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November 18, 1980

50-317

Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

ATTENTION: Mr. R. A. Clark, Chief
Operating Reactors Branch #3
Division of Licensing

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 1, Docket No. 50-317
Amendment to Operating License DPR-53
Fifth Cycle License Application
Responses to NRC Staff Questions

Gentlemen:

Enclosed are our reponses to questions posed by NRC staff on the subject application.

Very truly yours,

BALTIMORE GAS AND ELECTRIC COMPANY

A. E. Lundvall, Jr.
Vice President - Supply

AEL/WJL/mit

Copy To: J. A. Biddison, Esquire (w/out Encl.)
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Messrs. E. L. Conner, Jr., NRC
P. W. Kruse, CE

Enclosure (40 copies)

P

ENCLOSURE

QUESTION 1X

Provide comparative Steam Line Break analyses between CESEC-SLB and old version of CESEC. The comparison should include the following cases:

a. CESEC-SLB with pumps off
b. CESEC-SLB with pumps on
c. old CESEC version with pumps off
d. old CESEC version with pumps on.

Also, provide the minimum DNBR for these cases and the conditions used to calculate the DNBR.

RESPONSE

Figures 1X-1 to 1X-5 present the NSSS response during a SLB event with RCP's off using the version of CESEC named CESEC-SLB.

Figures 1X-6 to 1X-10 present the NSSS response during a SLB event with RCP's on using the version of CESEC named CESEC-SLB.

Figures 1X-11 to 1X-15 present the NSSS response during a SLB event with RCP's off using the old version of CESEC named CESEC-Cycle 7.

Figures 1X-16 to 1X-20 present the NSSS response during a SLB event with pumps on using the old version of CESEC named CESEC-Cycle 7.

Table 1X-1 presents the key input parameters for calculating DNBR and also presents the transient minimum DNBR values. The DNBR's were calculated using the MacBeth rod cluster correlation (Reference 1X-1) with Lee non-uniform heat flux correction factor (Reference 1X-2).

A few important points to note about the graphs are given below:

ENCLOSURE

1. The SLB event with RCP's off, analyzed with code version CESEC-SLB, determines the moderator reactivity feedback based on the cold edge inlet temperature. For all other SLB events presented the moderator reactivity feedback is calculated using the core average moderator temperature.

2. The SLB event with RCP's on, analyzed with code version CESEC-SLB determines the moderator reactivity feedback based on the average moderator temperature. The use of cold edge temperatures will only result in an additional .3% $\Delta\rho$ and has no significant impact on the DNBR results presented.

3. The SLB event with RCP's on analyzed with code versions CESEC-SLB and CESEC-Cycle 7, show that the core remains subcritical by at least 1.6% $\Delta\rho$, even though the magnitude of subcriticality varies between the two code versions used.

4. The limiting SLB event is with the RCP's off analyzed using the code version CESEC-SLB. This event is presented in the Calvert Cliffs Unit 1, Cycle 5 license submittal (Reference 1X-3).

5. The minimum DNBR for the limiting SLB event is greater than 1.6.

Table 1X-1

MINIMUM DNBR DURING SLB EVENT
FOR CALVERT CLIFFS UNIT 1, CYCLE 5

	Code Version CESEC-SLB		Code Version CESEC-Cycle 7	
	w/o RCPs	with RCPs	w/o RCPs	with RCPs
Time of Maximum Post-Trip Reactivity (seconds)	121	68	168	54
Core Average Fission Power (BTU/hr-ft^2)	8550	3180	52	3510
Core Average Decay Power (BTU/hr-ft^2)	6690	8010	6290	8760
3-D Fission Power Peak	45	45	45	45
3-D Decay Power Peak	2.2	2.2	2.2	2.2
Axial Power Distribution	Fig. 1X-21	Fig. 1X-21	Fig. 1X-21	Fig. 1X-21
Core Average Mass Flow (lbm/hr-ft^2)	2.12×10^5	2.51×10^6	1.46×10^5	2.87×10^6
Minimum DNBR	1.6	>10	>10	>10

FIGURE IV-1

CESEC - SLB
Pumps OFF
REACTIVITY VS TIME

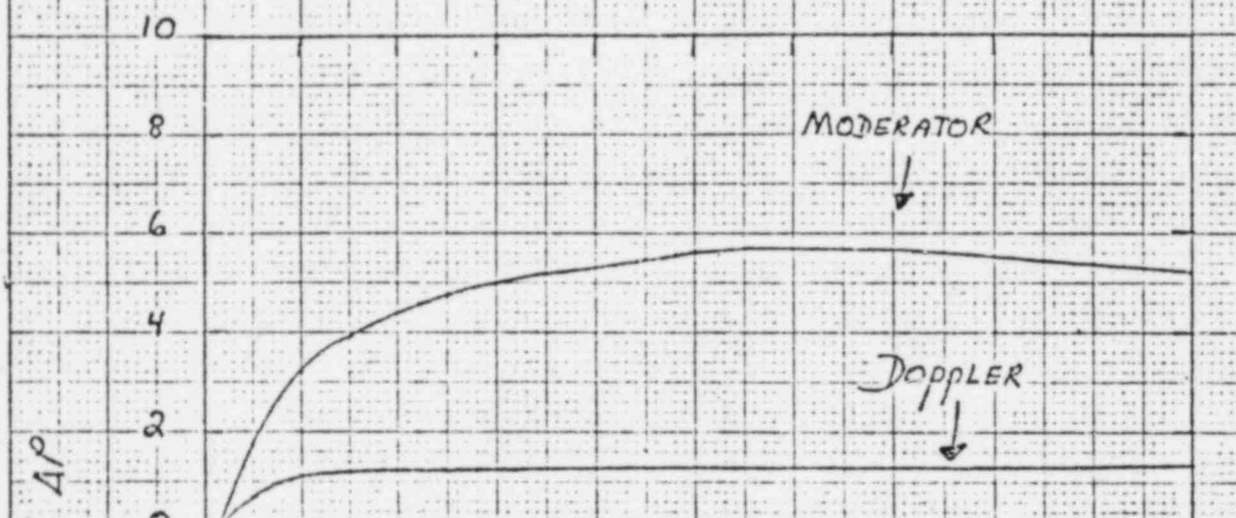
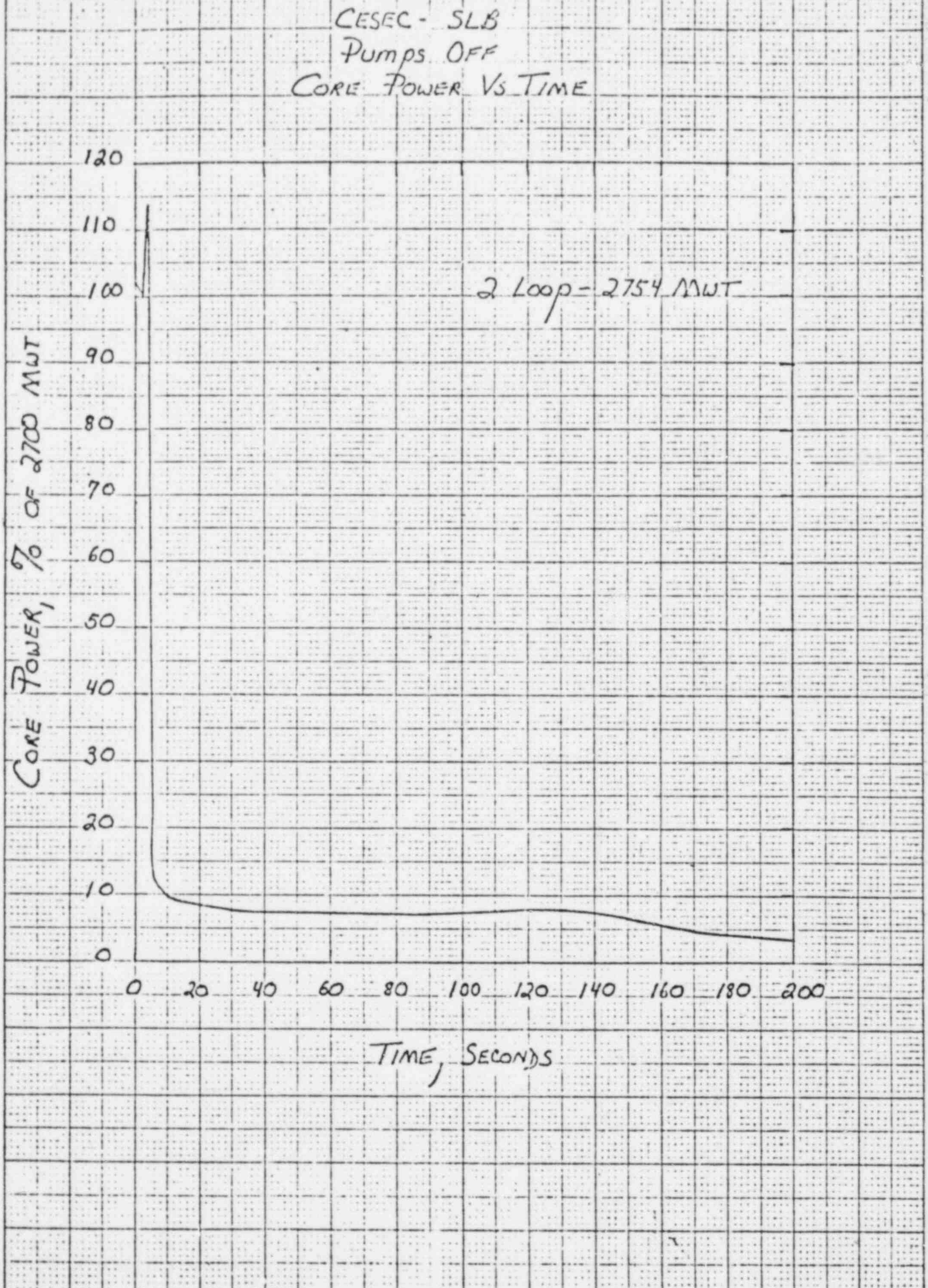


FIGURE IX-2


CESEC - SLB
Pumps OFF
CORE POWER VS TIME
2 Loop - 2754 MWT
CORE POWER, % OF 2700 MWT
120
110
100
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
180
200
TIME, SECONDS

