ATTACHMENT 1

POWER AUTHORITY OF THE STATE OF NEW YORK

INDIAN POINT 3 NUCLEAR POWER PLANT
DOCKET NO. 50-286

APPLICATION FOR A FULL POWER LICENSE

LOSS OF COOLANT ACCIDENT
EMERGENCY CORE COOLING SYSTEM ANALYSIS

April 13, 1978

8111180537 780413
PDR ADOCK 05000286
P PDR

DISCUSSION

An analysis has been performed to evaluate the effects of a modification to the Westinghouse ECCS Evaluation Model [1,2], October, 1975 Version. The modification was made to the LOCTA-IV [3] computer code and corrects the calculation of the volumetric heat generation from the Zirconium-water reaction. This volumetric heat generation had been underestimated in the previous calculations. The correction consists of multiplying the volumetric heat generation due to the Zirconium-water reaction at the clad outer surface, and inner surface at the burst elevation, by a factor of 2.0. This correction has been previously discussed with the NRC staff on March 29, 1978.

The case analyzed was the limiting break in the Indian Point Unit 3 October, 1975 Model analysis performed with the upper head at hot fluid conditions. This worst condition was the double ended cold leg guillotine break with a discharge coefficient, $C_D = 1.0$. This calculation was repeated using the October, 1975 version of the Westinghouse ECCS Evaluation Model with the modification as discussed above included, and is believed to be in compliance with Appendix K of 10CFR Part 50. No other modifications to the model were incorporated into this calculation, except for a reduction in total peaking factor to meet the Acceptance Criteria as presented in 10CFR50.46.

RESULTS

Table 1 presents the time sequence of events for this analysis. Table 2 presents the peak clad temperature, Zirconium-water reaction, and burst information for the hot rod. Figures 1 and 2 show the fluid quality and heat transfer coefficient transients at the peak clad temperature elevation and burst elevation. Figures 3 and 4 show the calculated core pressure and core pressure drop, respectively. Figures 5 and 6 show the clad temperature and fluid temperature transients at the peak clad temperature elevation and the burst elevation. Figure 7 shows the core flow rate, and Figure 8 shows the flooding rate transient.

The clad temperature analysis was based on a total peaking factor (F_Q^T) of 2.17. The hot spot metal-water reaction reached is 11%, which is below the embrittlement limit of 17% as required by 10CFR50.46. In addition, the total core metal water reaction is less than 0.3% as compared with the 1% required by 10CFR50.46. The core temperature is reduced and decay heat is removed for an extended period of time as required by the long-lived radioactivity remaining in the core.

CONCLUSION

For the limiting break for the Indian Point 3 facility, the ECCS will meet the Acceptance Criterion as presented in 10CFR50.46 assuming operation at a peaking factor of 2.17.

REFERENCES

1. Westinghouse ECCS Evaluation Model, October 1975 Version, WCAP-8622, November 1975 (Proprietary) and WCAP-8623, November 1975 (Non-Proprietary).

2. Letters from C. Eicheldinger of Westinghouse Electric Corporation to D.B. Vassallo of Nuclear Regulatory Commission, Letter Number NS-CE-924, January 23, 1976.

3. Bordelon, F.M., et al, "SATAN-VI Program Comprehensive Space-Time Dependent Analysis of Loss of Coolant Accident", WCAP-8306, June, 1974 (Proprietary), WCAP-8302, June, 1972, (Non-Proprietary).

TABLE 1

LARGE BREAK

TIME SEQUENCE OF EVENTS

	DECLG (Sec)
START	0.0
Rx Trip Signal	0.611
S. I. Signal	0.8
Acc. Injection	13.7
Pump Injection	25.8
End of Bypass	27.06
End of Blowdown	29.64
Bottom of Core Recovery	43.9
Acc. Empty	54.92

