VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

February 17, 1978

Mr. Edson G. Case, Acting Director
Office of Nuclear Reactor Regulation
Attn: Mr. Robert W. Reid, Chief
Operating Reactors Branch No. 4
Division of Reactor Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Serial No. 092
FR/MLB
LQA/DWSjr:kbo
Docket Nos. 50-280
50-281
License Nos. DPR-32
DPR-37

Dear Mr. Case:

In our letter of August 26, 1977 (Serial No. 372) and October 14, 1977 (Serial No. 403B), we requested an amendment to Operating Licenses DPR-32 and DPR-37 for the Surry Power Station, Units No. 1 and 2. The amendment requested was a change to the Technical Specifications designated as Change No. 57. The changes to the Technical Specifications were approved as Amendments No. 35 and 34 by your letter of December 2, 1977 for Unit 1 and Unit 2, respectively. However, in the NRC Safety Evaluation Report, a requirement was imposed to provide, within approximately ninety days, sufficient analytical studies to justify the continued use of the appropriately adjusted standard design (center-peaked) axial power shape as the limiting shape in the LOCA-ECCS analysis. The required analytical study has been completed and is documented in the Attachment. The results of the study justify the continued use of the appropriately adjusted standard design (center-peaked) axial power shape in all LOCA-ECCS analysis performed for Surry Units No. 1 and 2.

Should you have any questions, we would be most happy to meet with you at your earliest convenience.

Very truly yours,

C. M. Stallings

7805201191

C. M. Stallings
Vice President-Power Supply
and Production Operations

Attachments

cc: Mr. James P. O'Reilly, Director
Office of Inspection and Enforcement
Region II

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ATTACHMENT 1

ANALYTICAL STUDY TO JUSTIFY CONTINUED USE OF THE CENTER-PEAKED AXIAL POWER SHAPE AS THE LIMITING SHAPE IN THE LOCA-ECCS ANALYSIS

An analysis of the C_D=0.4 DECLG break LOCA has been performed for an axial core power shape other than the standard design chopped cosine shape (i.e., centered-peaked shape). The base analysis for comparison purposes is documented in Reference 1 and is, currently, the applicable limiting LOCA-ECCS analysis for Surry Units 1 and 2.

The axial core power shape used in this analysis is provided in Figure 1. The shape was developed from a typical end-of-cycle reload power shape for Surry Units 1 and 2. However, the shape was then adjusted to yield a $F^N_{\Delta H}$ equal to the Technical Specifications limit for $F^N_{\Delta H}\Big|^{LOCA}_{ROD}$. As indicated in Figure 1, the shape was further adjusted to maximize the linear power at higher elevations in the core and to just touch the K(Z) envelope at 10.5 feet. This shape was selected over other skewed axial power shapes because it peaks near the axial location of the peak clad temperature calculated in Reference 1, and it maximizes the enthalpy rise from the quench front to the peak clad temperature location. Previous sensitivity studies have showed that a skewed axial power shape with a 10.5 ft peak is limiting (from a LOCA-ECCS standpoint) relative to other skewed shapes because its use results in the case exhibiting the greatest amount of time in reflood with a flooding rate less than one inch per second (See Reference 2). It should also be noted that the skewed axial power shape provided in Figure 1 can not be obtained during Condition I operation. A review of measured axial power shapes from the Surry Units No. 1 and 2 confirms the above statement.

The analysis performed was consistent with the method described in Section F of Reference 2. With the skewed power shape of Figure 1, the steam cooling model without blockage case was adjusted for better agreement with FLECHT case results. However, even with the adjustment, the steam cooling model without blockage case still shows a significantly higher result than the FLECHT case and thus complies with NRC requirements. The results of this case comparison are provided in Table 1. The steam cooling model with flow blockage was then used in the analysis.

A comparison of the results from this analysis (skewed axial power shape of Figure 1) and the base case (chopped cosine shape of Reference 1) shows that the calculated peak clad temperature for the base case (chopped cosine shape of Reference 1) is still limiting. (See Tables 1 through 3) The difference between the skewed power shape case results and the base case results would be even greater if better agreement had been initially obtained between the results from the FLECHT case and the results from the steam cooling model without flow blockage case.

Additional results from this analysis are provided in Figures 2 through 14.

REFERENCES

1. Letter from Vepco to NRC dated August 26, 1977, Serial No. 372.

2. WCAP-8471/8472, "The Westinghouse ECCS Evaluation Model: Supplementing Information", April 1975, (Westinghouse Electric Corporation).

TABLE 1

COMPARISON OF CALCULATED PEAK CLAD TEMPERATURES

FOR SKEWED POWER DISTRIBUTION CASE

Case (Power Distribution)	Calculated Peak Clad Temperature (°F) A	B	C
Cosine Power Shape	2177.	2104.	2086.
10.5' Power Shape	2109.	2084.	1988.

A - Steam Cooling Model with Blockage Geometry

B - Steam Cooling Model without Blockage Geometry

C - FLECHT

TABLE 2

TIME SEQUENCE OF EVENTS
COMPARISON FOR DECLG (C_D=0.4)

	Skewed Shape (sec)	Cosine Shape (sec)*
START	0.0	0.0
Reactor Trip Signal	0.646	0.649
S.I. Signal	2.25	2.26
Acc. Injection	15.8	15.8
End of Bypass	23.6	23.71
End of Blowdown	26.83	27.94
Pump Injection	27.25	27.26
Bottom of Core Recovery	37.13	37.18
Acc. Empty	55.30	55.46

*From Reference 1

TABLE 3

COMPARISON OF DECLG C_D=0.4 RESULTS

Results	Skewed Power Shape	Cosine Power Shape*
Peak Clad Temp. °F	2109	2177
Peak Clad Location, Ft.	11.0	10.5
Local Zr/H_2O RXN (max), %	5.94	7.4
Local Zr/H_2O Location, Ft.	11.0	9.0
Total Zr/H_2O RXN, %	<0.3	<0.3
Hot Rod Burst Time, sec.	25.9	24.2
Hot Rod Burst Location, Ft.	2.75	6.0