46 1320

CESEC - SLB
PUMPS OFF
CORE HEAT FLUX VS TIME

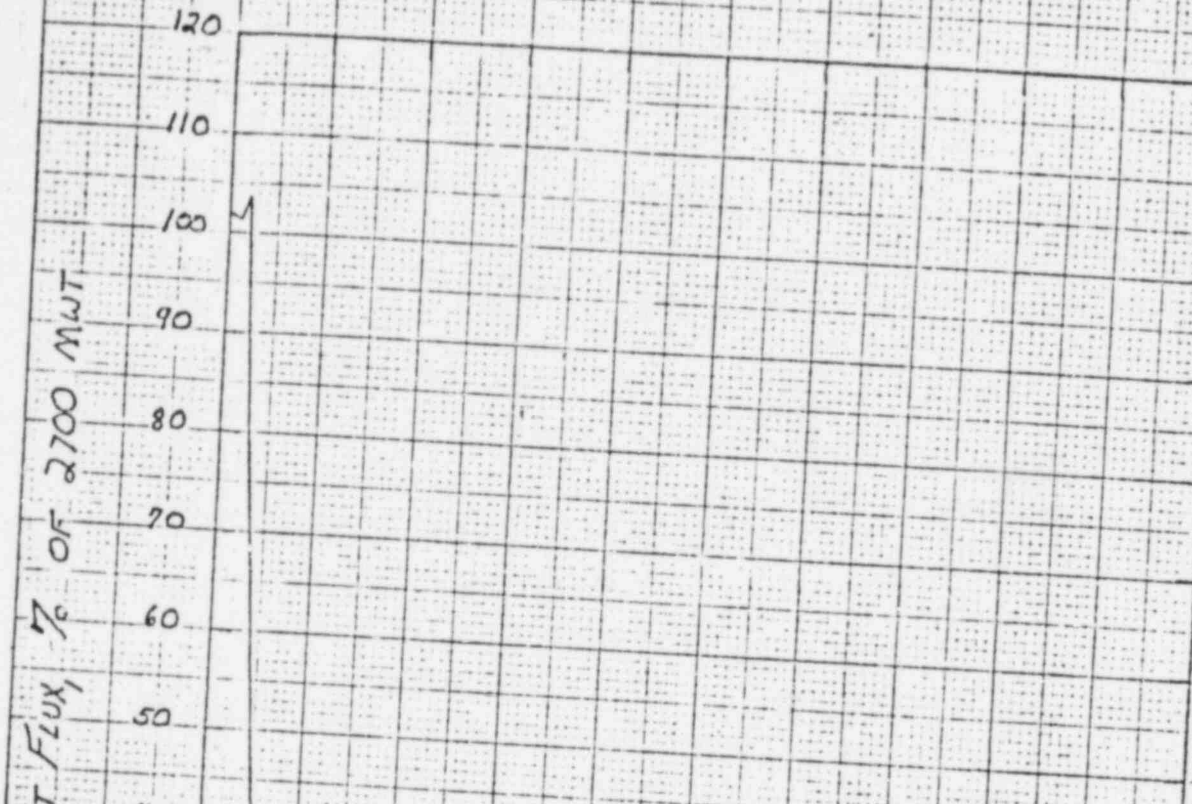


FIGURE IX-4

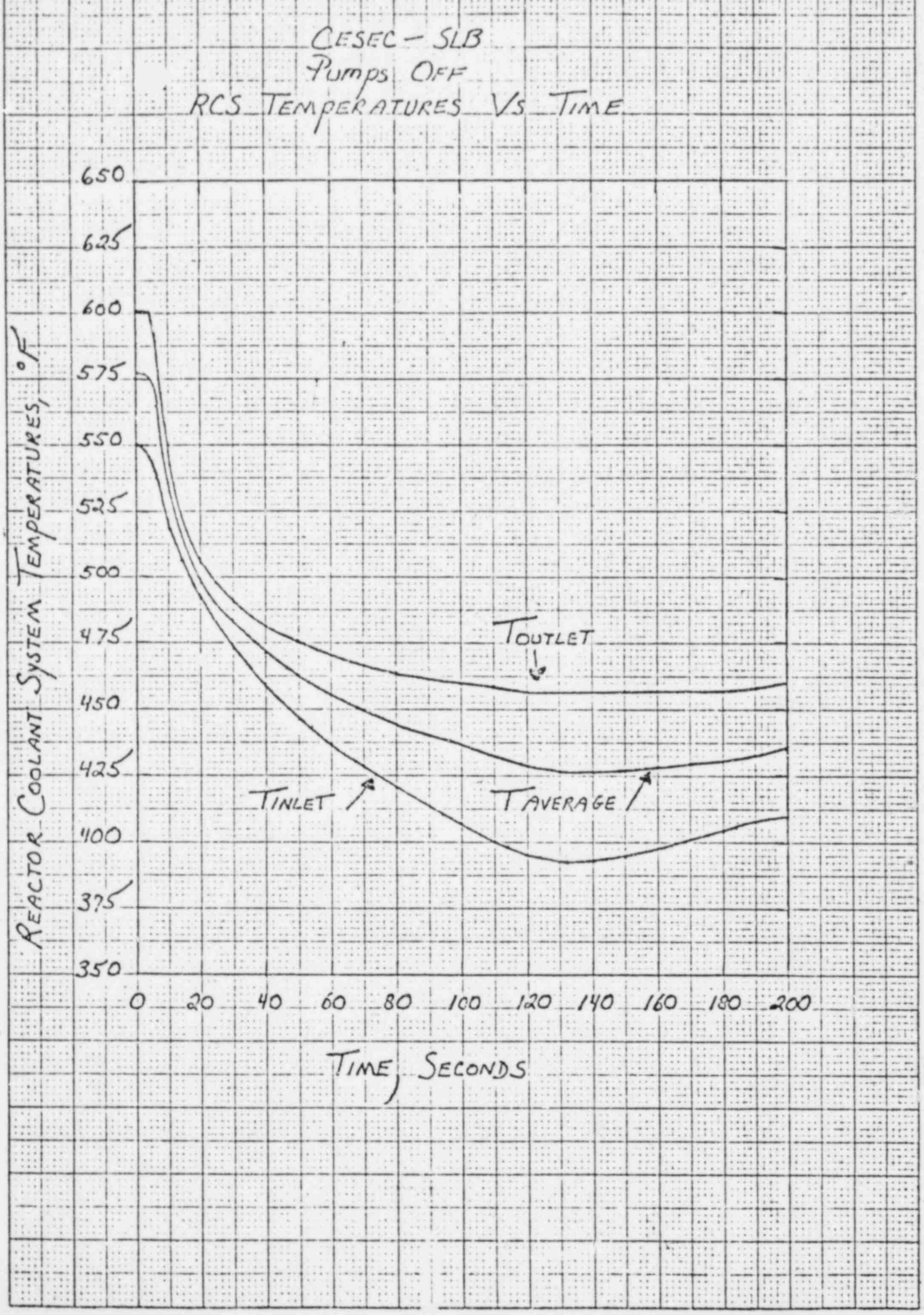

CESEC – SLB
Pumps OFF
RCS TEMPERATURES VS TIME
REACTOR COOLANT SYSTEM TEMPERATURES, °F
650
625
600
575
550
525
500
475
450
425
400
375
350
0
20
40
60
80
100
120
140
160
180
200
TIME, SECONDS
TOUTLET
TAVERAGE
TINLET

FIGURE IX-5

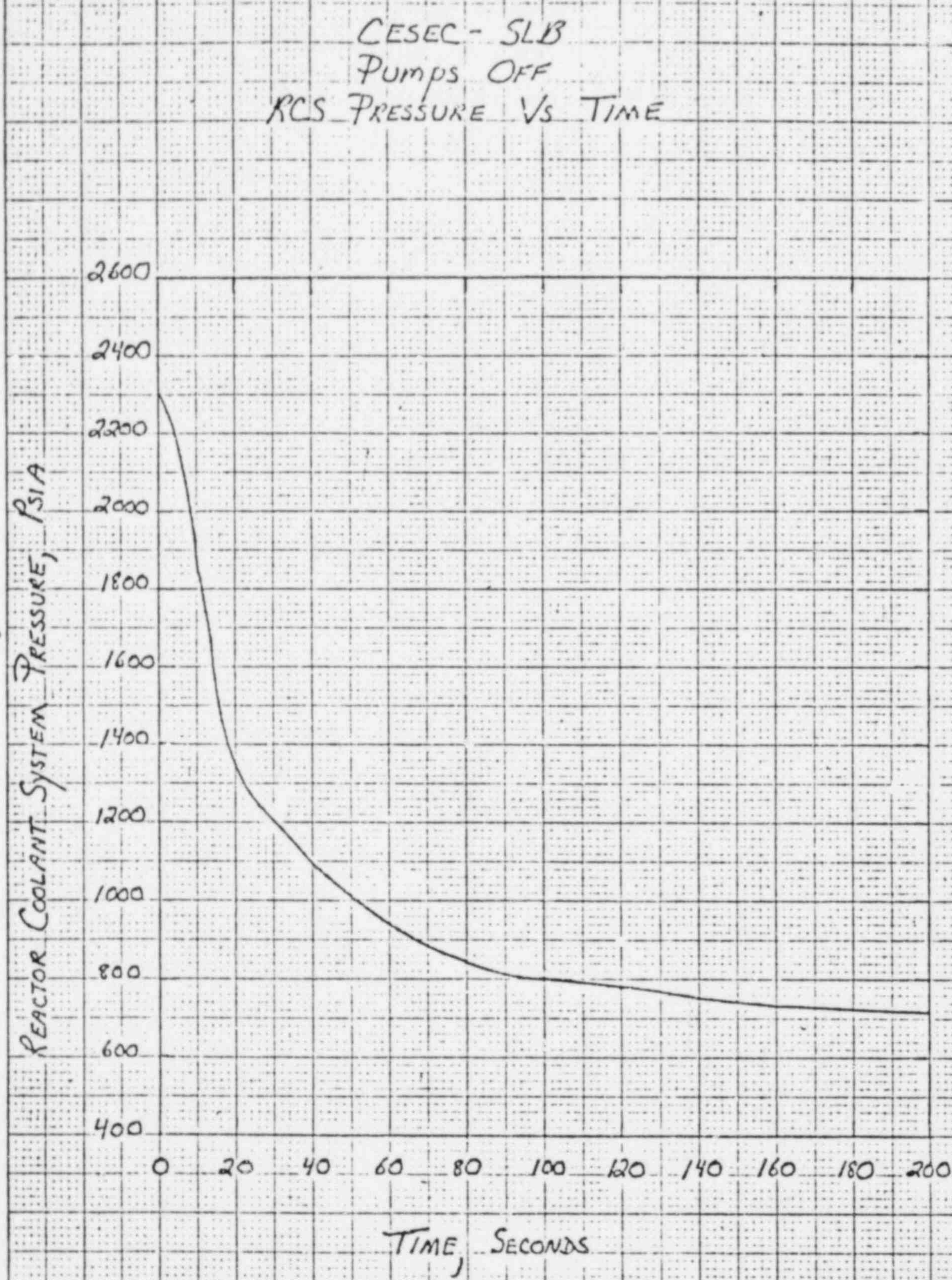

CESEC - SLB
Pumps Off
RCS Pressure Vs Time
Reactor Coolant System Pressure, PSIA
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
0
20
40
60
80
100
120
140
160
180
200
Time, Seconds

