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POWER SYSTEMS

July 9, 1975
P-CE-4033

Docket, 50-255

RECEIVED JUL 14 1975 U.S. ATOMIC ENERGY COMMISSION Regulatory Mail Section

Division of Reactor Licensing
U.S. Nuclear Regulatory Commission
Attention: Mr. R. A. Purple
Washington, D.C. 20555

Subject: Palisades Plant ECCS Analysis, Docket 50-255, License DPR-20

Reference: (a) Letter from Consumers Power Company, Mr.R.B. Sewell to NRC-DRL, Mr. R.A. Purple, dated July 9, 1975, same subject

Enclosure: (1) Palisades, Core I ECCS Performance Results, Supplement 1.

Gentlemen:

At the request of Consumers Power Company, Enclosure (1) is forwarded directly to the Division of Reactor Licensing, as discussed in reference (a). This Supplement to the Palisades Core I ECCS Performance Results should be read in conjunction with reference (a).

Very truly yours,

for J. V. Strimaitis
Project Manager
Palisades Plant

JVS:RSB:nm
Enclosure (40 copies)

cc: R. B. Sewell - CPC

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Palisades, Core I ECCS Performance Results
Supplement 1

It has recently been determined[1] that the containment heat sink data used in the Palisades FAC ECCS performance analysis may not have been conservatively calculated. This data was used in the break spectrum analysis of this report. In order to demonstrate that the allowable peak LHGR determined by this analysis (11.3 kw/ft) is valid despite the heat sink data uncertainties, a set of conservative containment physical data was compiled as per agreement with the Consumers Power Company and the NRC Staff[2]. Using this containment model, the worst break (1.0 x DES/PD) hot rod transient was recomputed using the approved CE large break evaluation model[3]. Although some change occurred in the reflood period clad temperature transient, the peak clad temperature (2198^{0}F) occurred during the blowdown period. Therefore, there was no impact of the change in containment pressure on the allowable peak LHGR.

The containment physical parameters used for this analysis are shown in Table S-1.1. The following conservatisms have been included:

1. Net free volume has been increased to 105% of the FSAR value.
2. The containment building and sump wall surface areas have been increased to 105% of the FSAR values.
3. The initial relative humidity in the containment atmosphere has been assumed to be 100%.
4. The initial containment atmosphere temperature and pressure have been selected at the minimum anticipated values.
5. The containment spray flow rates have been maximized at the lowest head tested (247 ft.). The containment spray pumps are at an elevation of 570 ft. and the spray nozzles are at approximately 760 ft. The differential elevation is 190 ft. It is considered reasonable, therefore, that the flow rate data at the minimum head tested is the maximum flow which could be expected from the containment spray system.

6. The containment fan cooler heat removal rate has been based on the minimum service water temperature of 30°F.
7. The internal passive heat sink information has been derived from Branch Technical Position CSB 6-1.

In addition to the above conservatisms, the actuation time for the active heat removal systems was selected at 0.0 seconds.

The results of this analysis, for the 1.0 x DES/PD break, are presented in figures as designated in Table S-1.2. The effect of the different containment physical models can be assessed by comparison of figures beginning with the designation S-1 and those beginning with the designation II.9 in this report. It is noticed that the containment pressure is lower using the conservative physical data model. This lower containment pressure had the following impact:

1. The peak clad temperature was unaffected since it occurred during the blowdown period.
2. The maximum change in the reflood period clad temperature was from 1996 to 2055°F which occurred in a non-limiting hot rod node.
3. The peak local clad oxidation for the 1.0 x DES/PD break increased from 4.98% to 6.10%. In the break spectrum analysis of this report, the highest local clad oxidation was 5.74% which occurred for the 0.6 x DEG/PD break. Therefore, using the lower containment pressure, the peak local clad oxidation for the 0.6 x DEG/PD break may be expected to increase by $\gtrsim$1.1% but would be far below the 17% limit of 10 CFR 50.46. Similarly, the highest core-wide clad oxidation can be expected to increase slightly from the maximum value of 0.53% reported for the 0.6 x DEG/PD, but would be well below the 1.0% limit.