*From Reference 1

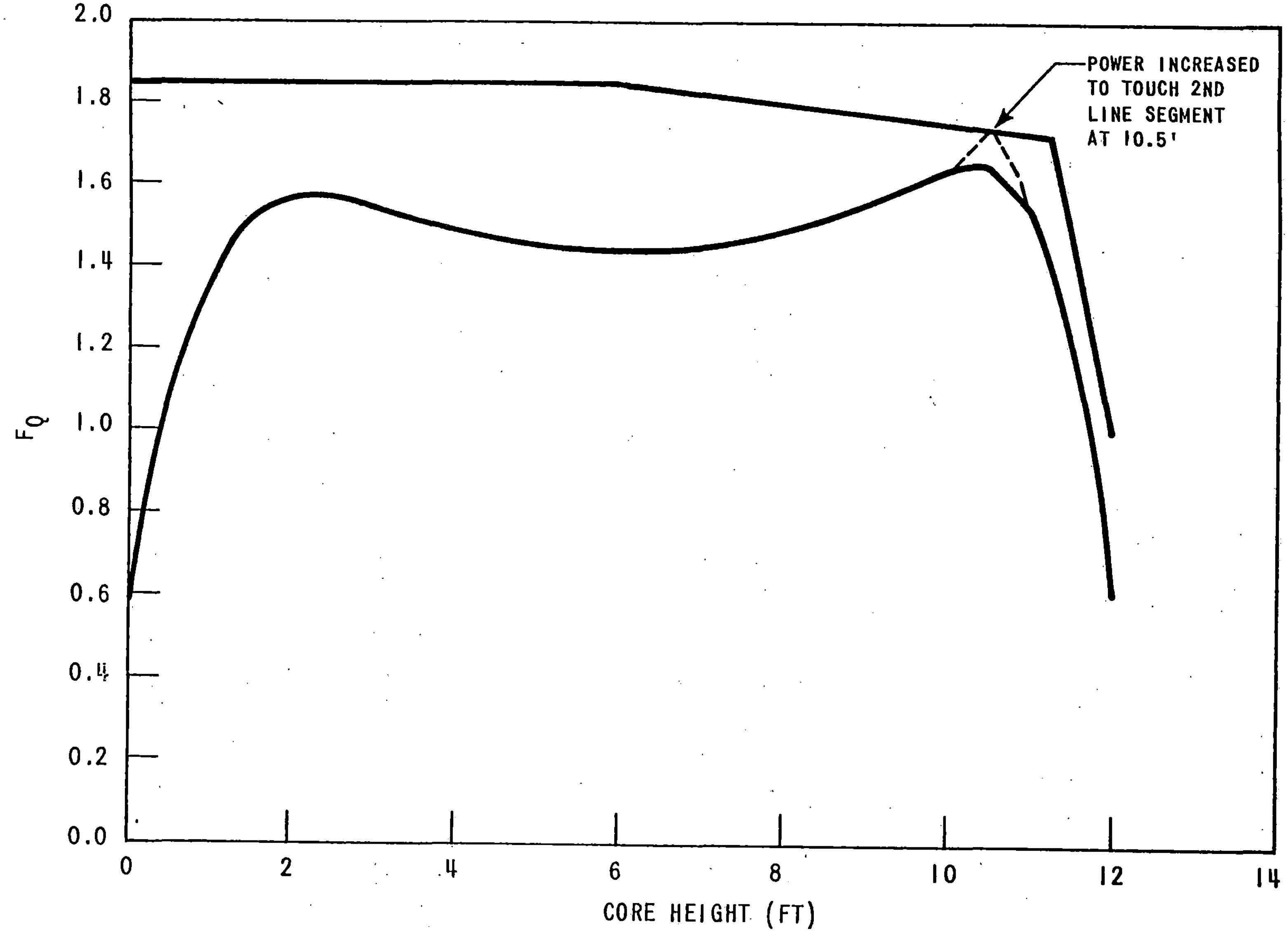

Figure 1

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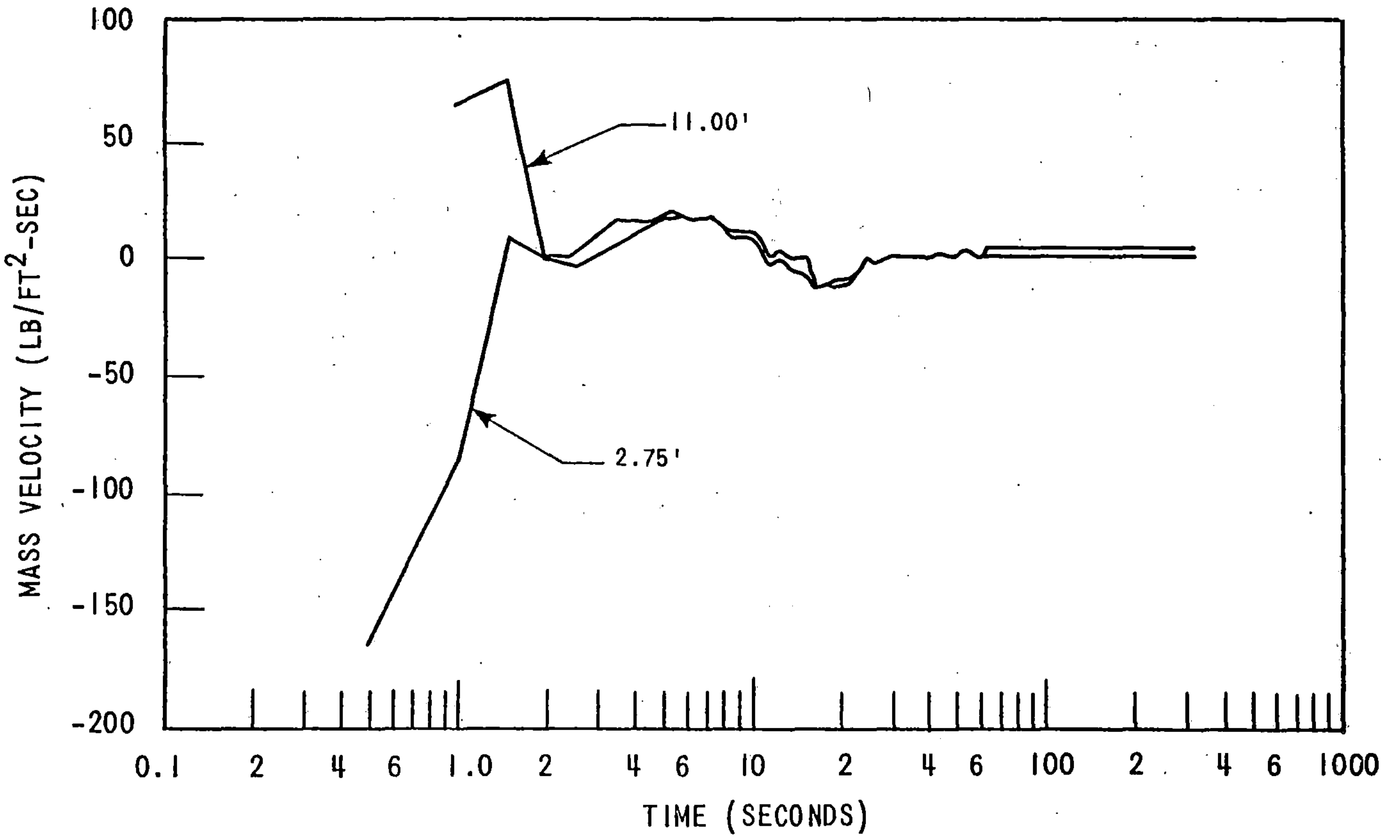

Figure 2. Mass Velocity - DECLG (C_D = 0.4)