DECLG-Double Ended Cold Leg Grillotine Break

TABLE 2

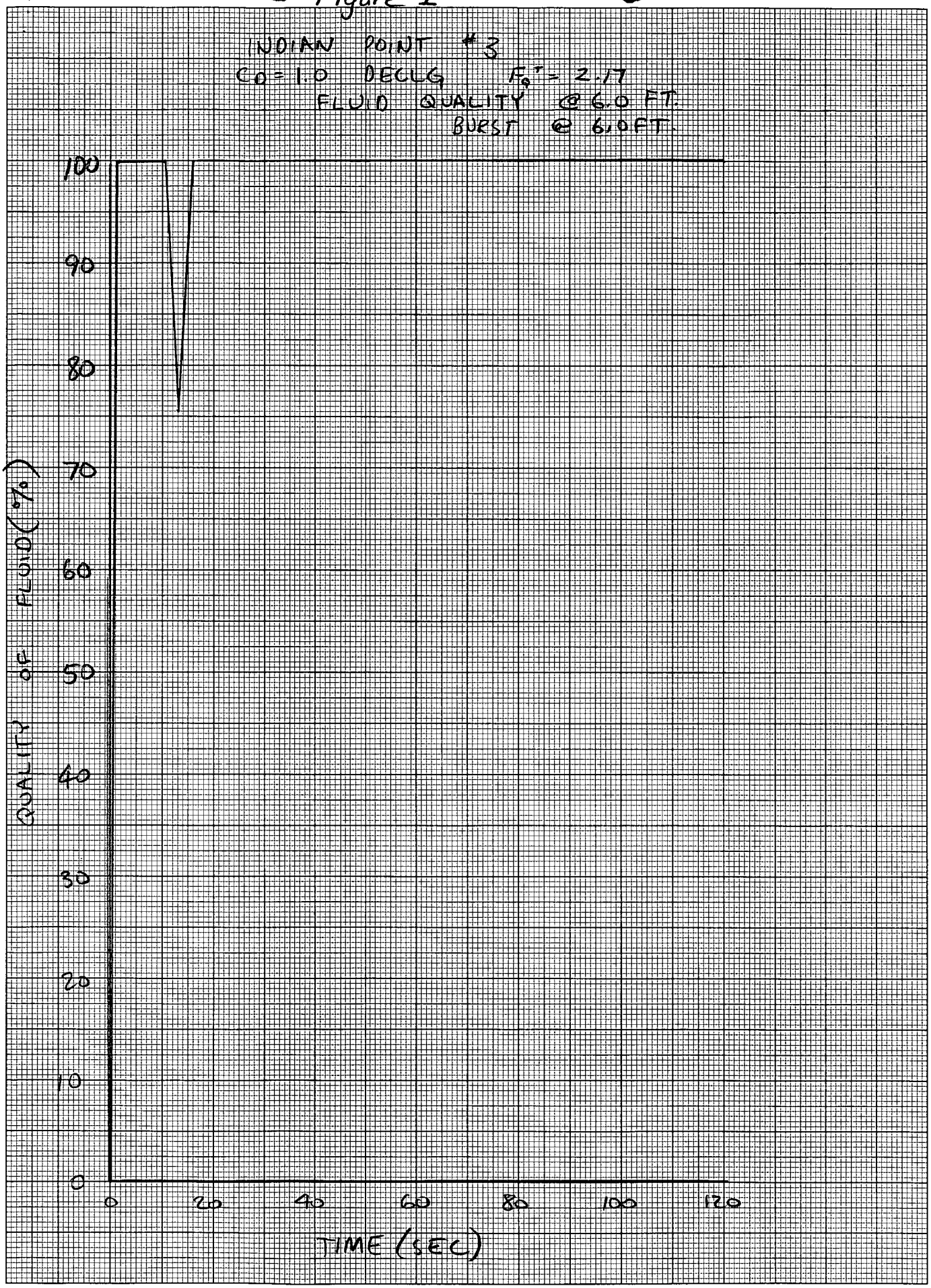
LARGE BREAK

	DECLG
Results	
Peak Clad Temp. ^{o}F	2199
Peak Clad Location Ft.	6.0
Local Zr/H_2O Rxn (max)%	11
Local Zr/H_2O Location Ft.	6.0
Total Zr/H_2O Rxn %	< 0.3
Hot Rod Burst Time sec	31.
Hot Rod Burst Location Ft.	6.0

Calculation	
NSSS Power Mwt 102% of	3025
Peak Linear Power kw/ft 102% of	13.55
Peaking Factor (At license Rating)	2.17
Accumulator Water Volume	800 ft^3