FIGURE IX-6

CESEC - SLB
Pumps ON
REACTIVITY Vs TIME

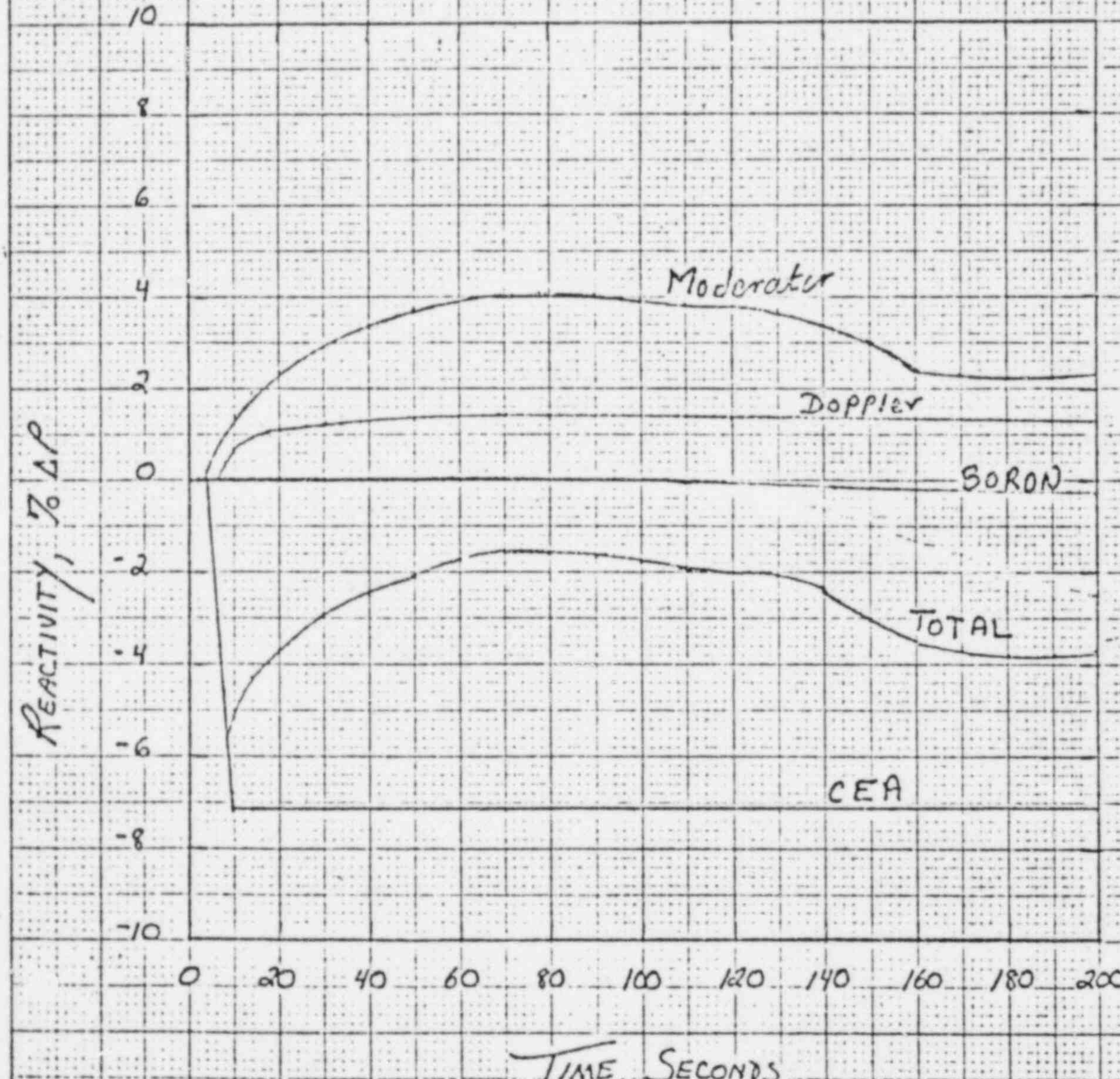


FIGURE IX-7

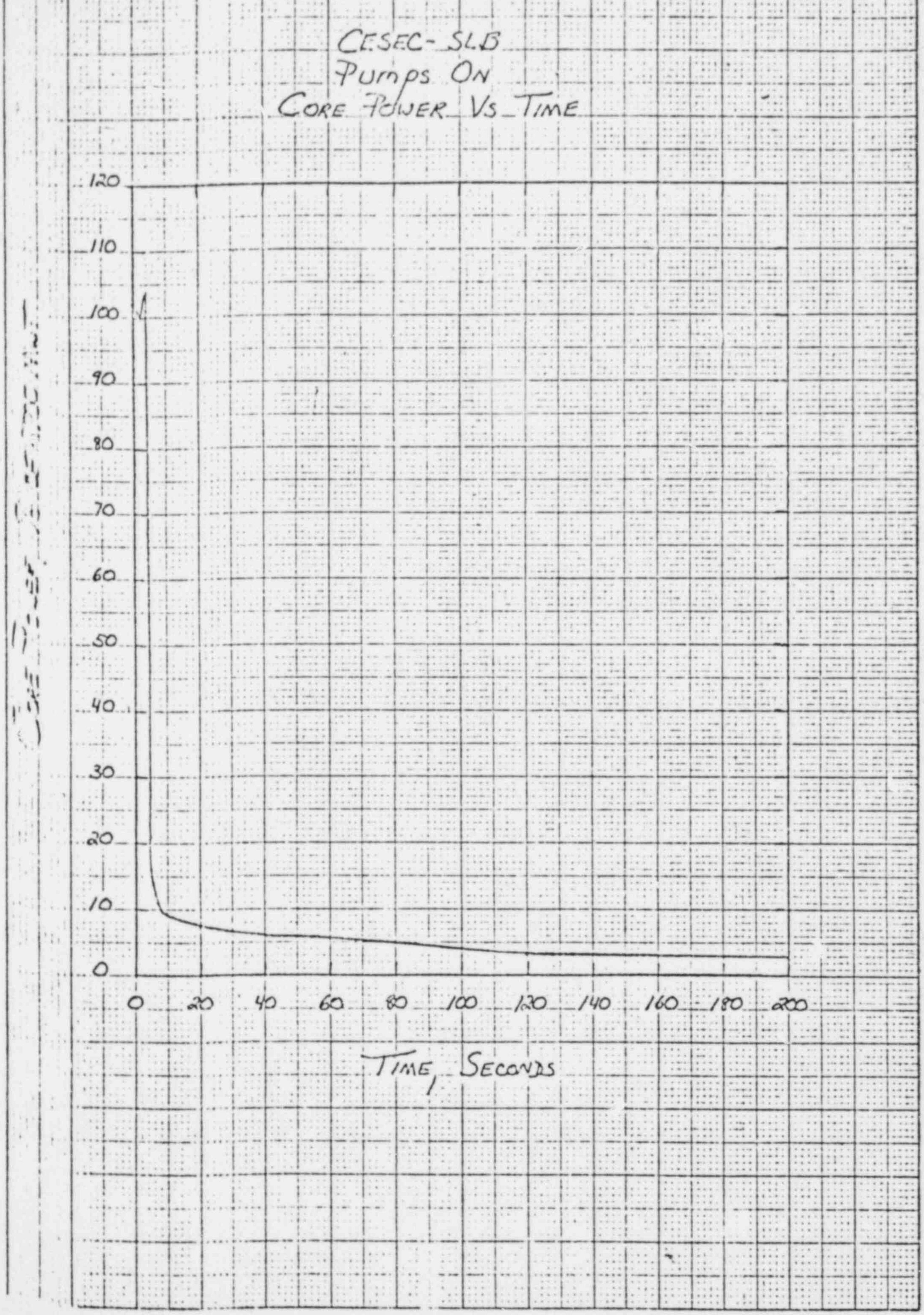

CESEC-SLB
Pumps On
Core Power Vs Time
120
110
100
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
180
200
Time, Seconds