12419-11

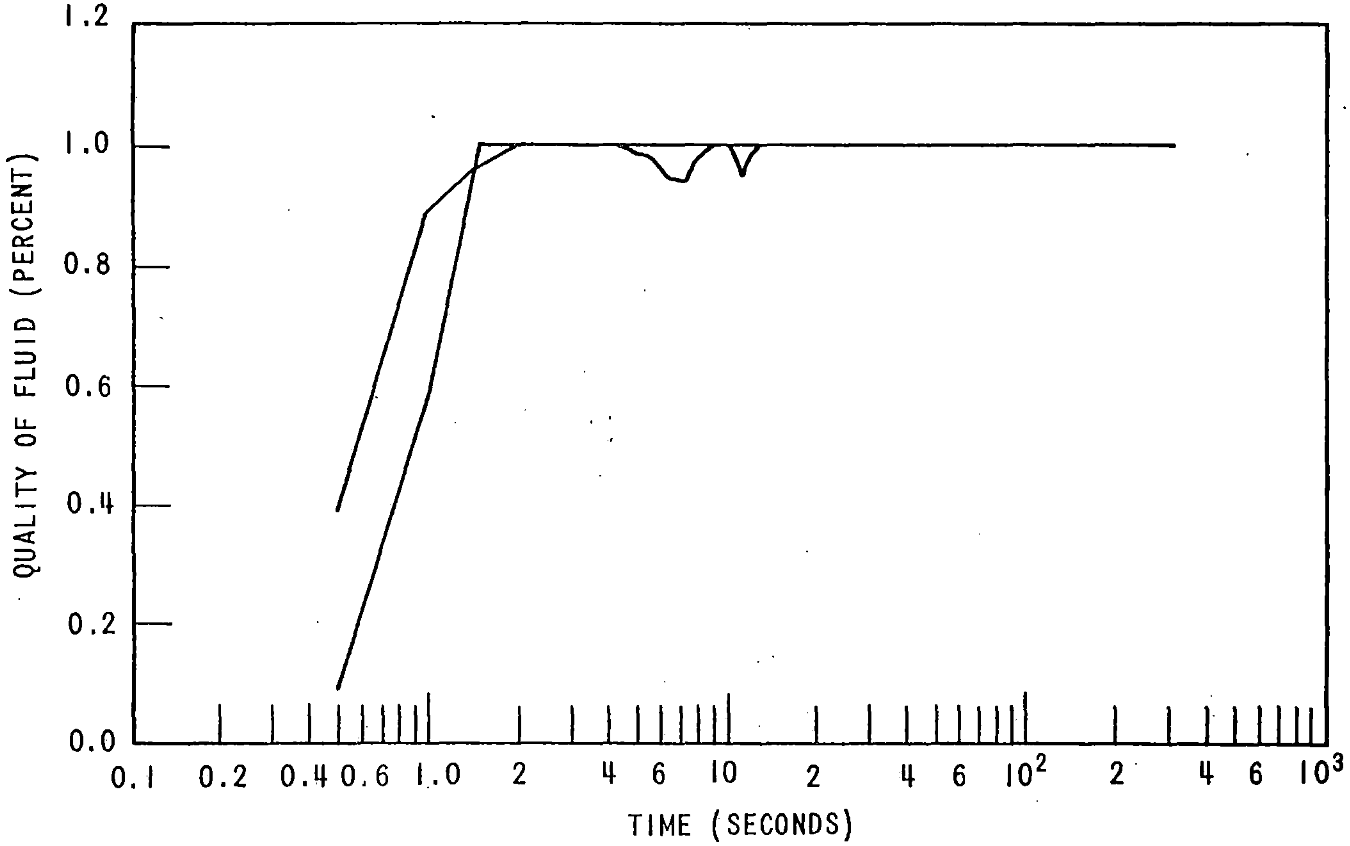

Figure 3. Fluid Quality - DECLG (C_D = 0.4)

12419-10

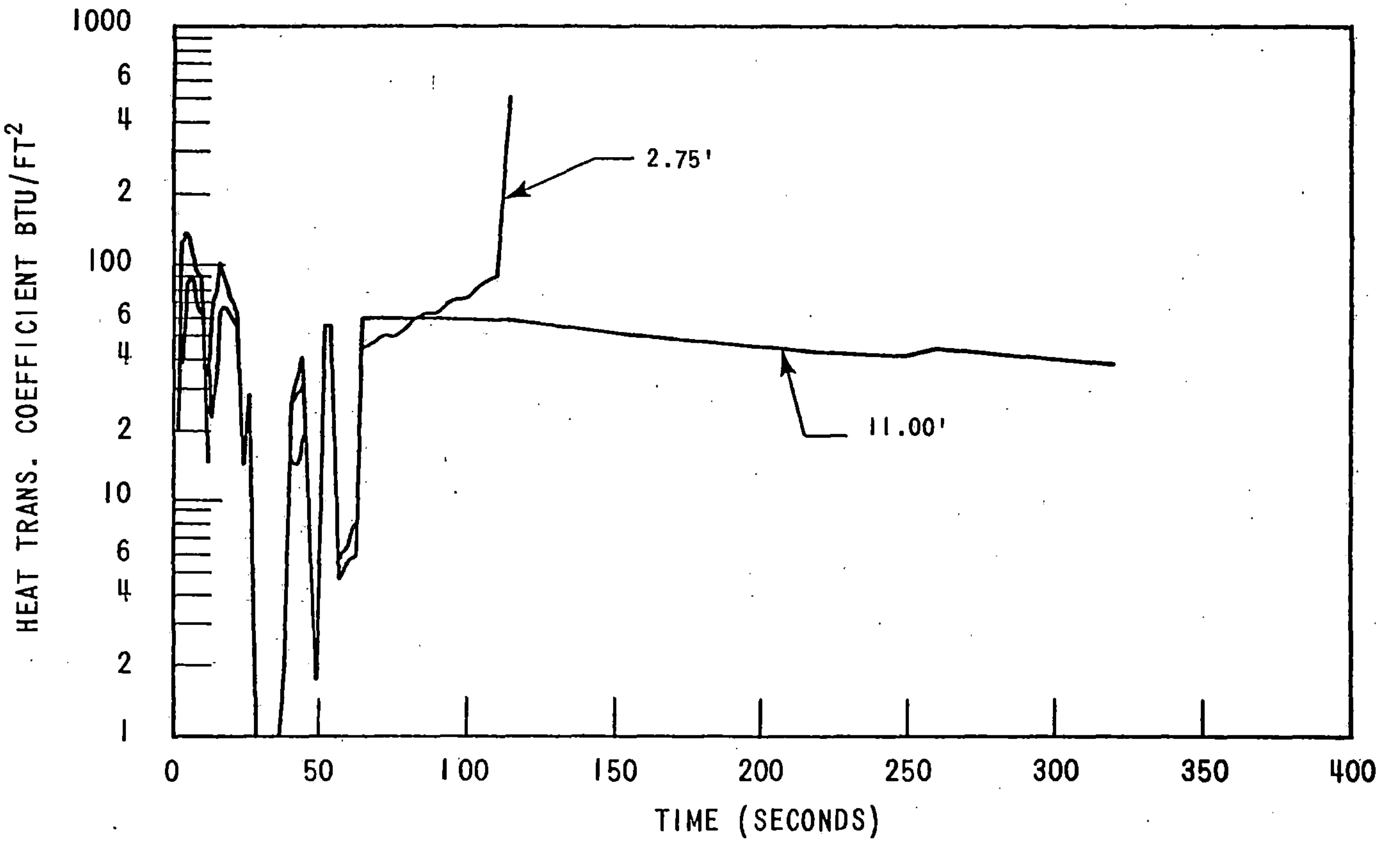

Figure 4. Heat Transfer Coefficient - DECLG (C_D = 0.4)

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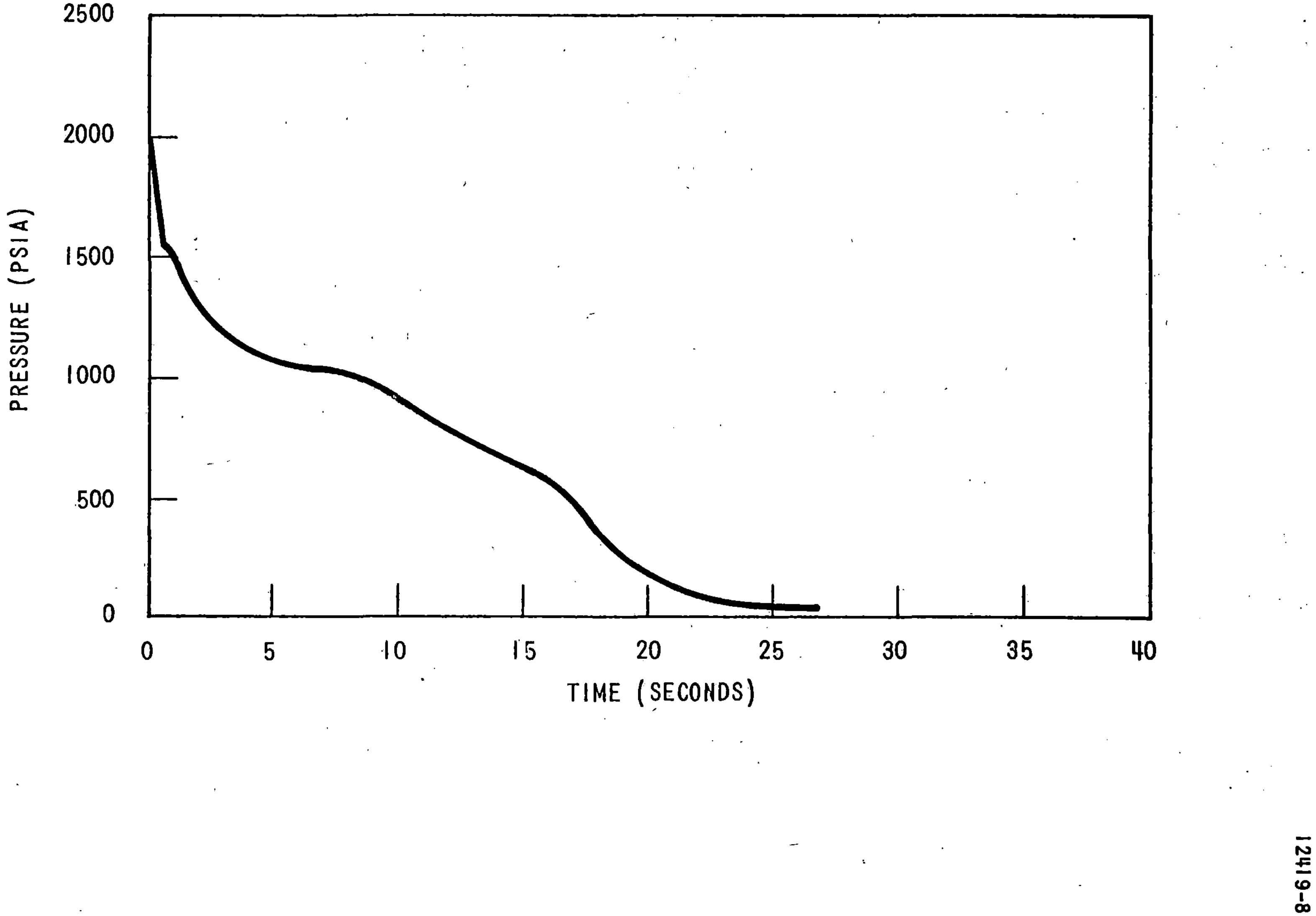