Fuel region + cycle anlayzed	Cycle	Region
	2	ALL

Figure 1



461510
K&E 10 X 10 TO THE CENTIMETER 18 X 25 CM.
KEUFFEL & ESSER CO. MADE IN U.S.A.

Figure 2

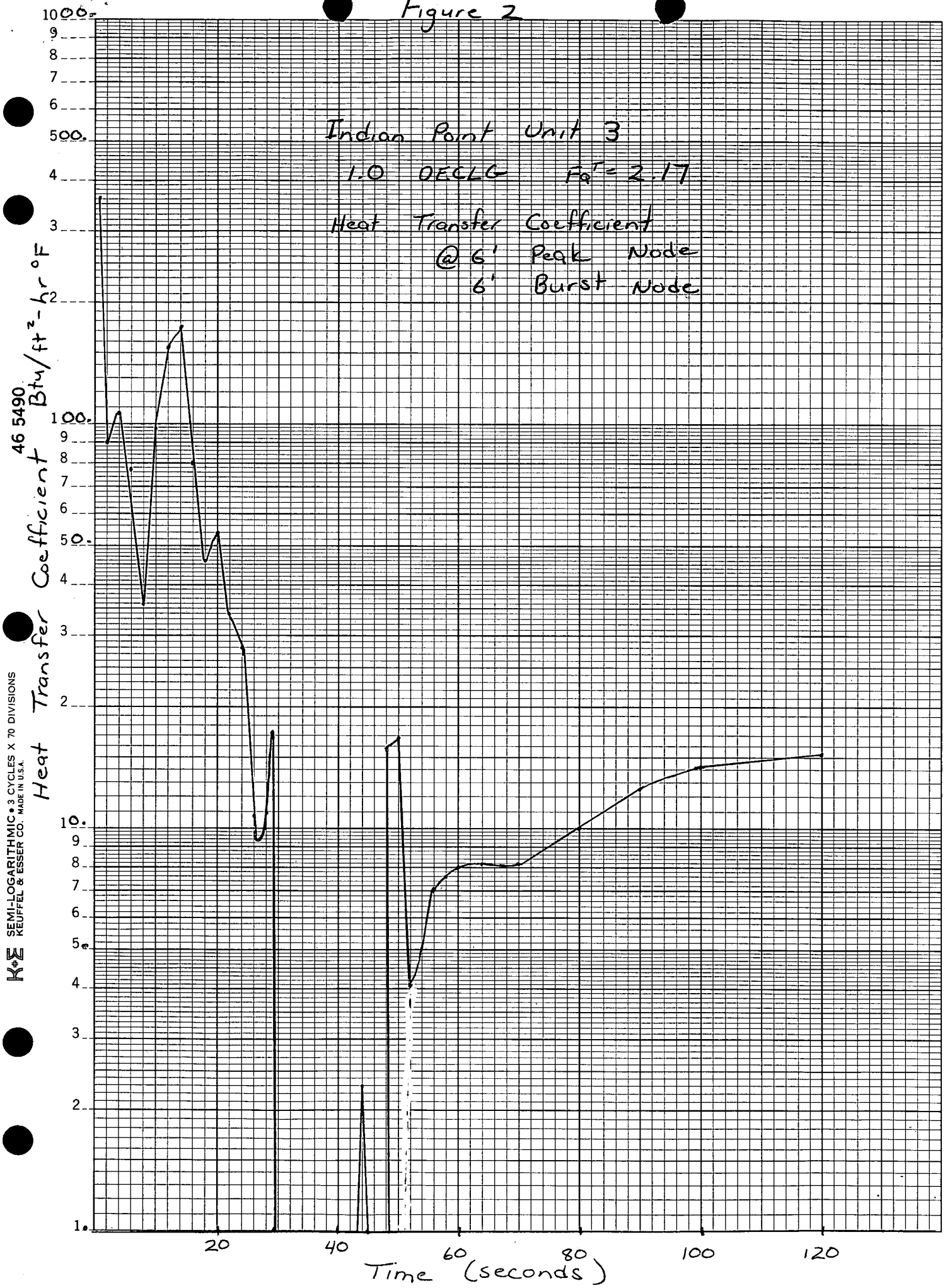

Indian Point Unit 3
1.0 DECLG $F_Q^T = 2.17$
Heat Transfer Coefficient
@ 6' Peak Node
6' Burst Node
Heat Transfer Coefficient Btu/ft²-hr °F
Time (seconds)
1000.
500.
100.
50.
10.
1.
20
40
60
80
100
120
46 5490
K&E SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