Therefore, it is concluded that a very conservative treatment of the containment physical model does not alter the allowable peak LHGR (11.3 kw/ft) as determined by the break spectrum analysis presented in this report.

References:

1. Letter from R. B. Sewell (Consumers Power Company) to R. A. Purple (NRC) RE: Palisades Plant Containment Building Data, Docket 50-255, June 16, 1975.

2. Telephone Communication Between J. Longo, Jr. (CE) and C. H. Berlinger (NRC) RE: Containment Physical Data Appropriate for ECCS Performance Evaluation of Palisades Plant, July 2-3, 1975.

3. CENPD-132, "Calculative Methods for the CE Large Break LOCA Evaluation Model", August, 1974 (Proprietary).

   CENPD-132, Supplement 1, "Updated Calculative Methods for the CE Large Break LOCA Evaluation Model", December, 1974 (Proprietary).

Table S-1.1

Palisades Core I

Containment Physical Parameters

Net Free Volume (105% of Nominal)	1.722×10^6 ft^3
Initiation Time for:	
Spray Flow	0.0 seconds
Fan Coolers	0.0 seconds
Containment Initial Conditions:	
Temperature (lowest anticipated operating temperature)	90°F.
Pressure (lowest anticipated operating temperature)	-0.2 psig
Relative Humidity	100%
Containment Spray Water:	
Temperature	40°F.
Flow Rate (Total, 2 pumps) Expected run-out flow)	4840 gpm

Fan Air Cooler Capacity (per cooler)
Based on expected minimum service water temperature of 30°F.

Vapor Temperature (°F)	Capacity (BTU/sec.)
30	0
104	3,850
184	19,470
244	33,000
283	44,775

Table S-1.1 (Cont'd)

Heat Sinks:

External Surface Area (105% of Nominal)

Containment Dome	7,634 square feet
Containment Dome Base	11,550 square feet
Containment Wall	57,120 square feet
Containment Base Slab	8,640 square feet

Internal Surface Areas:

The internal heat sink surface areas are based on NRC Branch Technical Position CSB 6-1

Internal Heat Sink Area of Steel (3/8" plate) Based on Net Free Volume of 1.72×10^6 ft^3	360,000 ft^2
Internal Heat Sink Area of Concrete (1' thick slab)	160,000 ft^2

Thermal Conducitvity (Maximum)
and
Volumetric Heat Capacity (Maximum)

For External Walls

	Thermal Conductivity (BTU/hr-ft-^{o}F)	Specific Heat (BTU/lbm-^{o}F)	Volumetric Heat Capacity (BTU/ft^3-^{o}F)
Organic Protective Coatings	0.3	-	62
Inorganic Protective Coatings	2	-	62
Stainless Steel Liner Plate	11	0.12	59
Carbon Steel Liner Plate	28	0.12	59
Structural Concrete	0.9	0.23	33

Table S-1.1 (Cont'd)

For Internal Walls:

Heat sink thermophysical properties of NRC Branch Technical Position CSB 6-1 are used.

	Thermal Conductivity (BTU/hr-ft-^{o}F)	Specific Heat (BTU/lbm-^{o}F)	Volumetric Heat Capacity (BTU/ft^{3}-^{o}F)
Concrete	0.92	0.156	22.6
Steel	27.0	0.12	58.8

Heat Transfer Coefficients:

a. Containment atmosphere to sump: 500 BTU/hr-ft^{2}-^{o}F

b. Sump to base slab: 20 BTU/hr-ft^{2}-^{o}F

c. Containment structure to enclosure building atmosphere: 10.0 BTU/hr-ft^{2}-^{o}F

Table S-1.2

Variables Plotted as a Function of Time for the 1.0 x DES/PD Break

Variable	Figure Designation
Containment Pressure	S-1.1-F
Mass Added to Core During Reflood	S-1.1-G
Peak Clad Temperature	S-1.1-H
Local Clad Oxiation	S-1.1-O
Heat Transfer Coefficient During Reflood	S-1.1-R
Containment Temperature	S-1.1-S
Sump Temperature	S-1.1-T