Figure 5. Core Pressure - DECLG (C_D = 0.4)

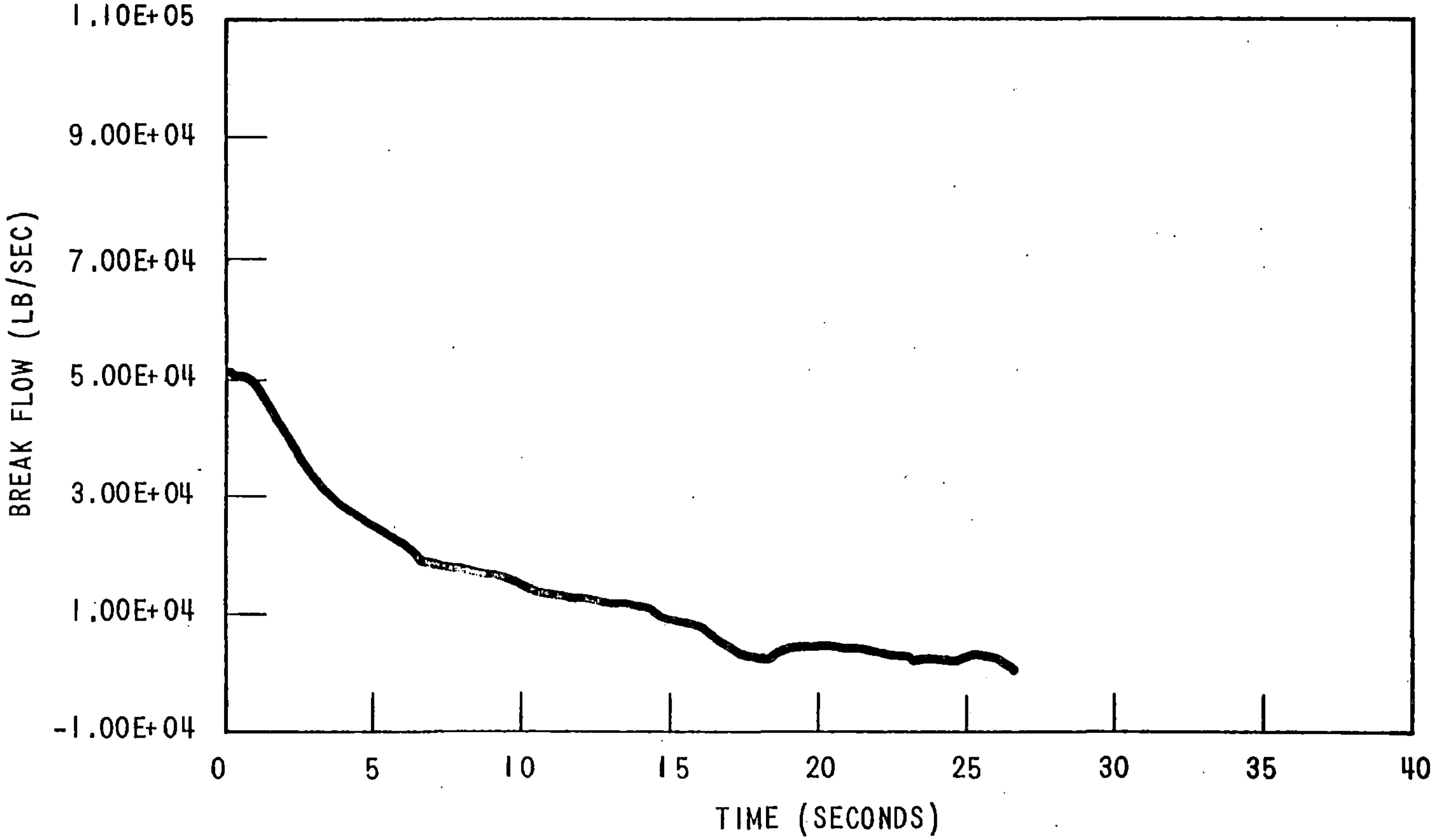

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Figure 6. Break Flow Rate - DECLG (C_D = 0.4)

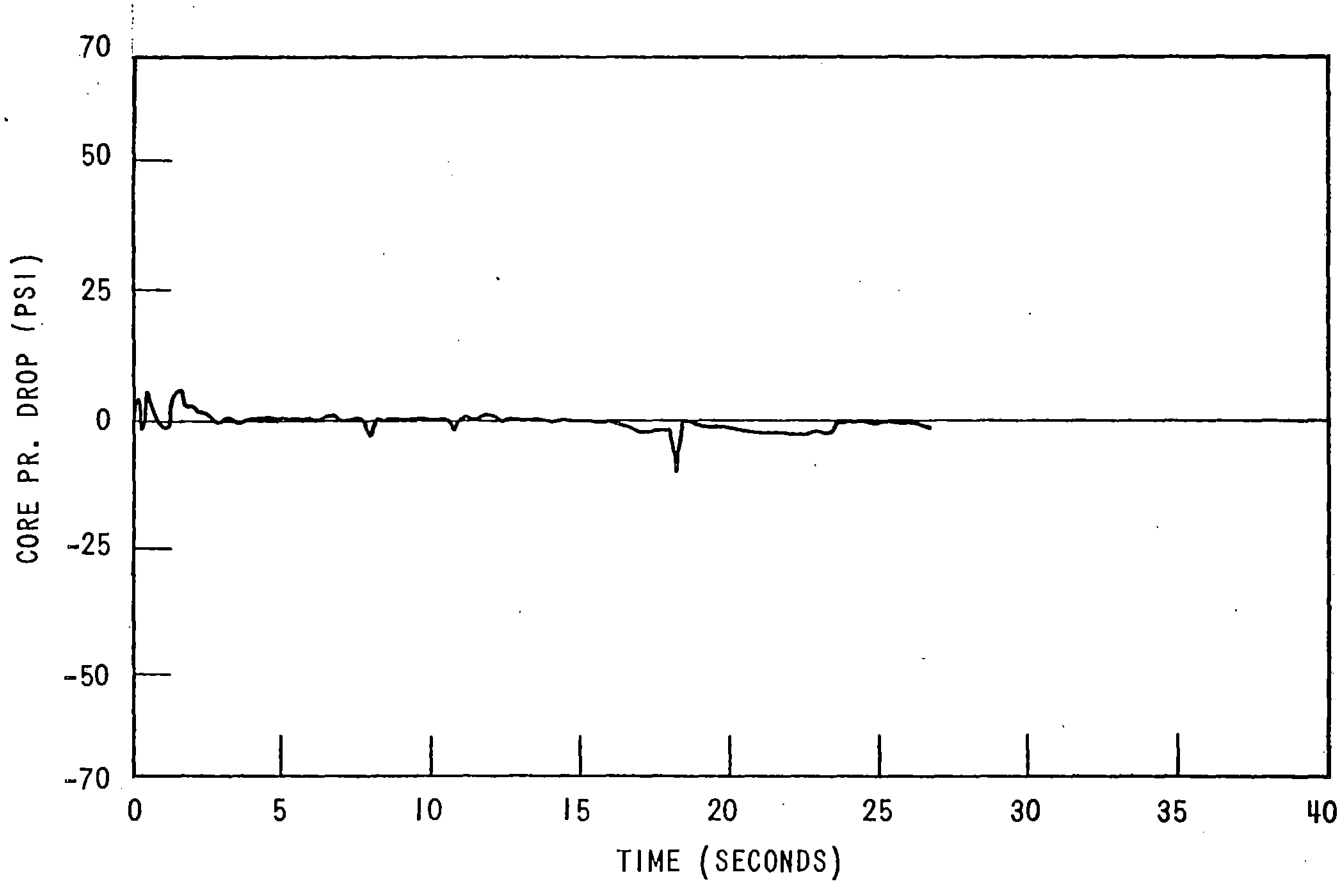

Figure 7 - Core Pressure Drop - DECLG (C_D = 0.4)