Figure 3

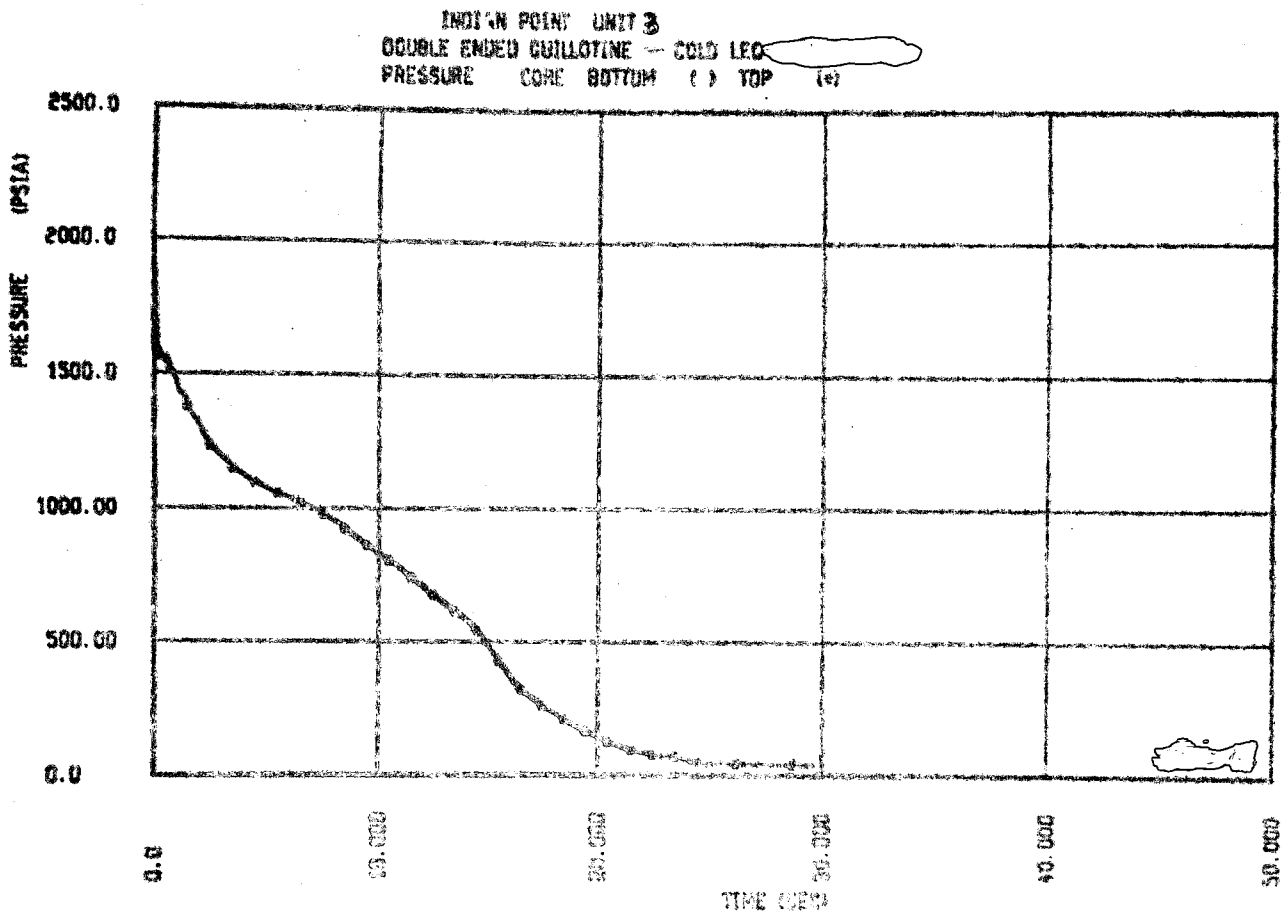

INDIAN POINT UNIT 3
DOUBLE ENDED GUILLOTINE — COLD LEG
PRESSURE CORE BOTTOM ( ) TOP (e)
PRESSURE (PSIA)
2500.0
2000.0
1500.0
1000.00
500.00
0.0
0.0
10.000
20.000
30.000
40.000
50.000
TIME (SEC)