FIGURE S-1. 1-F
PALISADES CORE 1 REANALYSIS
1.0 x DOUBLE ENDED SLOT BREAK IN PUMP DISCHARGE LEG
CONTAINMENT PRESSURE

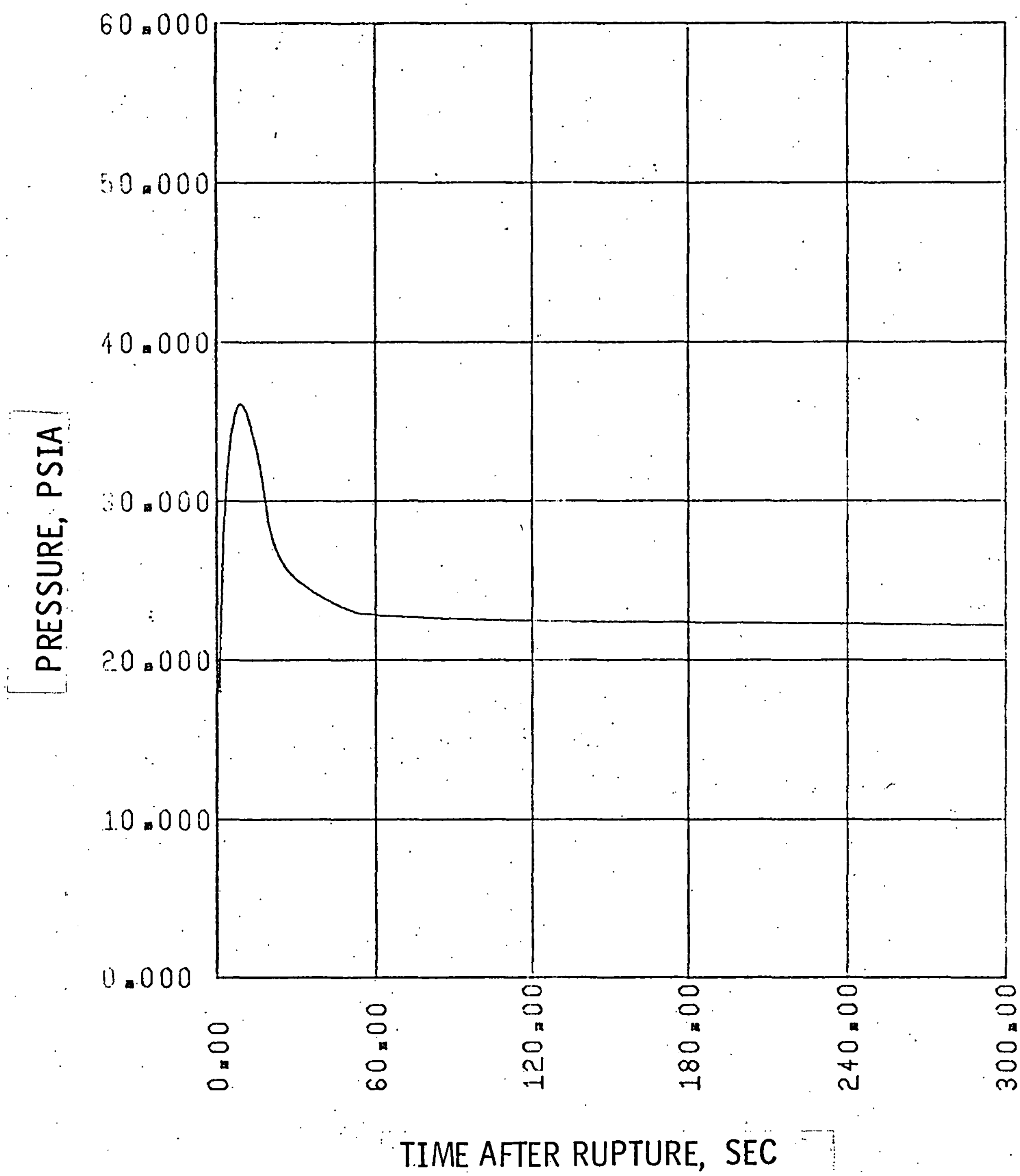


FIGURE S-1.1-G
PALISADES CORE 1 REANALYSIS
1.0 x DOUBLE ENDED SLOT BREAK IN PUMP DISCHARGE LEG
MASS ADDED TO CORE DURING REFLOOD