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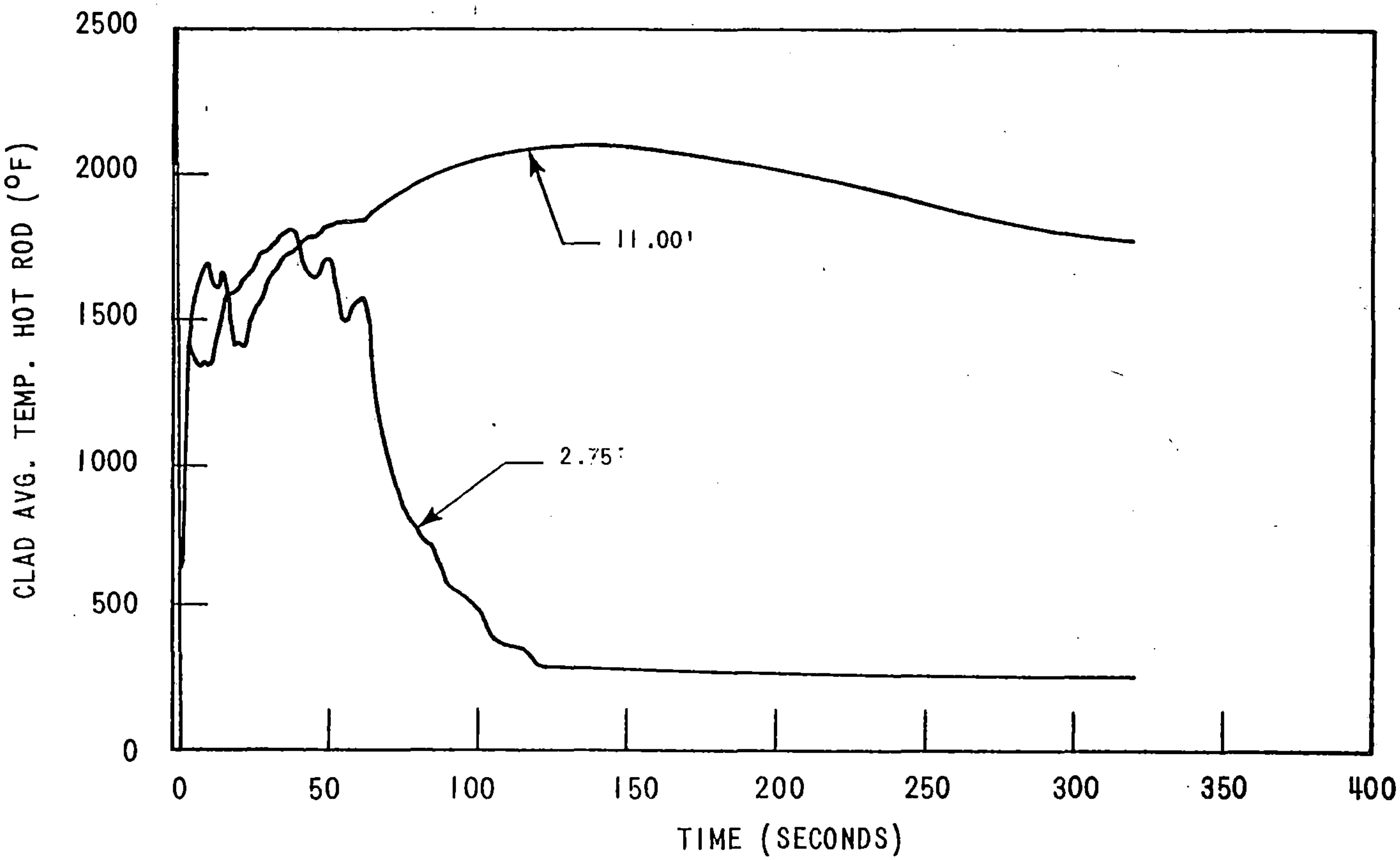

Figure 8. Peak Clad Temperature - DECLG (C_D = 0.4)

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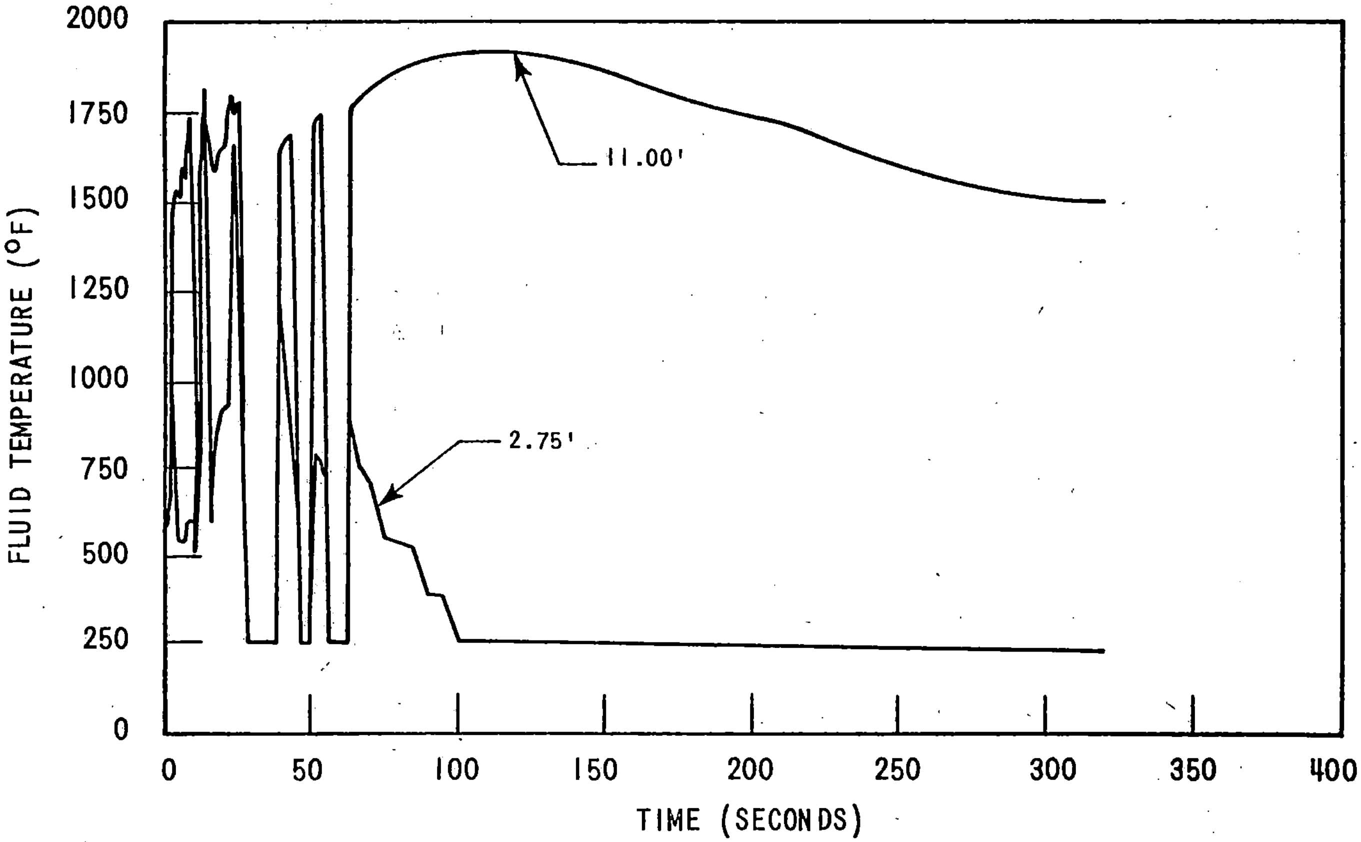

