 0925 | All rods at 46.25 in. Power level too high |
| | 0933 | All rods at 46.25 in. S.U.R. = 1.50 |
| | 0950 | All rods at 46.25 in. S.U.R. = 1.30 |
| | 1010 | All rods at 46.25 in. S.U.R. = .96 |
| | 1032 | All rods at 46.25 in. S.U.R. = .60 |
| | 1118 | All rods at 46.25 in. S.U.R. = .36 |
| | 1130 | All rods at 47.25 in. S.U.R. = .90 |
| | 1150 | All rods at 47.25 in. S.U.R. = .68 |
| | 1217 | All rods at 47.25 in. S.U.R. = .43 |
| | 1300 | All rods at 47.25 in. S.U.R. = .14 |
| | 1311 | All rods at 48.75 in. S.U.R. = 1.00 |
| | 1335 | All rods at 48.75 in. S.U.R. = .70 |
| | 1411 | All rods at 48.75 in. S.U.R. = .33 |
| | 1430 | All rods at 48.75 in. S.U.R. = .106 |

DUQUESNE LIGHT COMPANY
POWER STATIONS DEPARTMENT
SHIPPINGPORT ATOMIC POWER STATION

DETERMINATION OF COEFFICIENTS OF REACTIVITY
DLCS 1510108
T-550132

Results Prepared By Richard M. Euscherowski

Results Reviewed By J. H. Shank Jr.

Approved (Duquesne Light Company) [Signature] Date 10-17-60

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