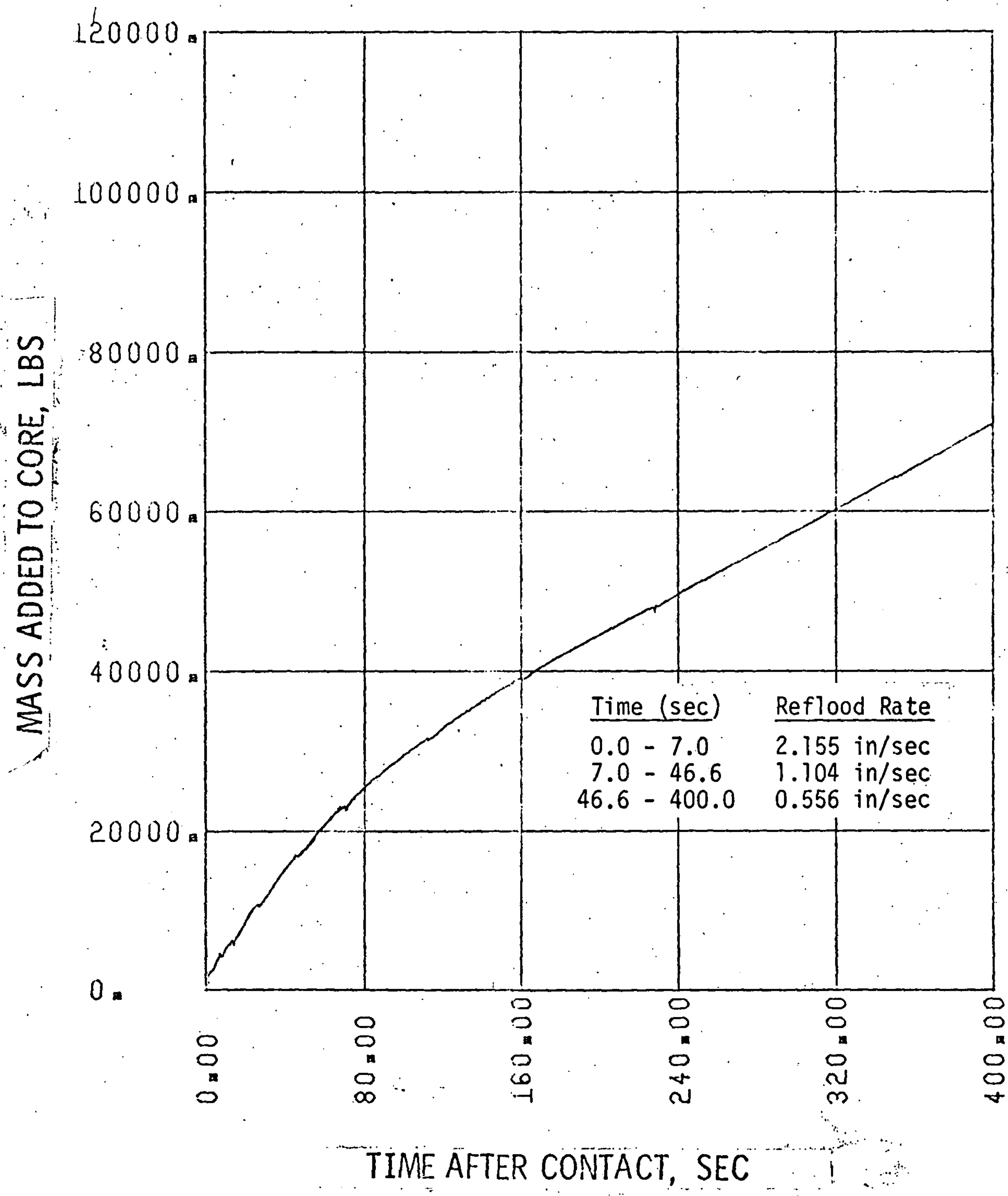