FIGURE IX-8

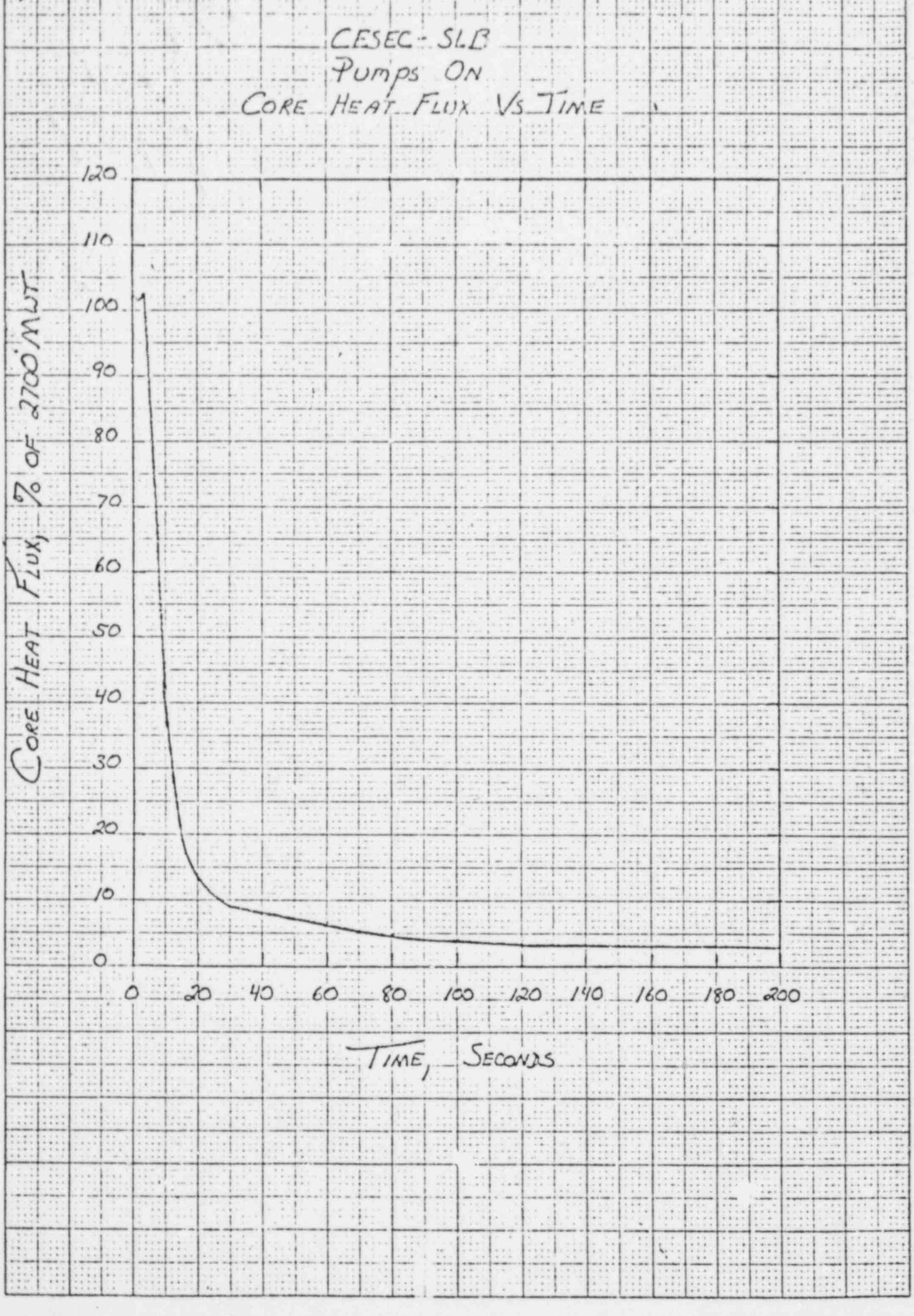

CESEC - SLB
Pumps On
Core Heat Flux Vs Time
Core Heat Flux, % of 2700 MWt
120
110
100
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
180
200
Time, Seconds

FIGURE IX-9

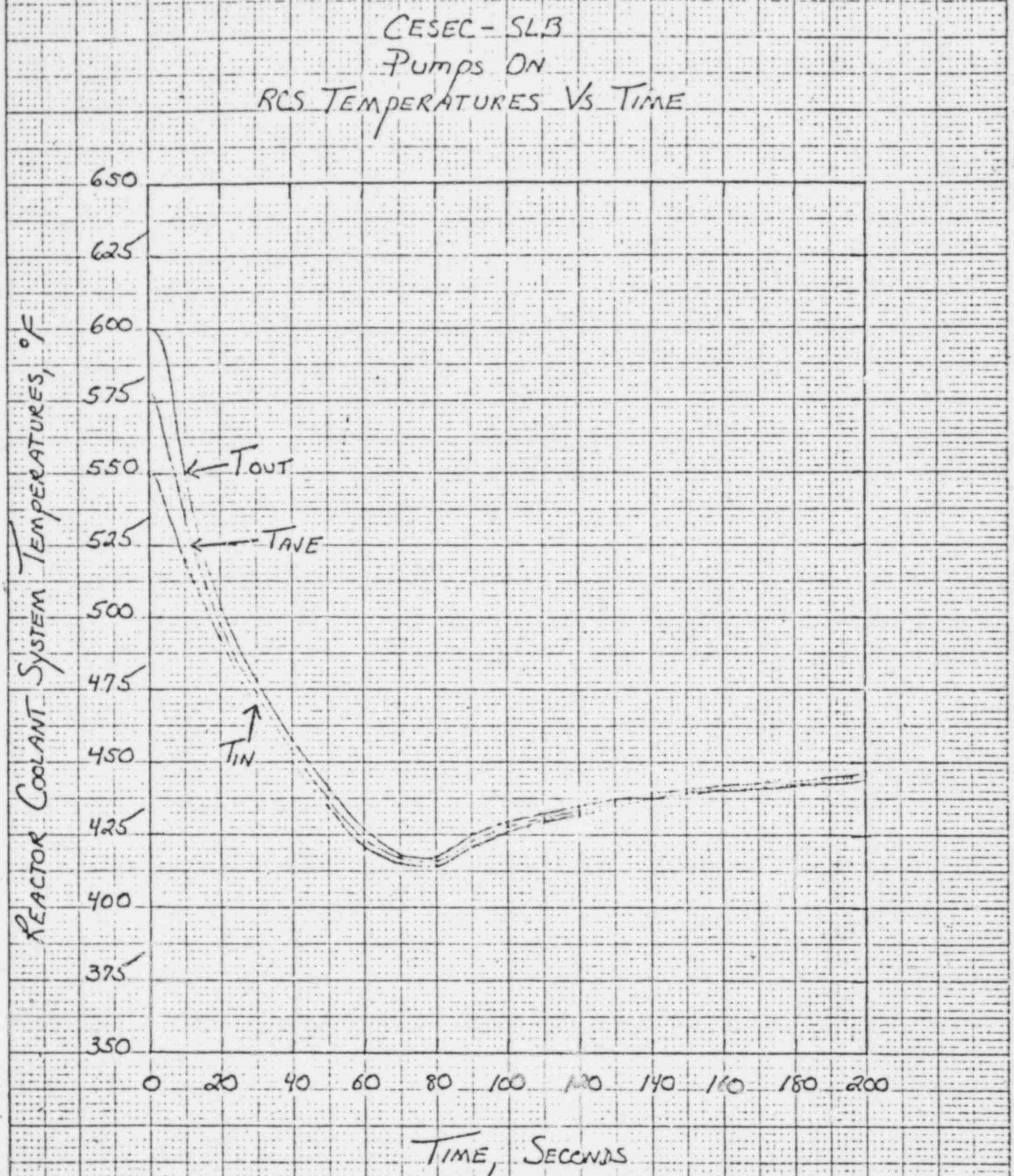

CESEC - SLB
Pumps ON
RCS TEMPERATURES Vs TIME
650
625
600
575
550
525
500
475
450
425
400
375
350
TOUT
TAVE
TIN
REACTOR COOLANT SYSTEM TEMPERATURES, °F
0
20
40
60
80
100
120
140
160
180
200
TIME, SECONDS

FIGURE IX-10

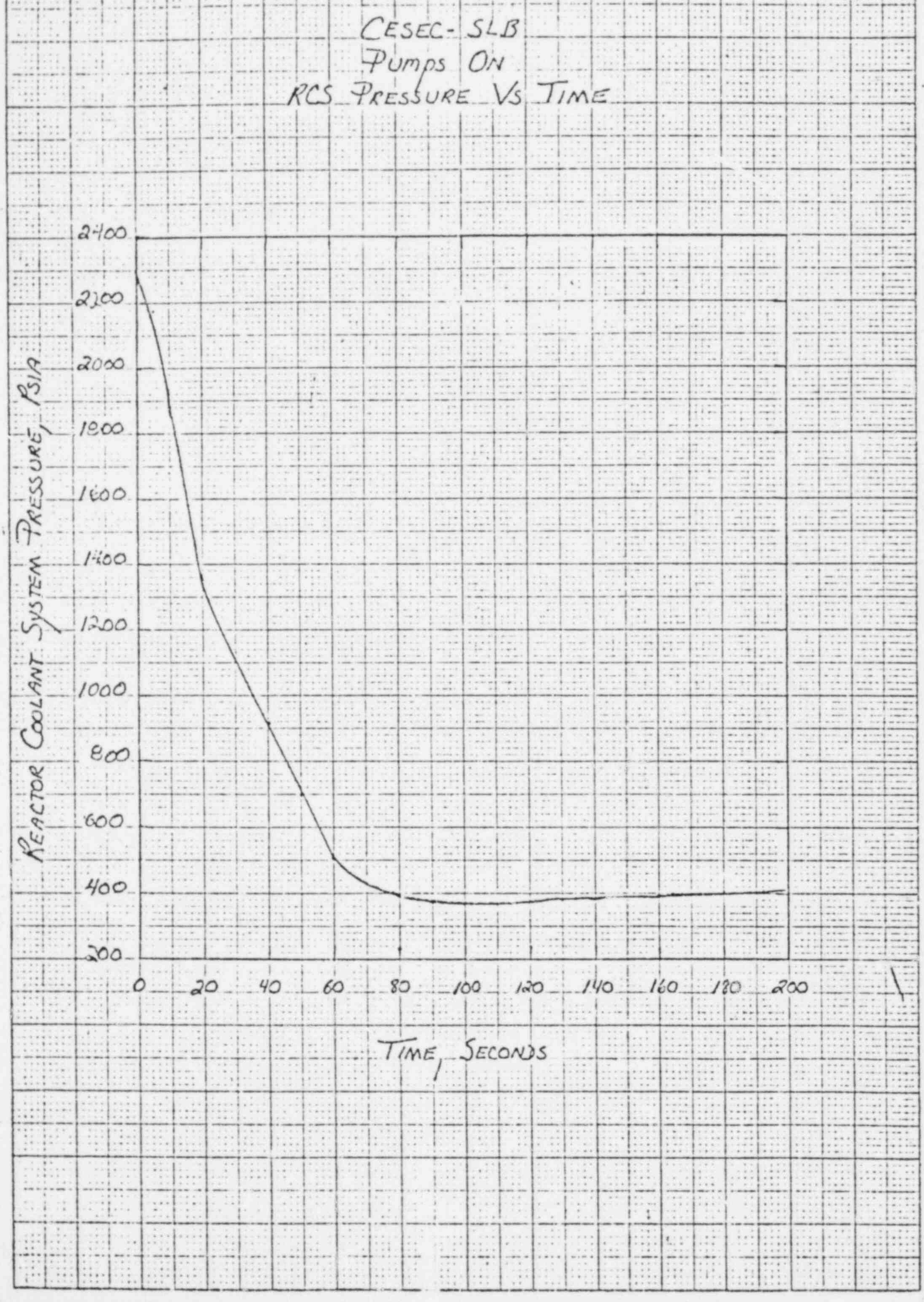

CESEC-SLB
Pumps On
RCS Pressure Vs Time
Reactor Coolant System Pressure, PSIA
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
20
40
60
80
100
120
140
160
180
200
Time, Seconds