Figure 9. Fluid Temperature - DECLG (C_D = 0.4)

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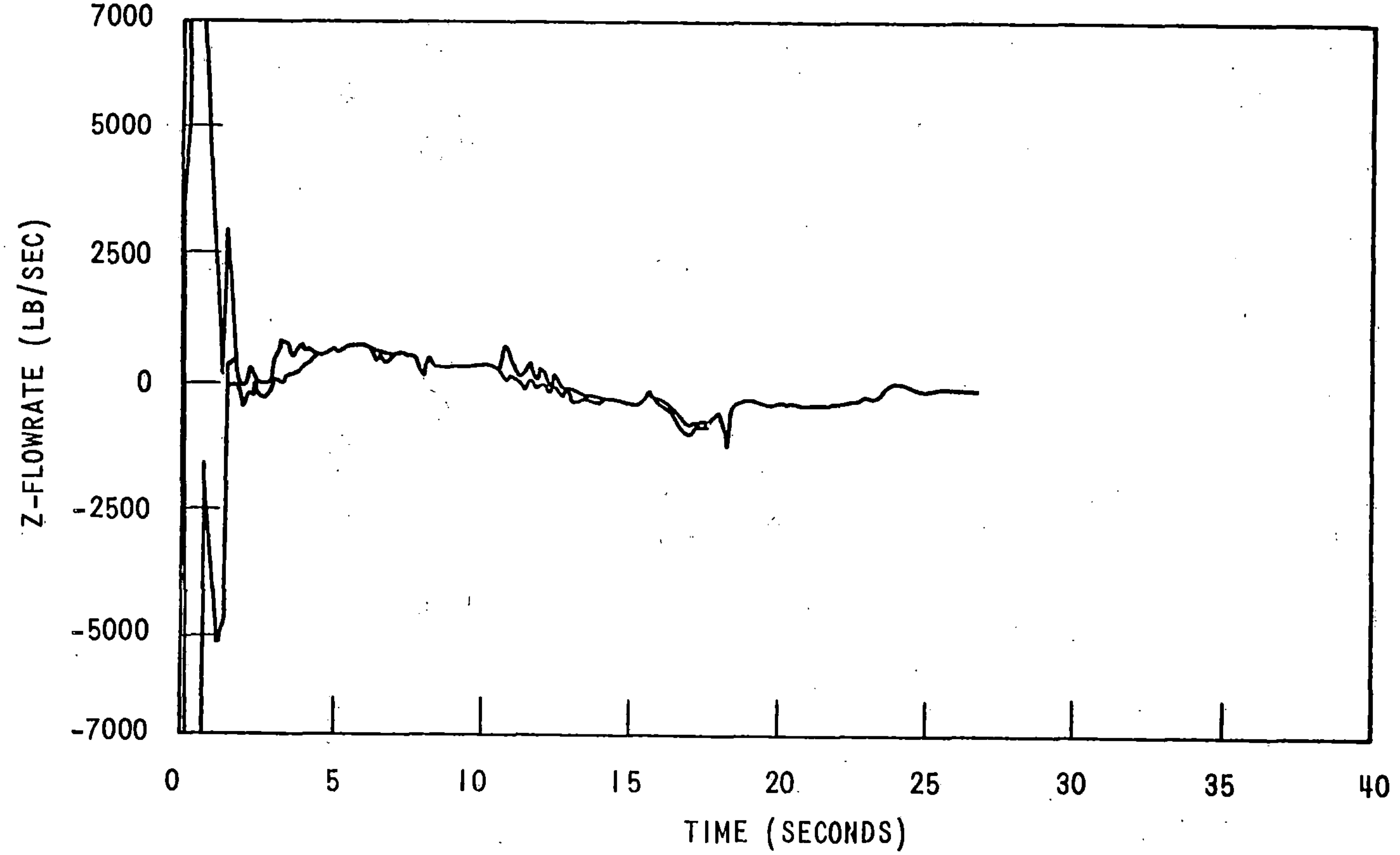

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Figure 10. Core Flow - Top and Bottom - DECLG ($C_D = 0.4$)