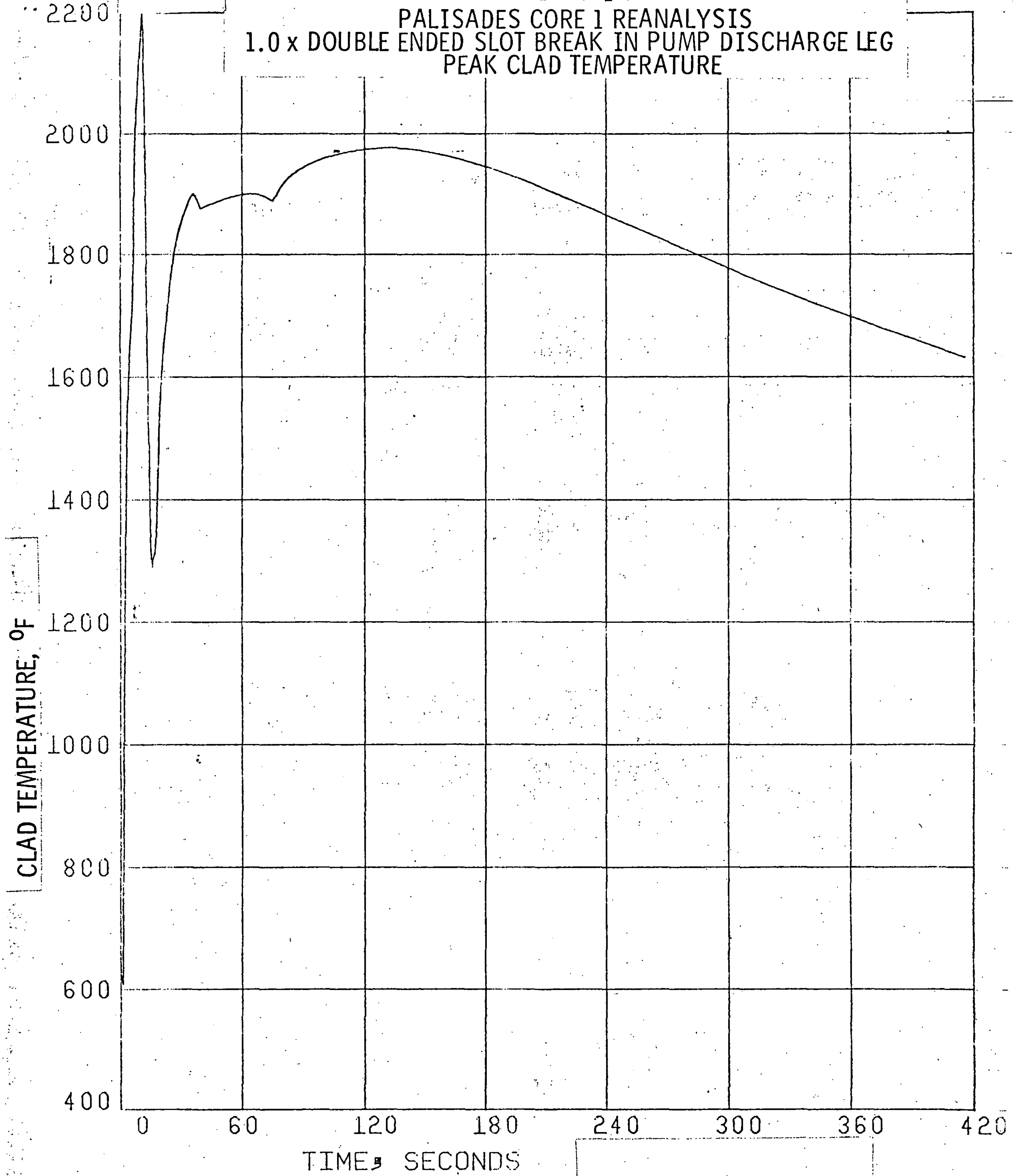