FIGURE IX-11

CESEC Cy 7
Pumps OFF
REACTIVITY VS TIME

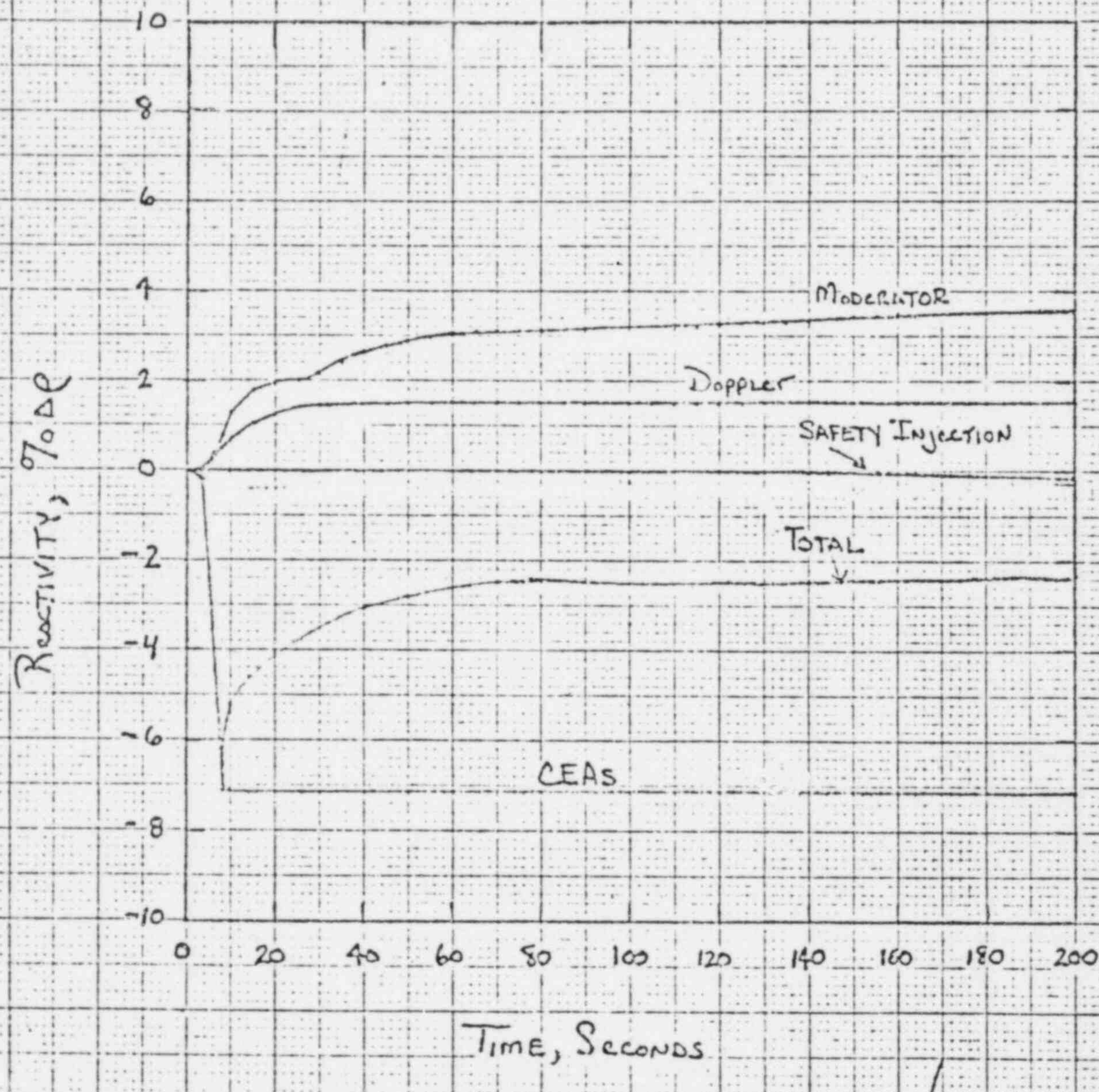
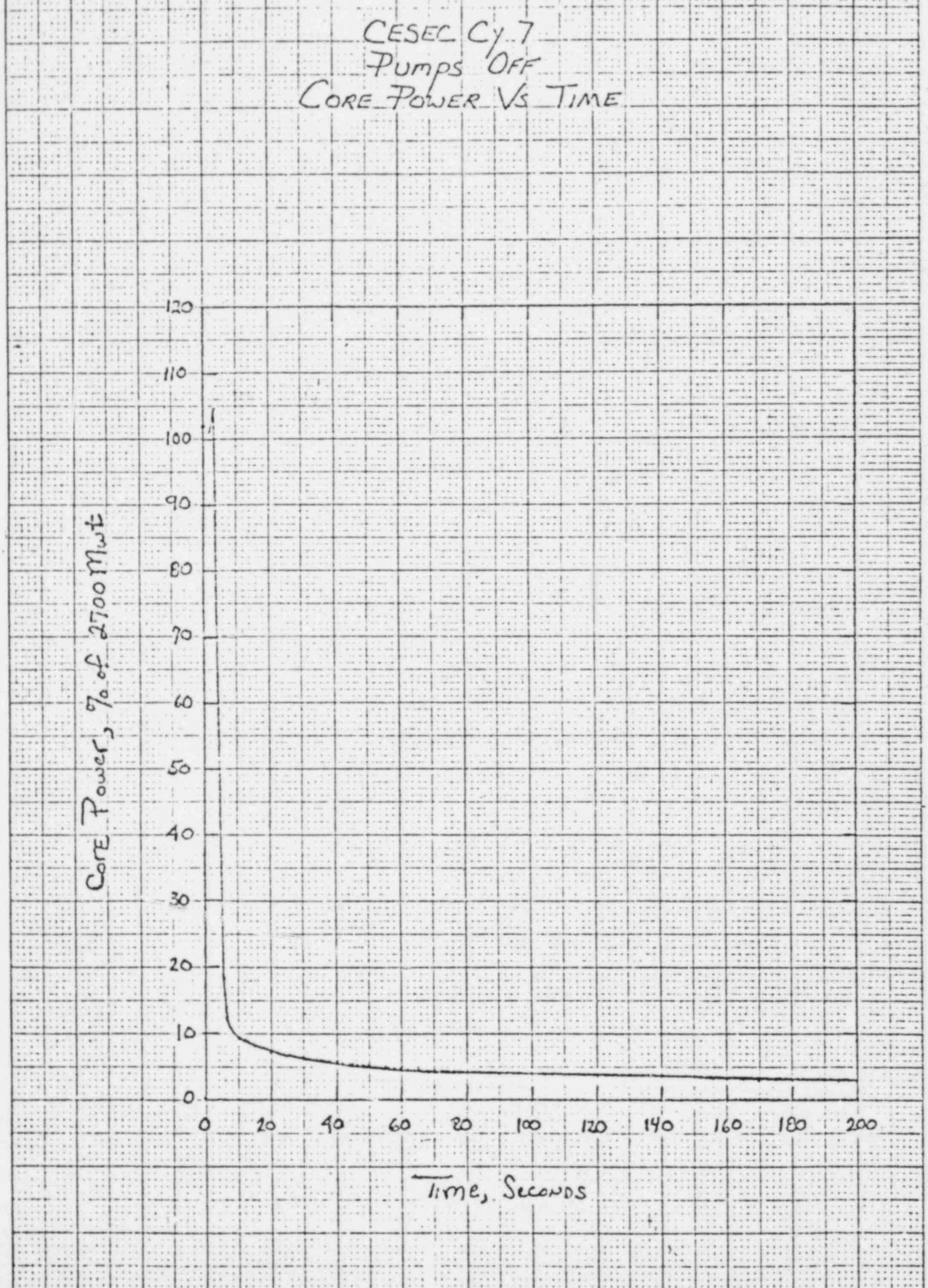


FIGURE IX-12



46 1320

K•E 10 X 10 TO ½ INCH 7 X 10 INCHES KEUFFEL & ESSER CO.