Figure 4

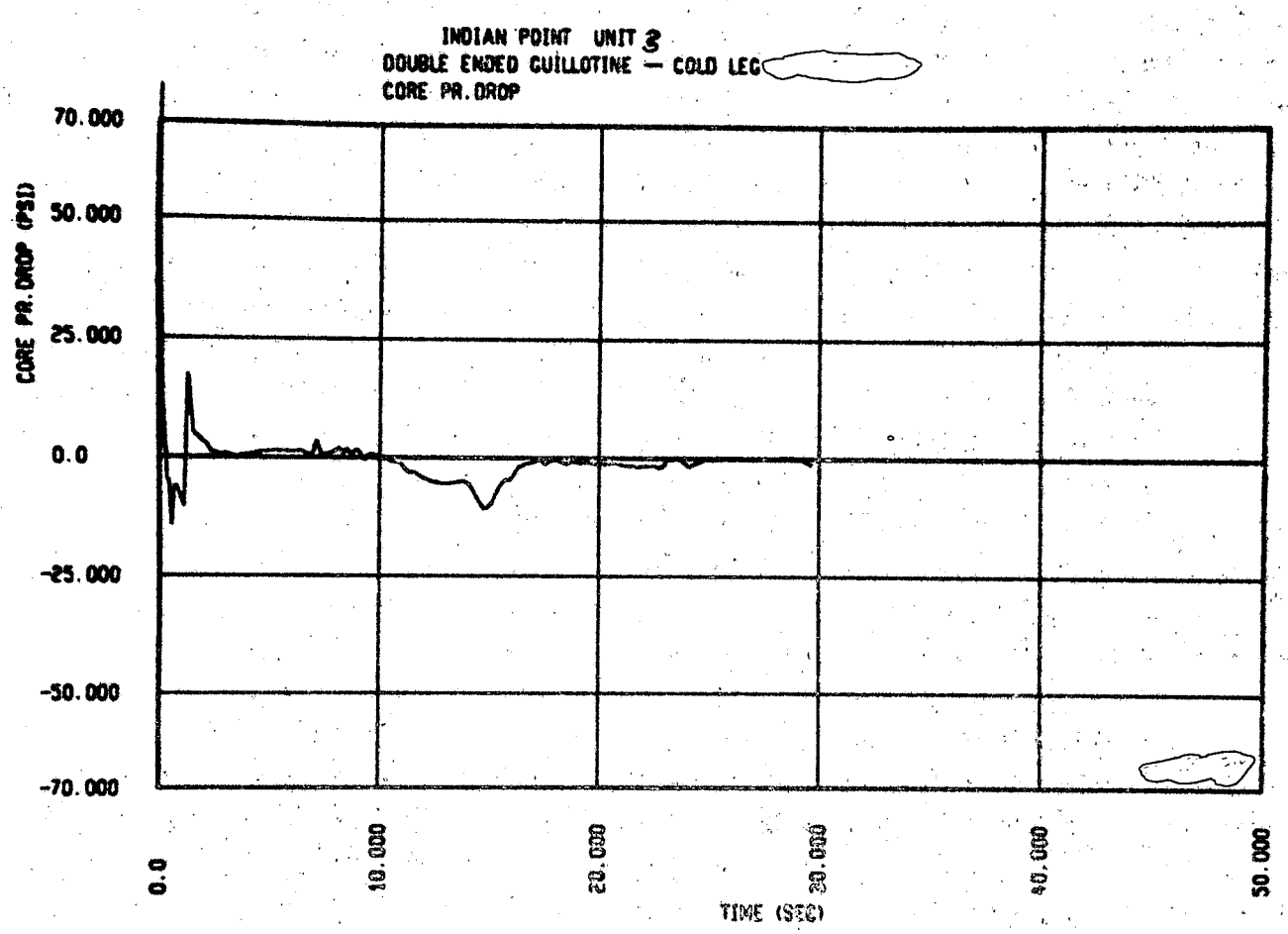
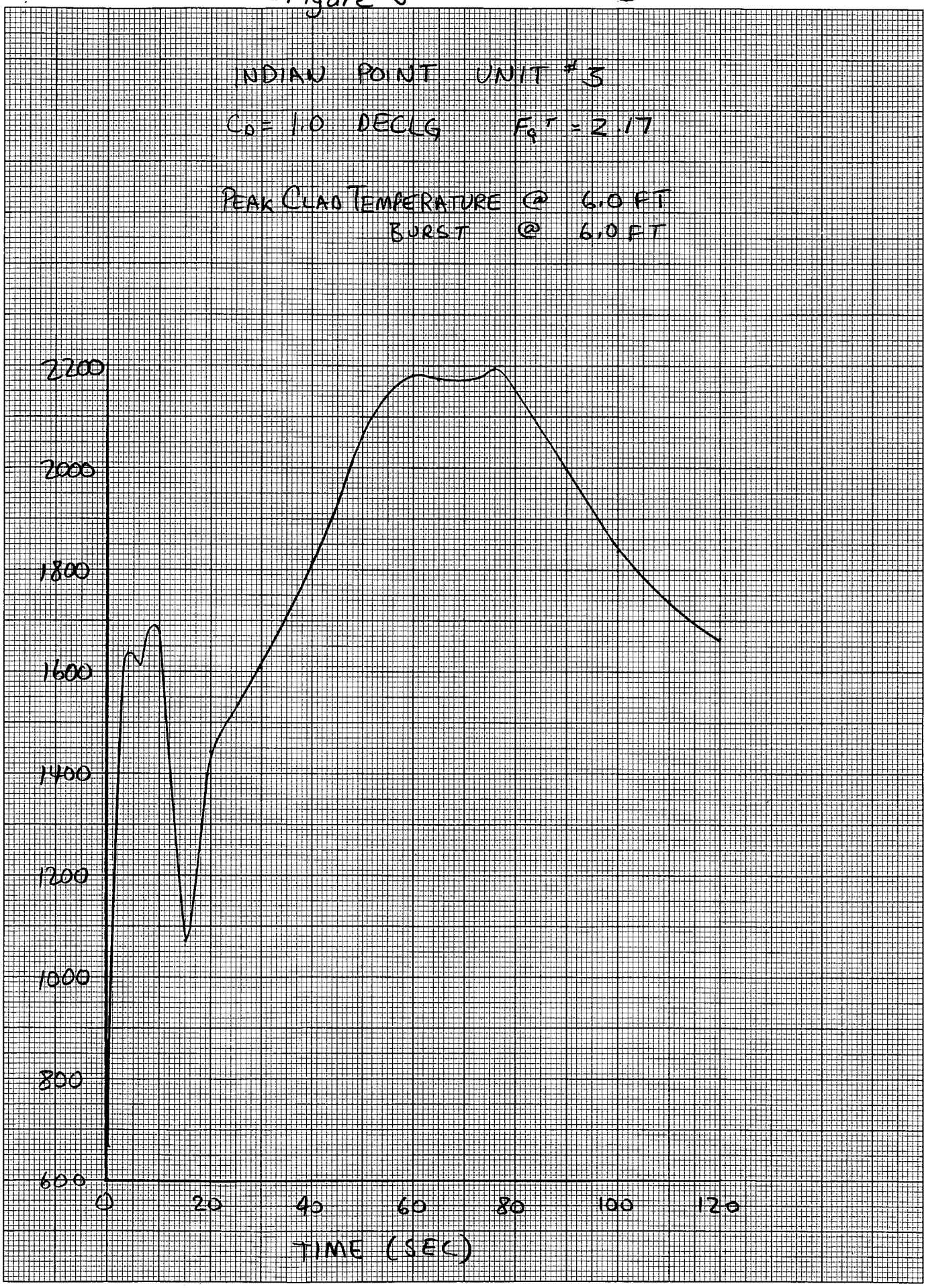