FIGURE S-1.1-H
PALISADES CORE 1 REANALYSIS
1.0 x DOUBLE ENDED SLOT BREAK IN PUMP DISCHARGE LEG
PEAK CLAD TEMPERATURE



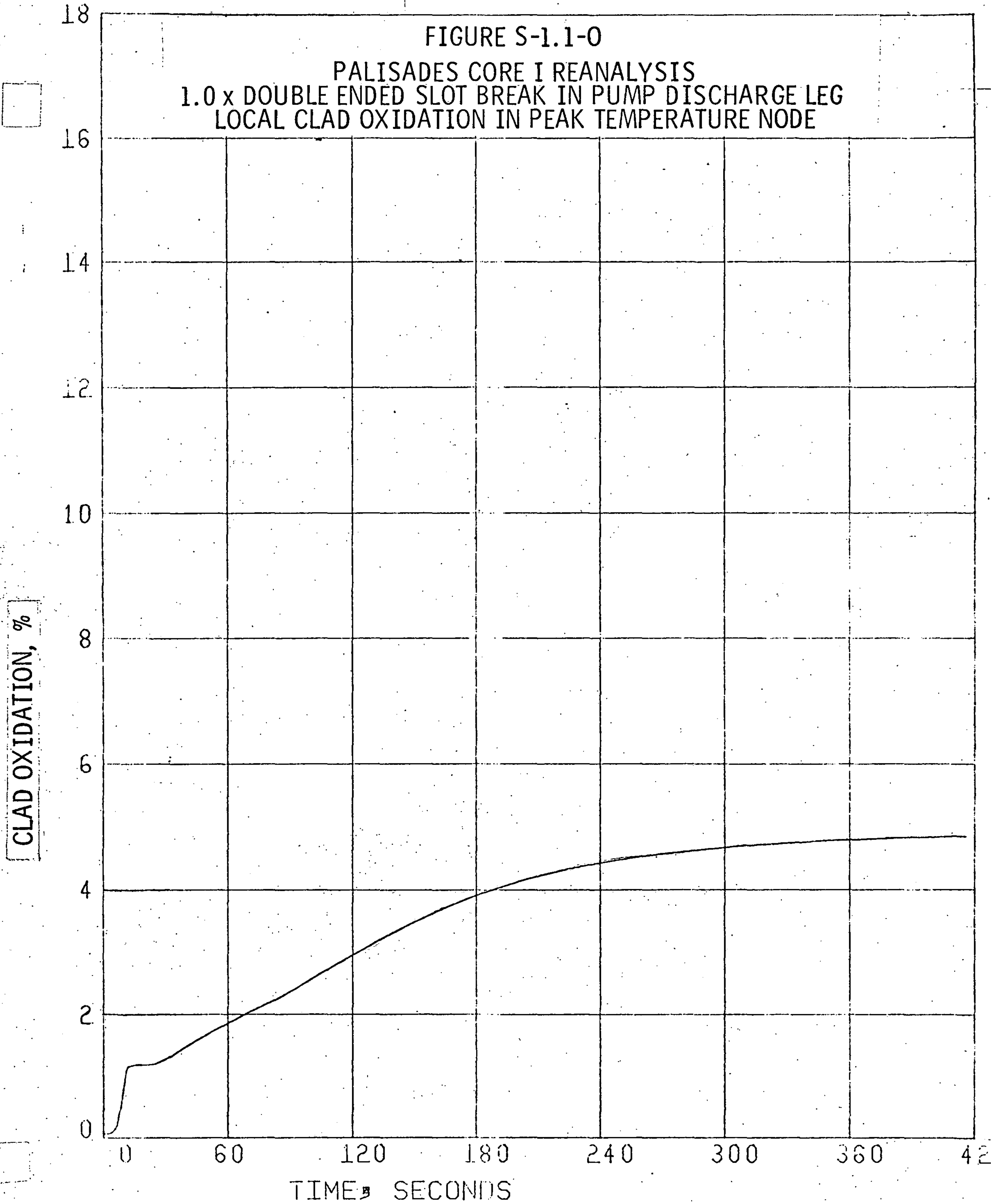


FIGURE S-1.1-0
PALISADES CORE I REANALYSIS
1.0 x DOUBLE ENDED SLOT BREAK IN PUMP DISCHARGE LEG
LOCAL CLAD OXIDATION IN PEAK TEMPERATURE NODE
CLAD OXIDATION, %
18
16
14
12
10
8
6
4
2
0
0
60
120
180
240
300
360
42
TIME, SECONDS

FIGURE S-1.1-R
PALISADES CORE 1 REANALYSIS
1.0 x DOUBLE ENDED SLOT BREAK IN PUMP DISCHARGE LEG
HOT SPOT HEAT TRANSFER COEFFICIENT DURING REFLOOD