FIGURE IX-13

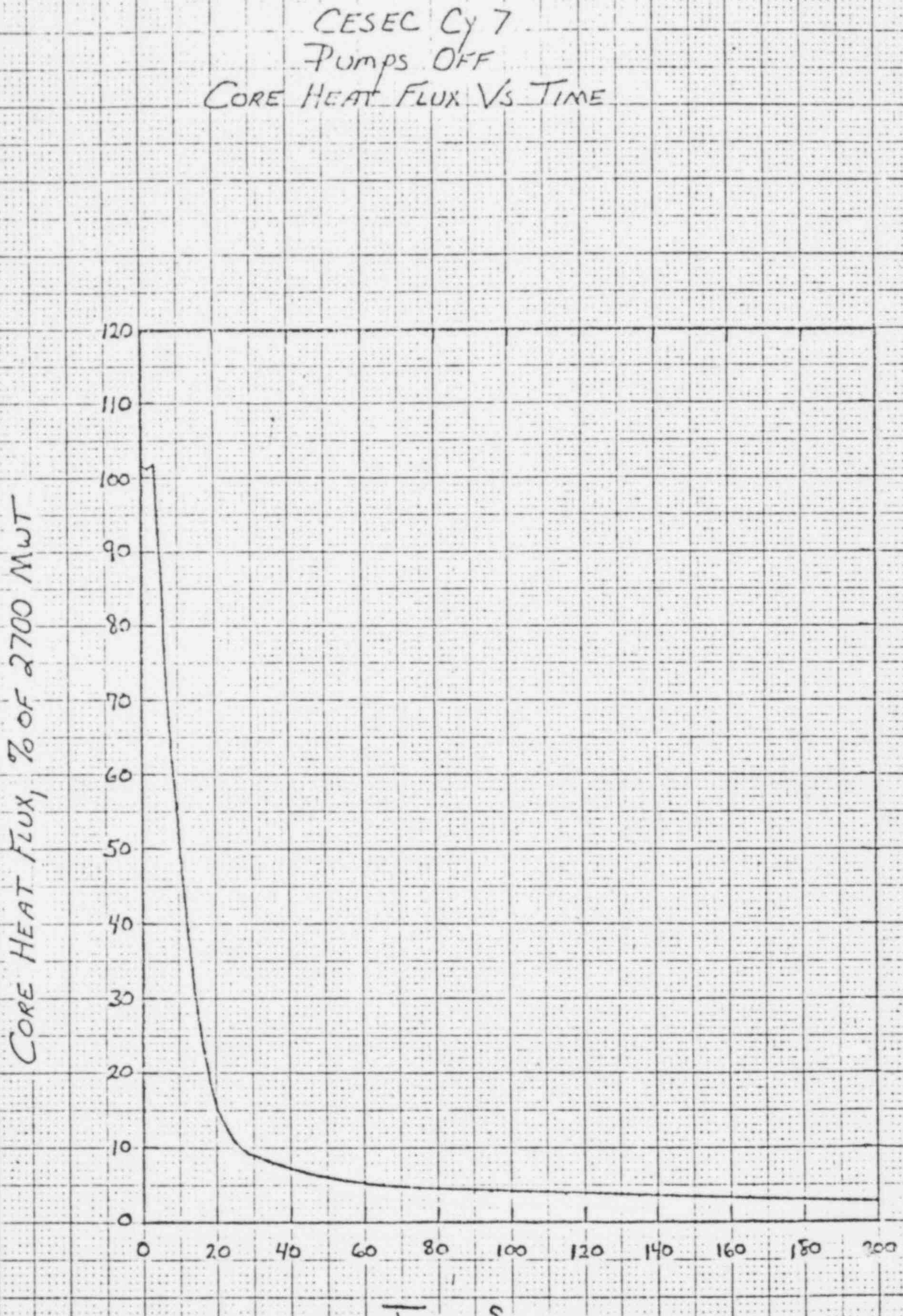
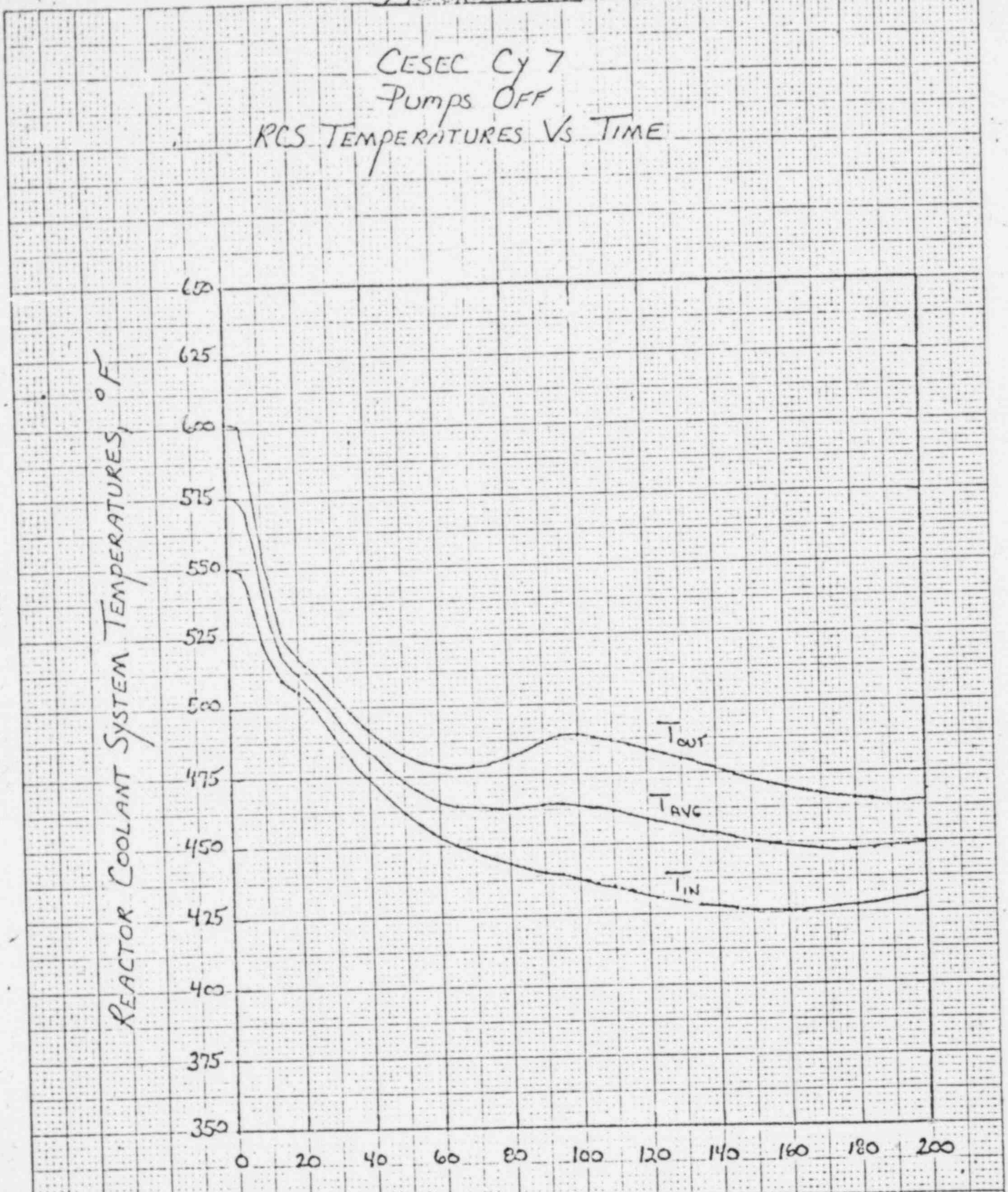

CESEC Cy 7
Pumps OFF
CORE HEAT FLUX Vs TIME
120
110
100
90
80
70
60
50
40
30
20
10
0
CORE HEAT FLUX, % OF 2700 MWT
0
20
40
60
80
100
120
140
160
180
200
TIME, SECONDS