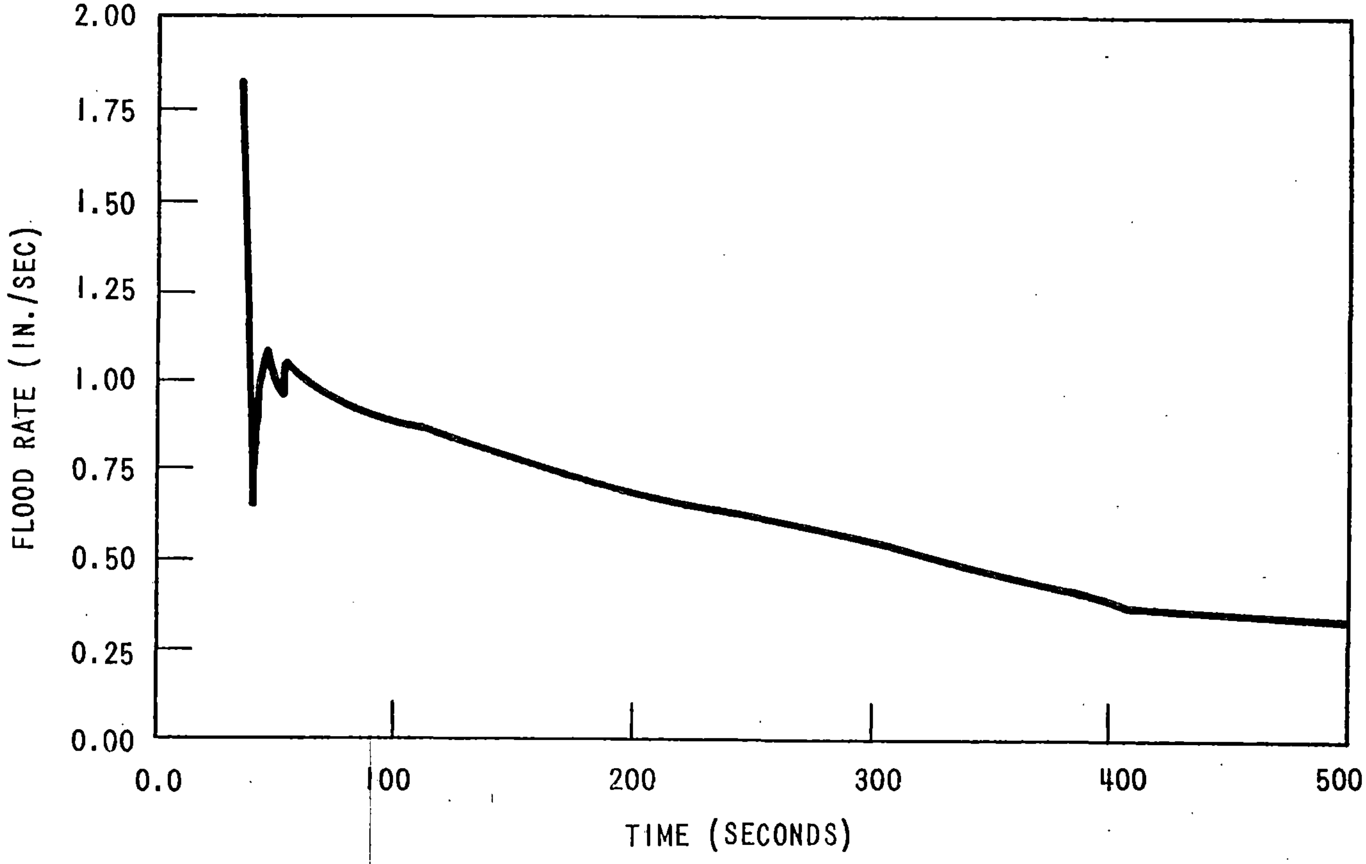

Figure 11a. Reflood Transient - DECLG (C_D= 0.4) Core Inlet Velocity

12419-2

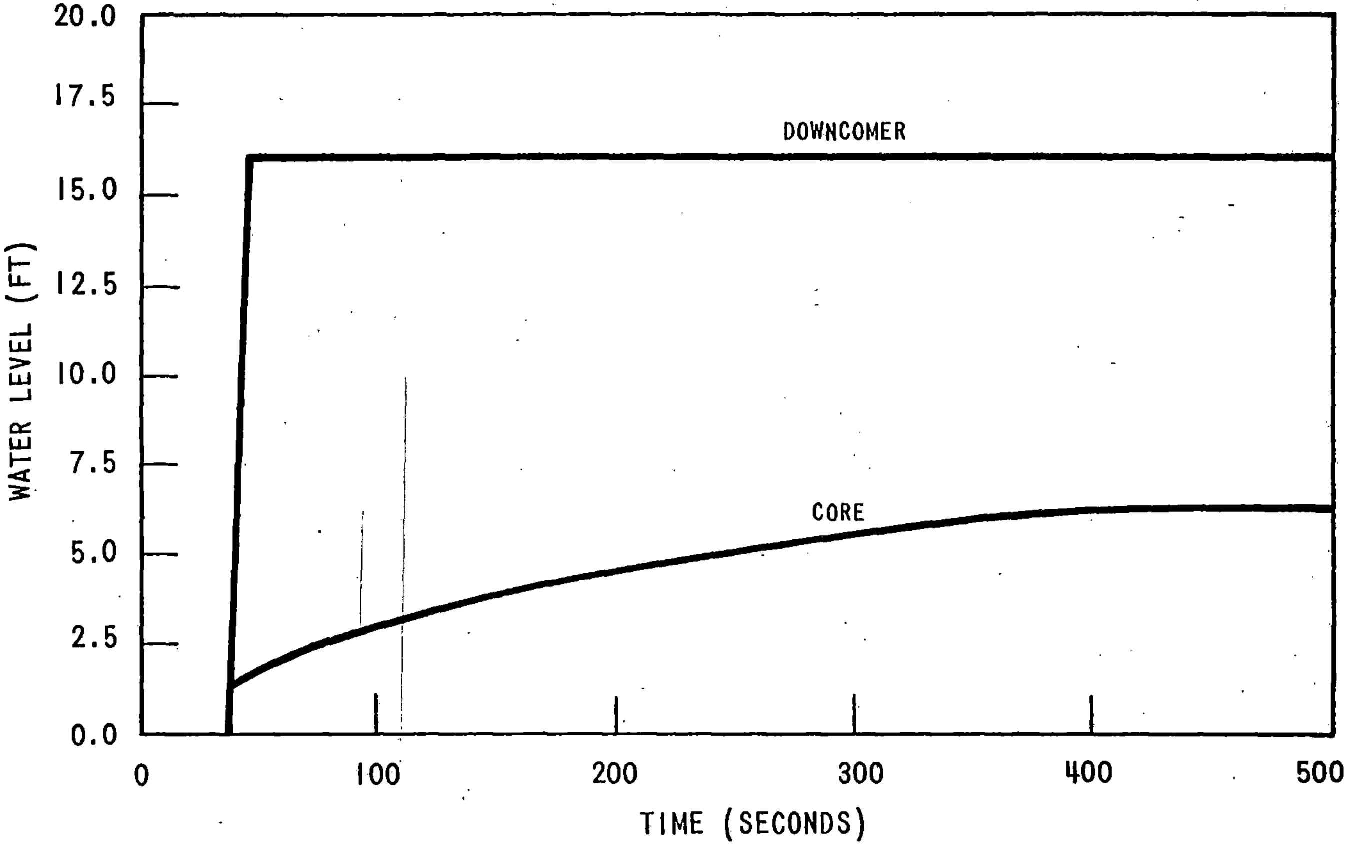

Figure 11b. Reflood Transient - DECLG (C_D = 0.4) Downcomer and Core Water Levels

12419-3

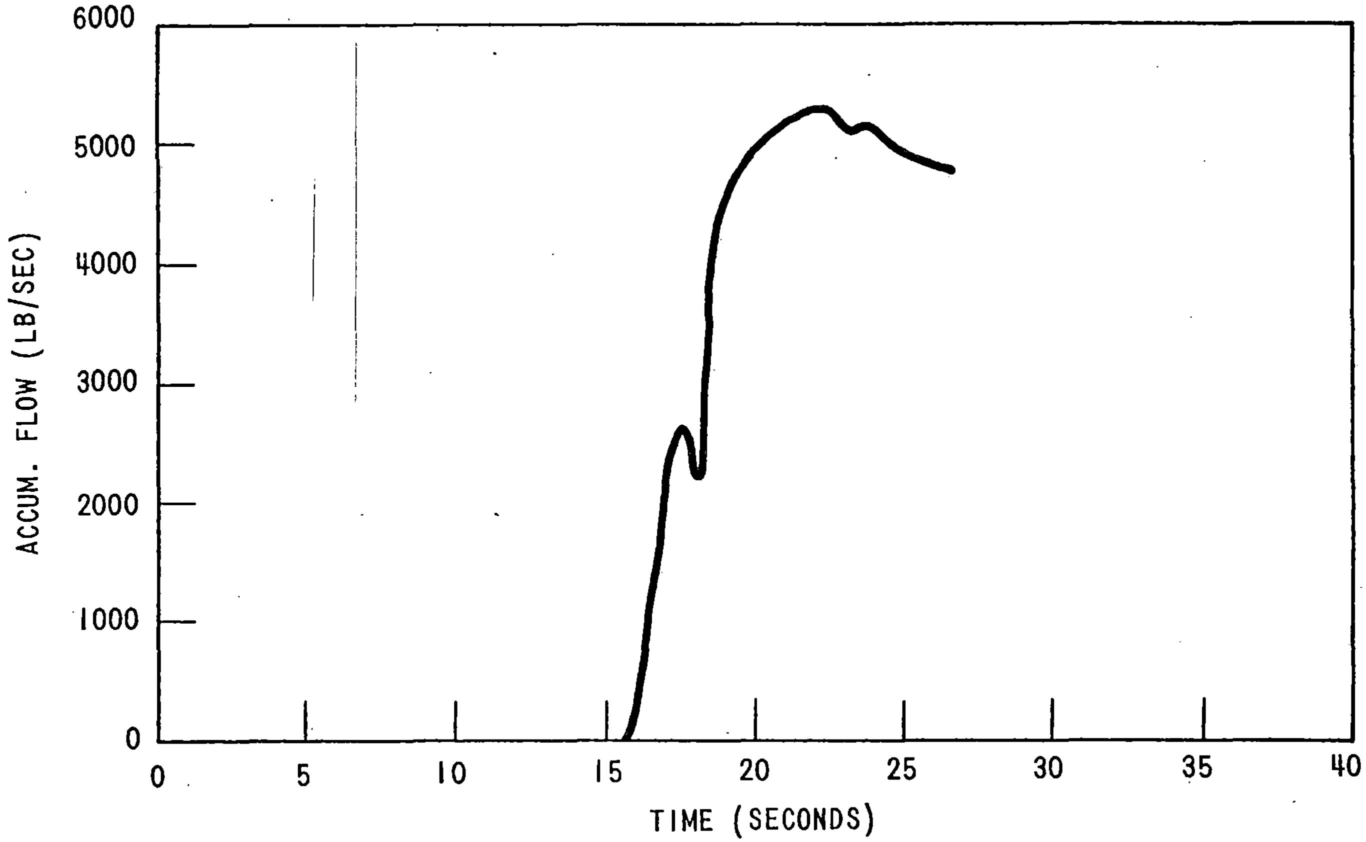

Figure 12. Accumulator Flow (Blowdown) - DECLG (C_D = 0.4)