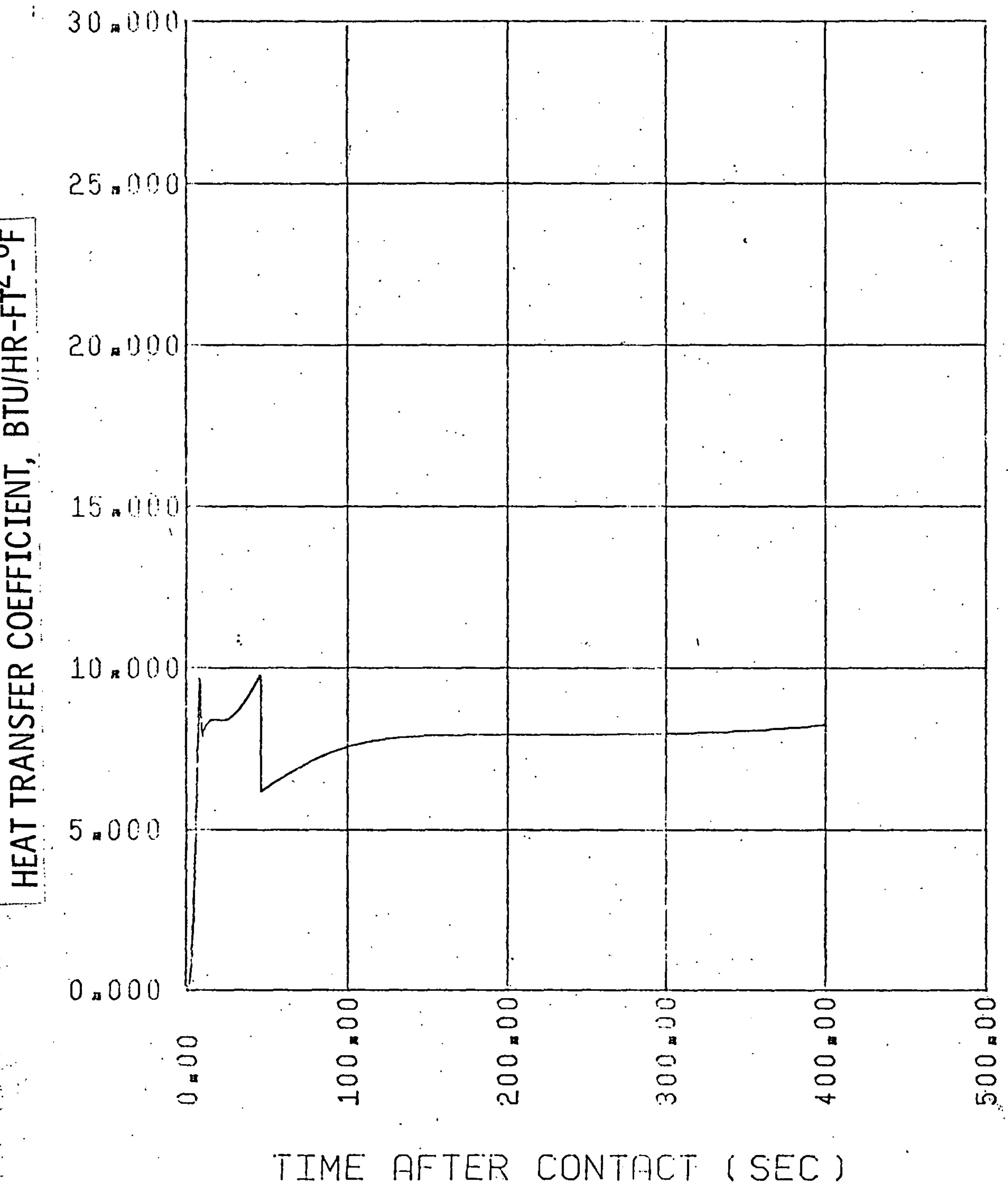


FIGURE S-1.1-S
PALISADES CORE 1 RENALAYSIS
1.0 x DOUBLE ENDED SLOT BREAK IN PUMP DISCHARGE LEG
CONTAINMENT TEMPERATURE