FIGURE IX-14



K&E 10 X 10 TO ½ INCH 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 1320

FIGURE 18-15

CESEC Cy 7
Pumps OFF
RCS PRESSURE Vs TIME

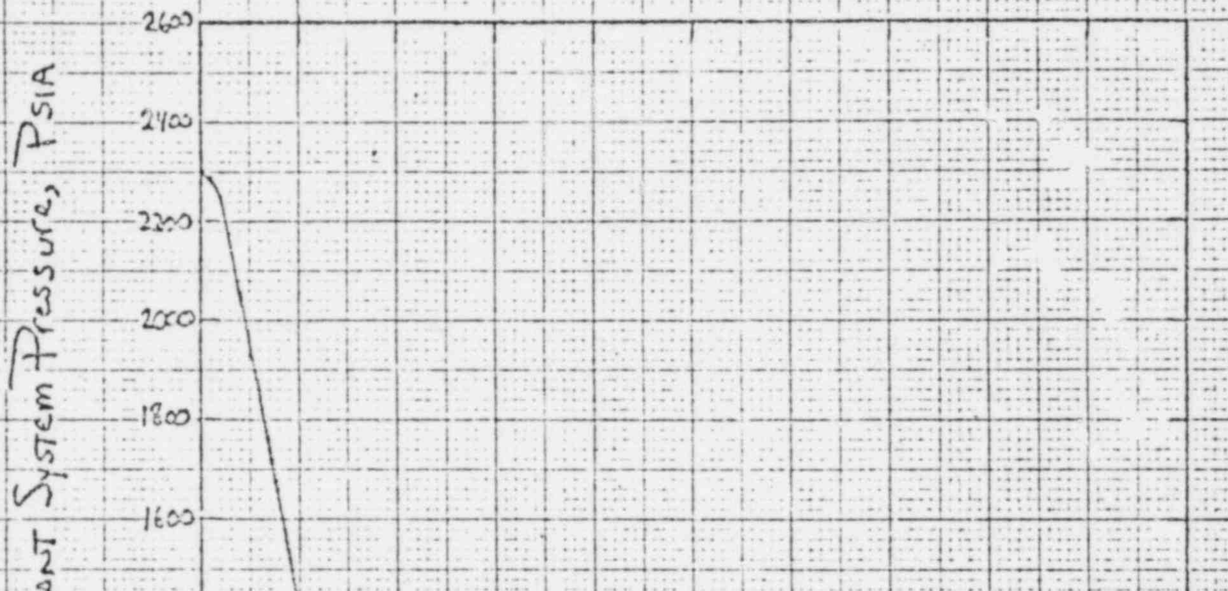


FIGURE IX-16

CESEC Cy 7
Pumps On
Reactivity Vs Time

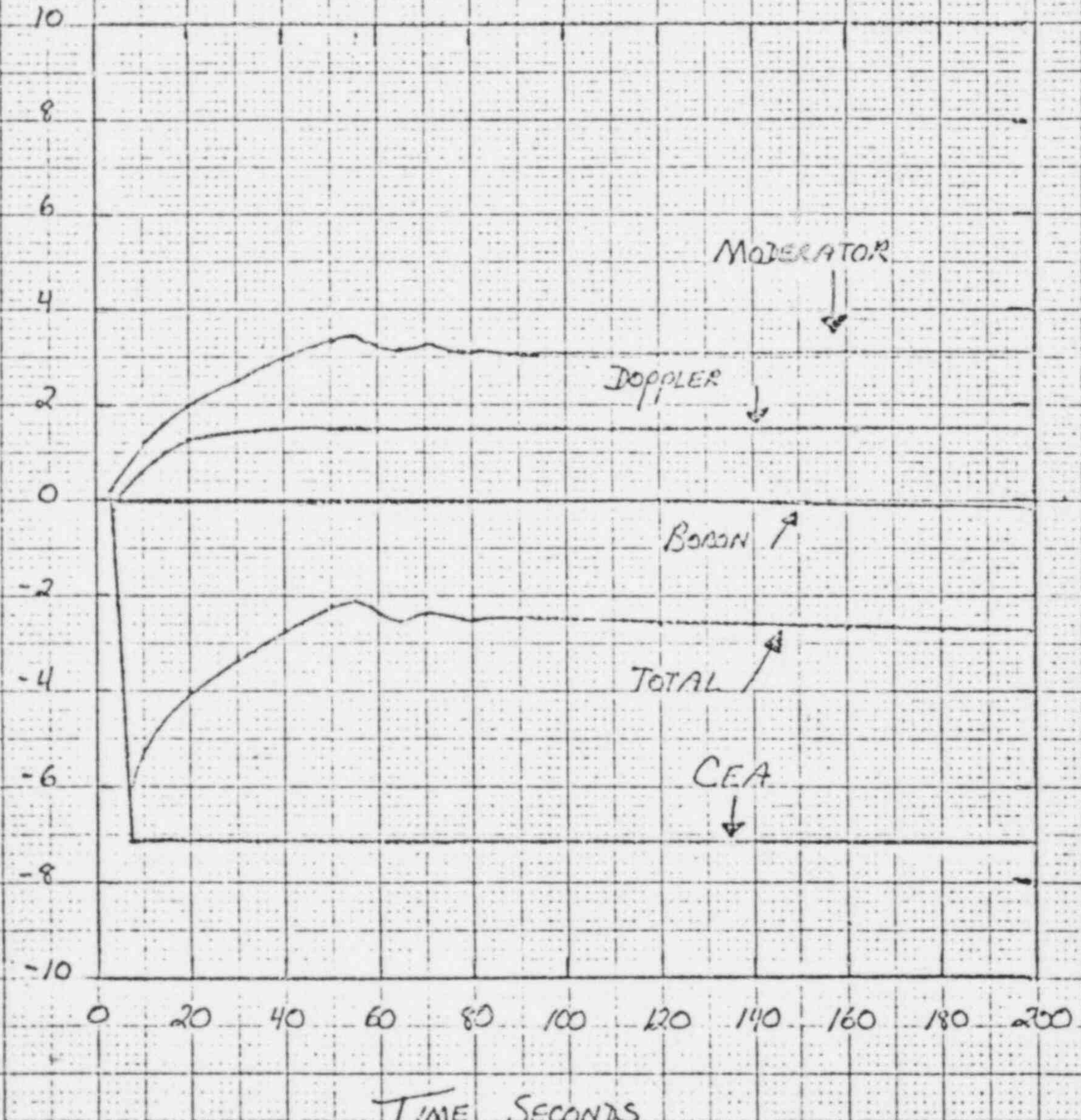


FIGURE IX-17

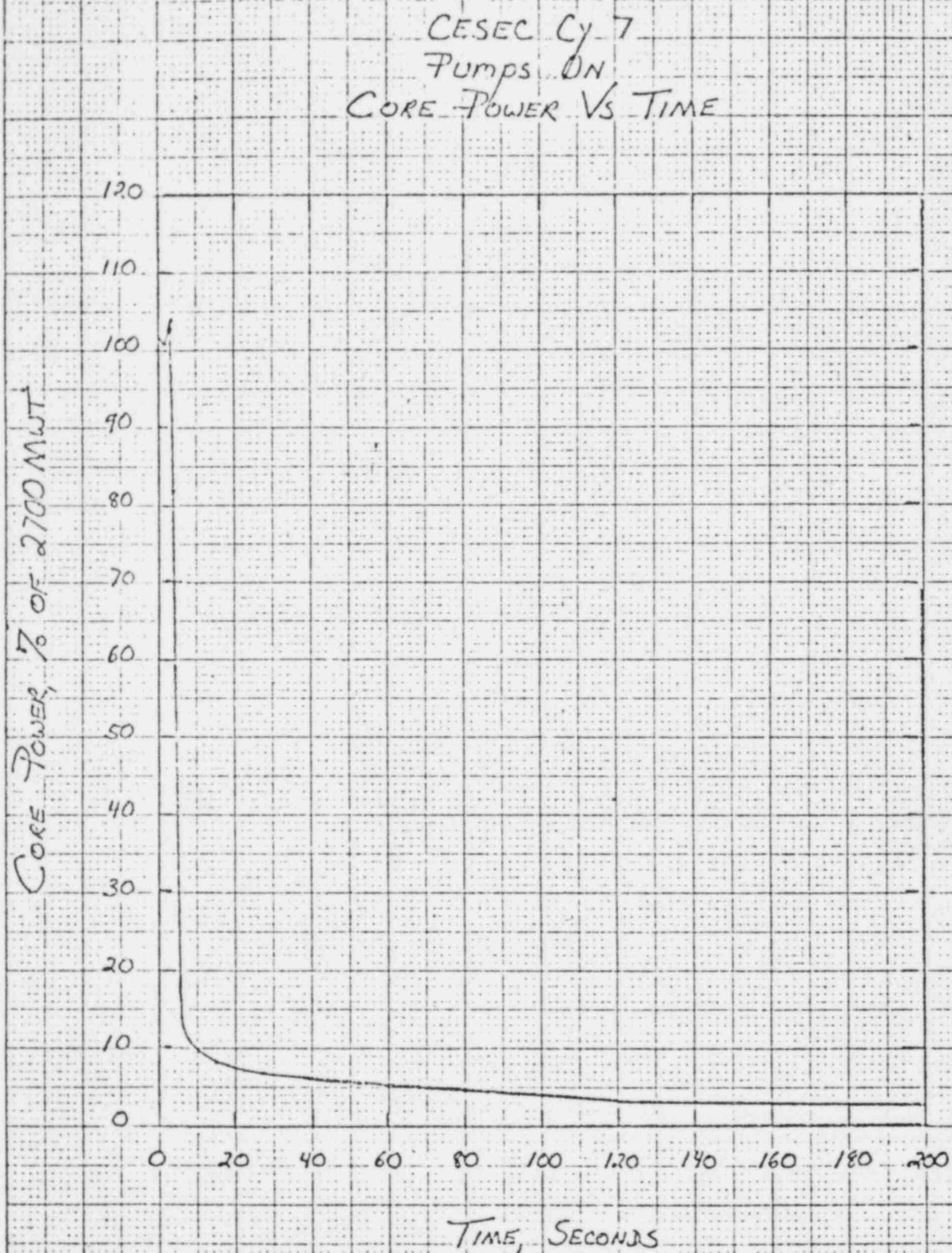
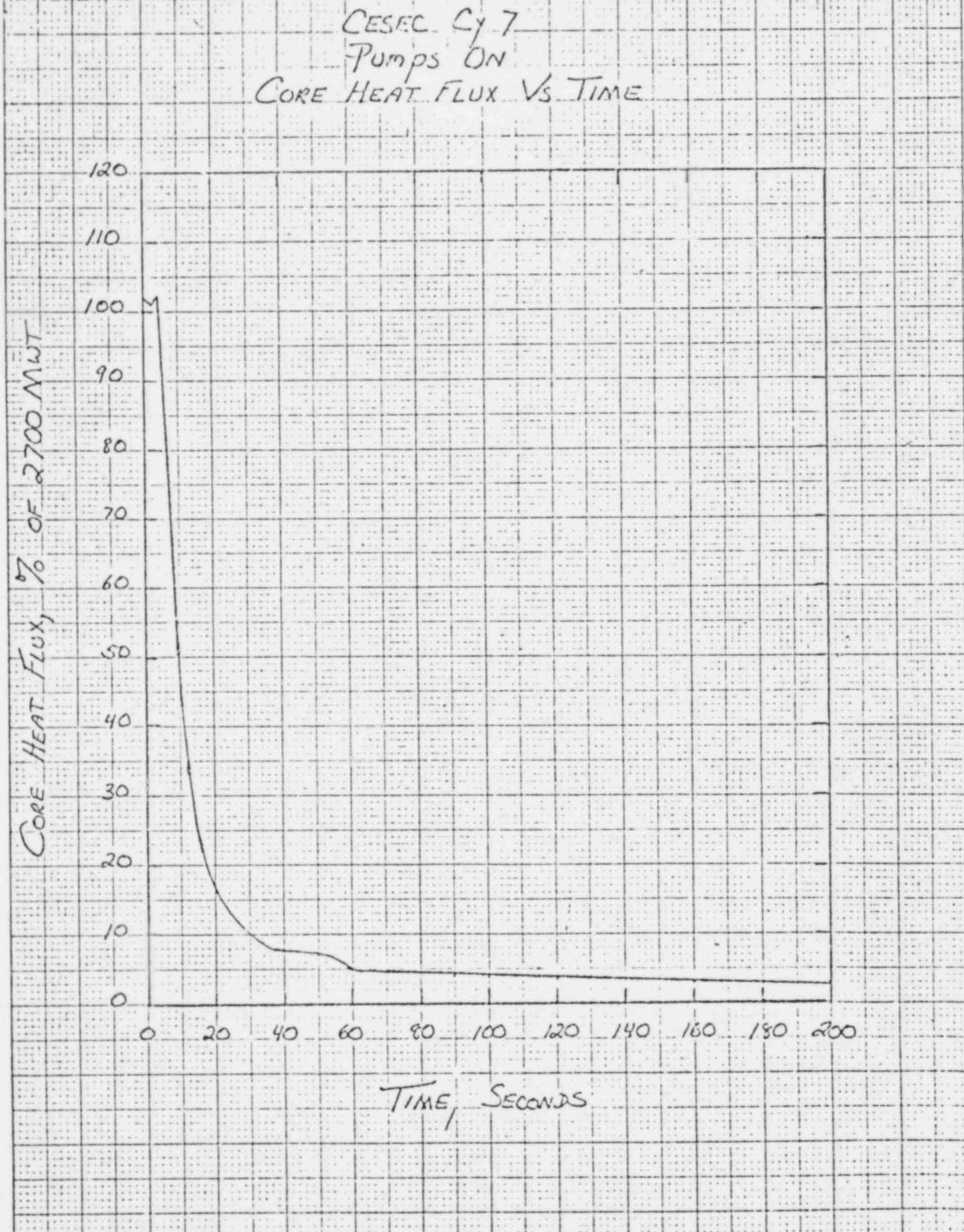

CESEC Cy 7
Pumps On
Core Power Vs Time
Core Power, % of 2700 MWt
120
110
100
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
180
200
Time, Seconds

FIGURE IX-18



CESEC Cy 7
Pumps ON
CORE HEAT FLUX Vs TIME
CORE HEAT FLUX, % OF 2700 MWT
0
10
20
30
40
50
60
70
80
90
100
110
120
0
20
40
60
80
100
120
140
160
180
200
TIME, SECONDS