INDIAN POINT UNIT 3
DOUBLE ENDED GUILLOTINE — COLD LEG
CORE PR. DROP
CORE PR. DROP (PSI)
70.000
50.000
25.000
0.0
-25.000
-50.000
-70.000
0.0
10.000
20.000
30.000
40.000
50.000
TIME (SEC)

Figure 5



461510
K+E 10 X 10 TO THE CENTIMETER 18 X 25 CM.
KEUFFEL & ESSER CO. MADE IN U.S.A.

Indian Point Unit 3 $C_D = 1.0$ DECLG $F_Q^T = 2.17$

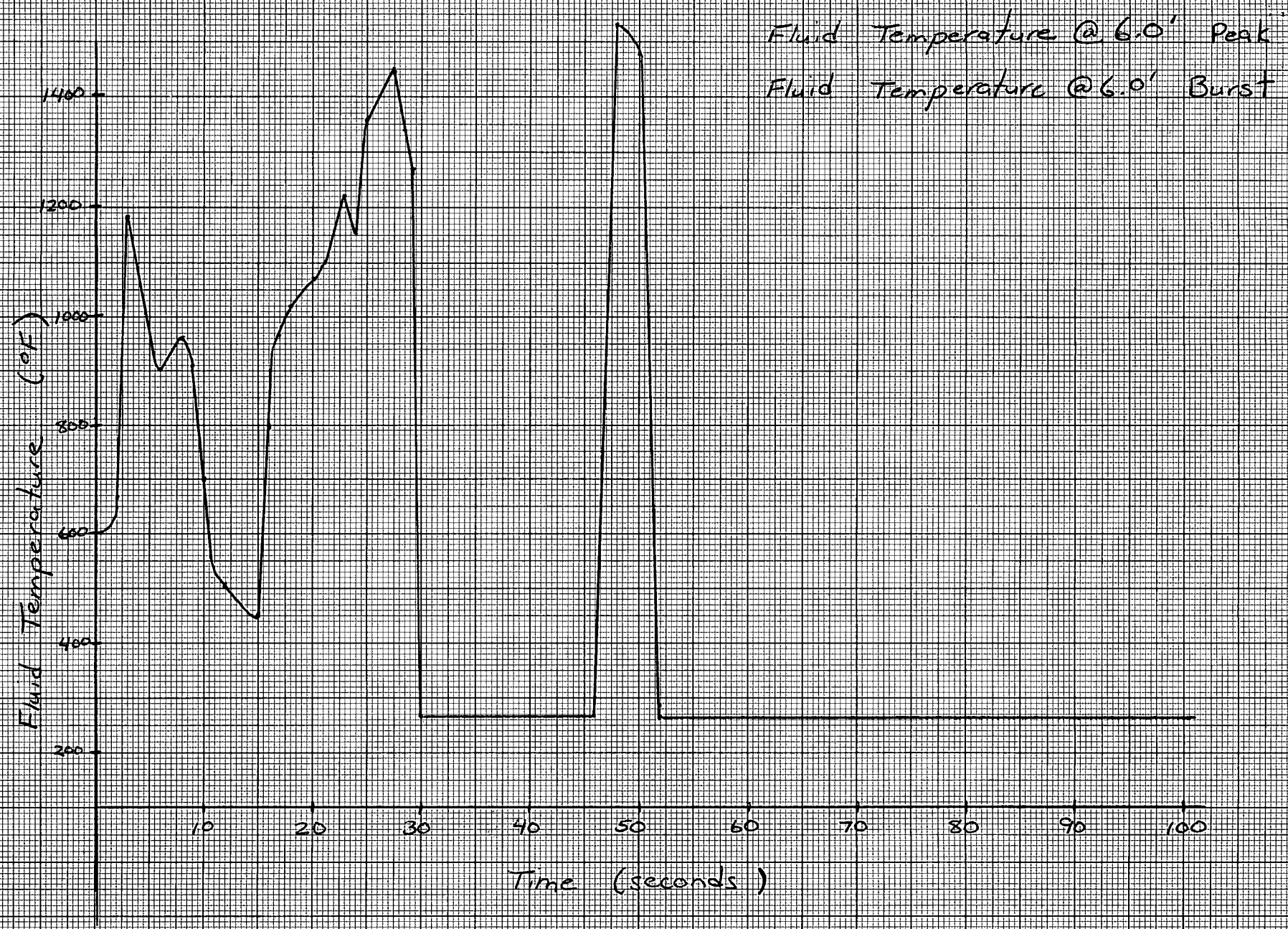


Figure 6

K+E 10 X 10 TO THE CENTIMETER 18 X 25 CM. KEUFFEL & ESSER CO. MADE IN U.S.A.
46 1510

Figure 7

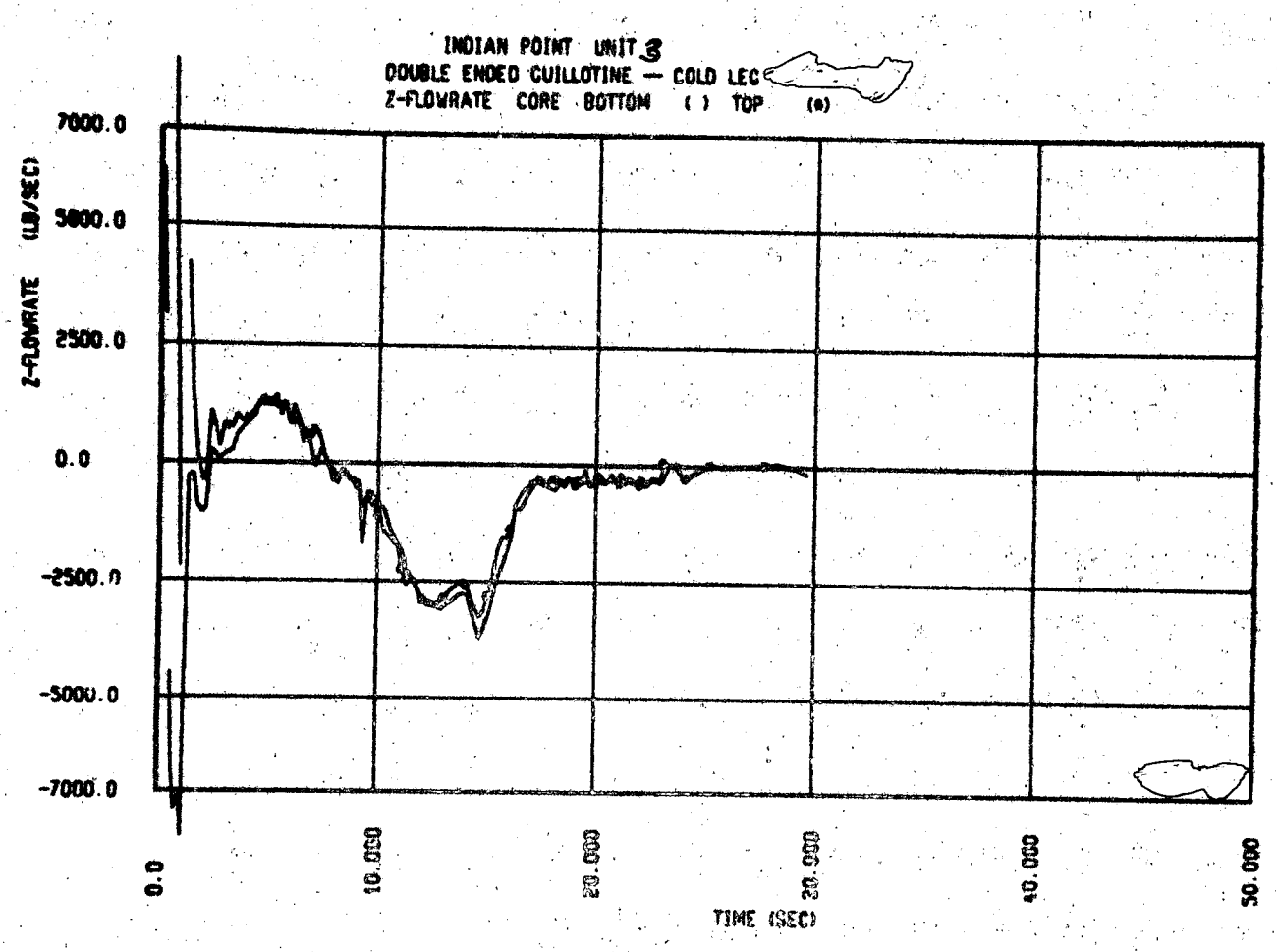
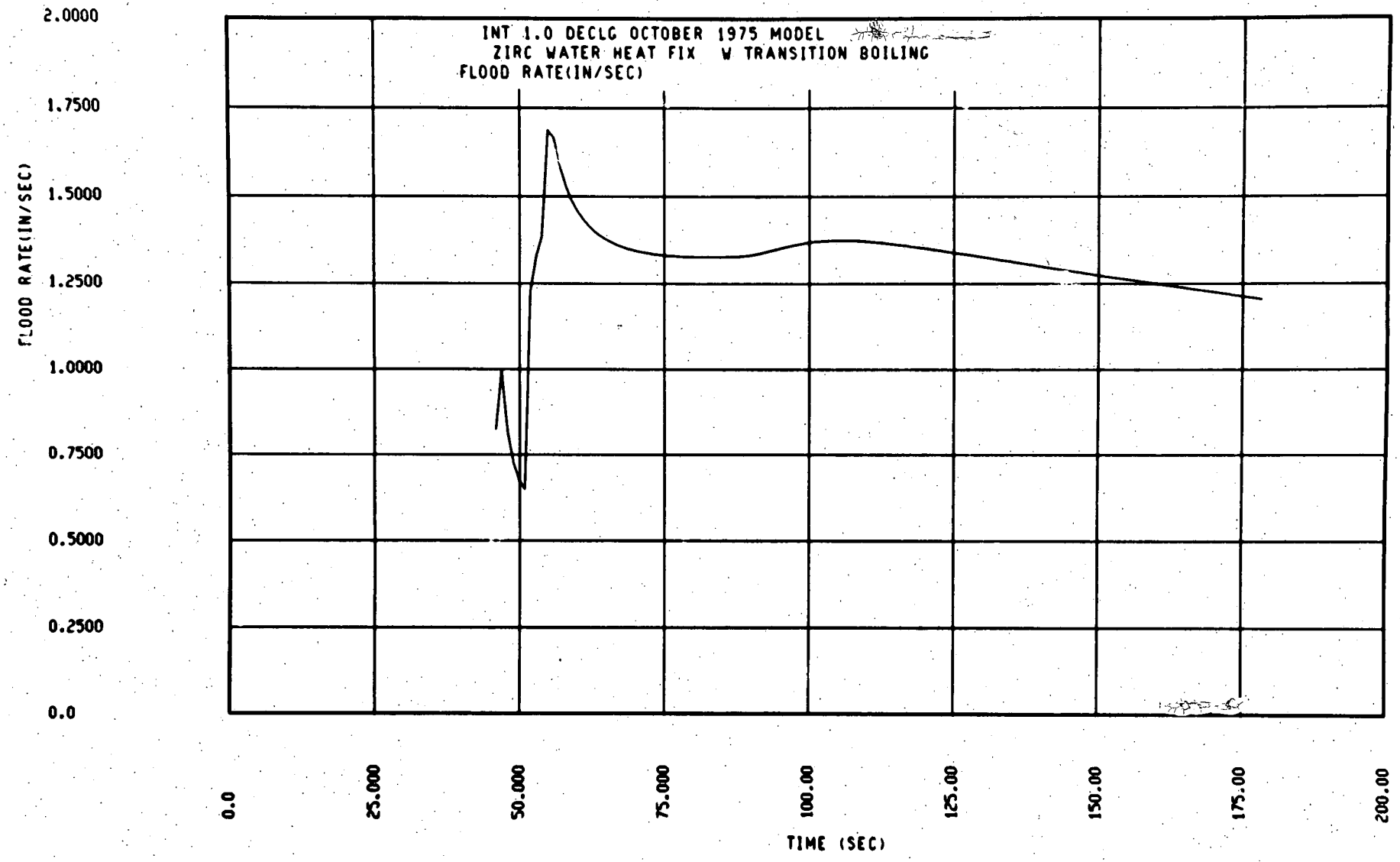

INDIAN POINT UNIT 3
DOUBLE ENDED GUILLOTINE — COLD LEG
Z-FLOWRATE CORE BOTTOM ( ) TOP (o)
Z-FLOWRATE (LB/SEC)
7000.0
5000.0
2500.0
0.0
-2500.0
-5000.0
-7000.0
0.0
10.000
20.000
30.000
40.000
50.000
TIME (SEC)

Figure 8


INT 1.0 DECLG OCTOBER 1975 MODEL
ZIRC WATER HEAT FIX W TRANSITION BOILING
FLOOD RATE(IN/SEC)
FLOOD RATE(IN/SEC)
2.0000
1.7500
1.5000
1.2500
1.0000
0.7500
0.5000
0.2500
0.0
0.0
25.000
50.000
75.000
100.00
125.00
150.00
175.00
200.00
TIME (SEC)