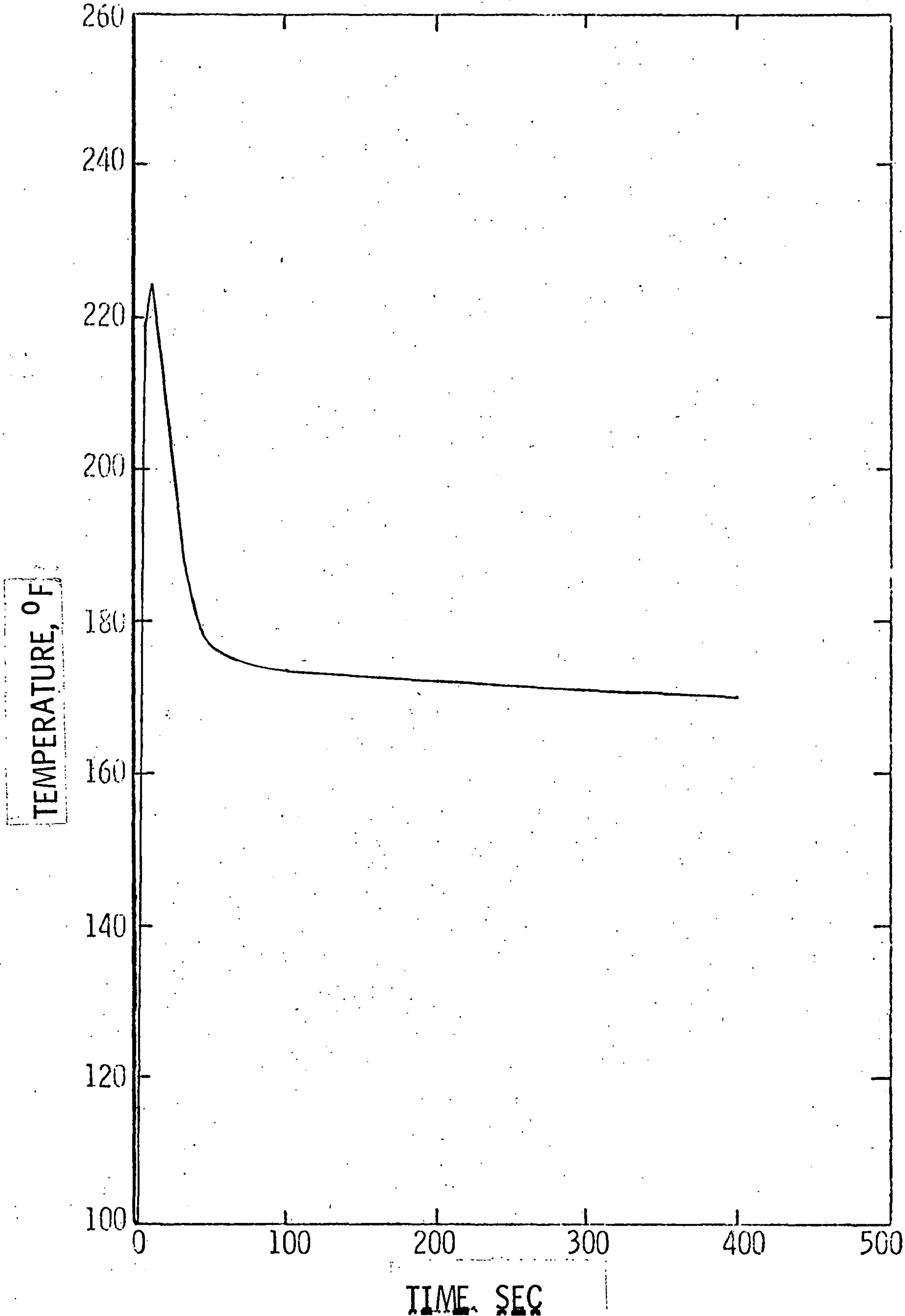


FIGURE S-1.1-T

PALISADES CORE 1 REANALYSIS
1.0 x DOUBLE ENDED SLOT BREAK IN PUMP DISCHARGE LEG
SUMP TEMPERATURE