FIGURE IX-19

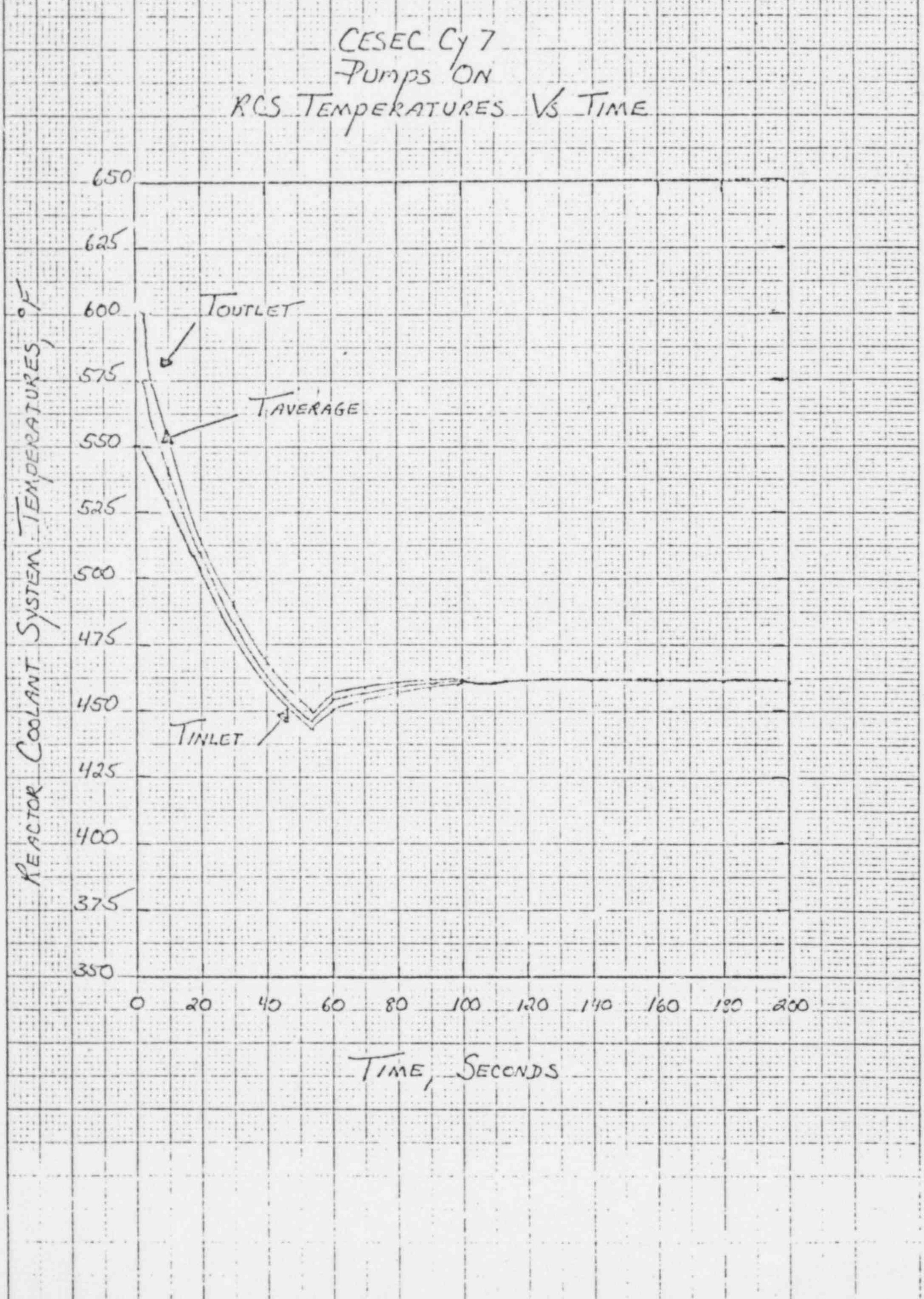
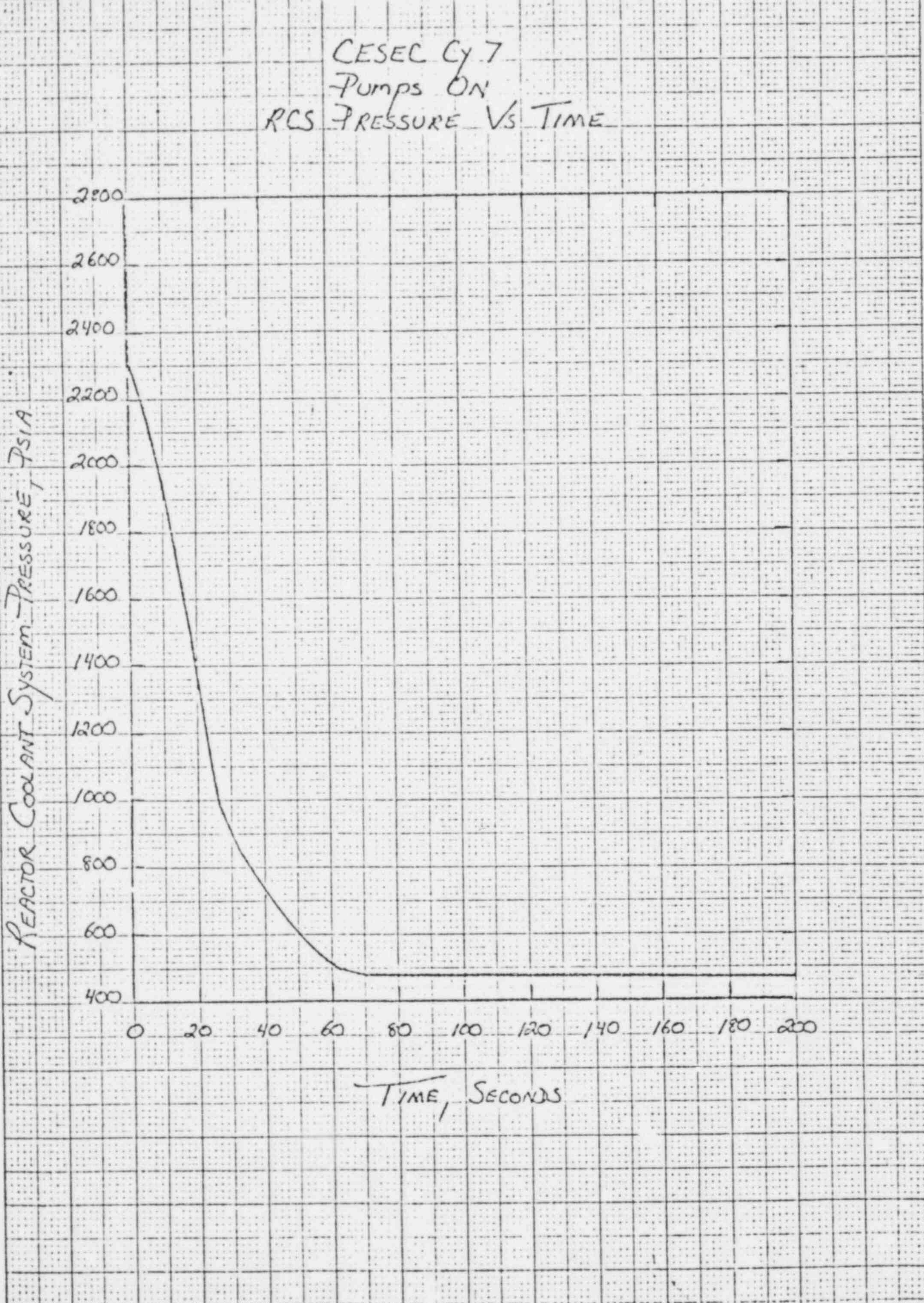

CESEC Cy 7
Pumps ON
RCS TEMPERATURES Vs TIME
650
625
600
575
550
525
500
475
450
425
400
375
350
TOUTLET
TAVERAGE
TINLET
REACTOR COOLANT SYSTEM TEMPERATURES, °F
0
20
40
60
80
100
120
140
160
180
200
TIME, SECONDS

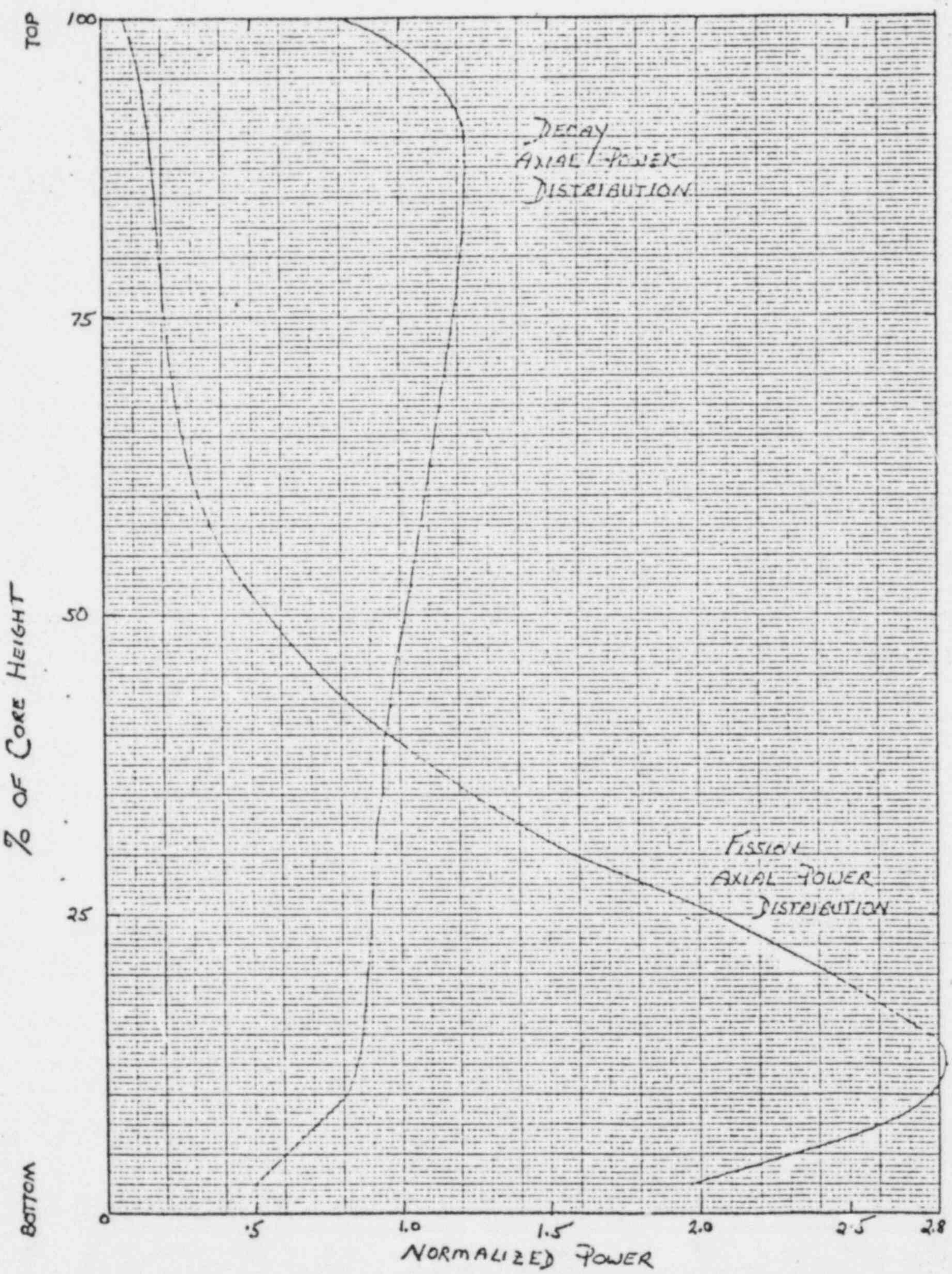
FIGURE IX-20



K+E 10 X 10 TO 1/2 INCH 7 X 10 INCHES KEUFFEL & ESSER CO. MADE IN U.S.A. 46 1320

FIGURE IX-21

AXPD FOR DNBR CALCULATIONS



References for Question IX

IX-1. R. V. Macbeth, "An appraisal of Forced Convection Burn-Out Data", Proc. Instn. Mech. Engrs., 1965-66, Vol. 180, Pt. 3C, pp. 37-50.

IX-2. D. H. Lee, "An Experimental Investigation of Forced Convection Burnout in High Pressure Water; Part IV, Large Diameter Tubes at About 1600 psia", AEEW-R 479, November, 1966.

IX-3. Calvert Cliffs Unit 1, Cycle 5 License Submittal, Letter dated September 22, 1980.