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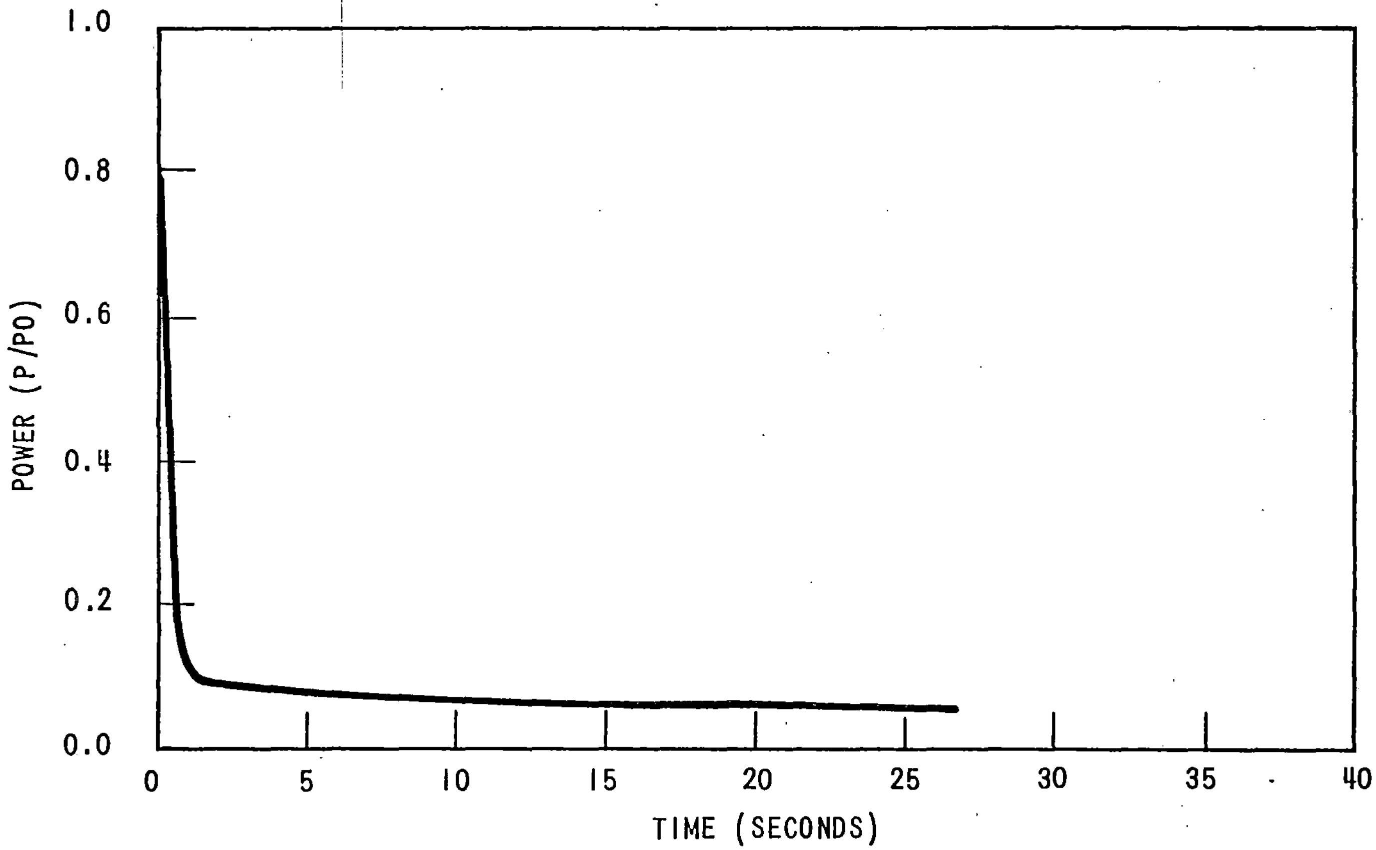

Figure 13. Core Power Transient - DECLG (C_D = 0.4)

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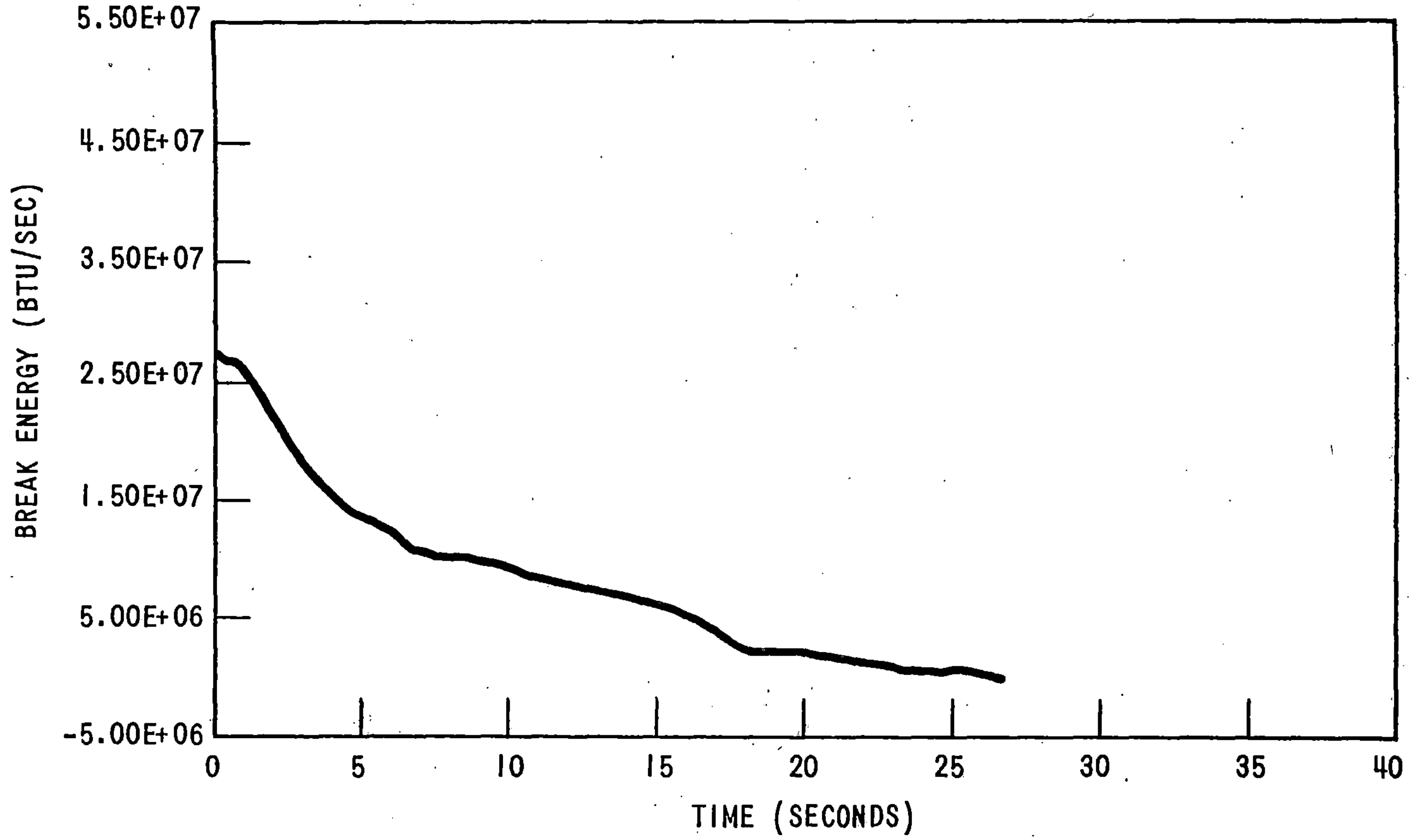

Figure 14. Break Energy Released to Containment

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