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Forwards corrected value for containment spray flow rate as part of ECCS performance analysis. Analysis supports continued oper of unit at peak linear heat rate of 14.8KW/ft w/cy of Reportable Occurrence 335-78-38 re erroneous values.

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FLORIDA POWER & LIGHT COMPANY

November 9, 1978
L-78-356

Office of Nuclear Reactor Regulation
Attention: Mr. R. W. Reid, Chief
Operating Reactors Branch #4
Division of Operating Reactors
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Reid:

Re: St. Lucie Unit 1
Docket No. 50-335
ECCS Performance Results

During a review of ECCS parameters, which was conducted as part of the Cycle 3 reload safety analysis, it was determined that an incorrect containment spray flow rate was used in the St. Lucie ECCS analysis. A description of this occurrence is contained in Reportable Occurrence Report 335-78-38 (attached).

The purpose of this letter is to submit the results of an ECCS performance analysis for St. Lucie Unit 1, Cycle 2, in which the correct value of containment spray flow rate has been used. The analysis supports continued operation of the unit at a peak linear heat rate of 14.8 kw/ft.

Very truly yours,

Robert E. Uhrig
Vice President

REU/MAS/cpc

Attachments

cc: Mr. James P. O'Reilly, Region II
Harold F. Reis, Esquire

7811160107

FLORIDA POWER & LIGHT COMPANY

PRN-LI-78-291
October 5, 1978

Mr. James P. O'Reilly, Director, Region II
Office of Inspection and Enforcement
U. S. Nuclear Regulatory Commission
101 Marietta Street, Suite 3100
Atlanta, Georgia 30303

Dear Mr. O'Reilly:

REPORTABLE OCCURRENCE 335-78-38
ST. LUCIE UNIT 1
DATE OF OCCURRENCE: SEPTEMBER 25, 1978

ECCS ANALYSIS

The attached Licensee Event Report is being submitted in accordance with Technical Specification 6.9 to provide prompt notification of the subject occurrence.

Very truly yours,

A. D. Schmidt
Vice President
Power Resources

WAK/dlh

Attachment

cc: Harold F. Reis, Esquire
Director, Office of Inspection and Enforcement (40)
Director, Office of Management Information and Program Control (3)

NRC FORM 366
(7-77)

U. S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT

CONTROL BLOCK: | | | | | | | (1) (PLEASE PRINT OR TYPE ALL REQUIRED INFORMATION)

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0 1	REPORT SOURCE L (6)	0 5 0 0 0 3 3 5 (7)	0 9 2 5 7 8 (8)	1 0 0 5 7 8 (9)
		DOCKET NUMBER	EVENT DATE	REPORT DATE

EVENT DESCRIPTION AND PROBABLE CONSEQUENCES (10)

| 0 2 | During review of the ECCS parameters for the Cycle 3 reload safety

| 0 3 | analysis, it was determinded that an error had been made in the input

| 0 4 | to the St. Lucie ECCS analysis concerning the containment spray flow rate.

| 0 5 | The NSSS vendor performed a reanalysis for Cycle 2 using the corrected

| 0 6 | spray pump flow. The reanalysis on this item confirms that St. Lucie 1

| 0 7 | does not exceed the Appendix K limit.

| 0 8 |

| 0 9 | SYSTEM CODE: S B (11) | CAUSE CODE: B (12) | CAUSE SUBCODE: A (13) | COMPONENT CODE: Z Z Z Z Z Z (14) | COMP. SUBCODE: Z (15) | VALVE SUBCODE: Z (16)

(17) LER/RO REPORT NUMBER: EVENT YEAR 7 8 | — | SEQUENTIAL REPORT NO. 0 3 8 | / | OCCURRENCE CODE 0 1 | REPORT TYPE T | — | REVISION NO. 0

ACTION TAKEN: X (18) | FUTURE ACTION: Z (19) | EFFECT ON PLANT: Z (20) | SHUTDOWN METHOD: Z (21) | HOURS (22): 0 0 0 0 | ATTACHMENT SUBMITTED: Y (23) | NPRD-4 FORM SUB.: N (24) | PRIME COMP. SUPPLIER: Z (25) | COMPONENT MANUFACTURER: Z 9 9 9 (26)

CAUSE DESCRIPTION AND CORRECTIVE ACTIONS (27)

| 1 0 | The cause of the incorrectly assumed CSP flow rate was due to

| 1 1 | ambiguous data supplied by the AE. We have reviewed the ECCS parameters

| 1 2 | for the Cycle 2 reload safety analysis to ensure that all input to the

| 1 3 | analysis is correct. An amendment to the Cycle 2 ECCS analysis will be

| 1 4 | submitted in the near future.

| 1 5 | FACILITY STATUS: E (28) | % POWER: 1 0 0 (29) | OTHER STATUS (30): NA | METHOD OF DISCOVERY: C (31) | DISCOVERY DESCRIPTION (32): SPECIAL INVESTIGATION

| 1 6 | ACTIVITY RELEASED: Z (33) | CONTENT OF RELEASE: Z (34) | AMOUNT OF ACTIVITY (35): NA | LOCATION OF RELEASE (36): NA

PERSONNEL EXPOSURES

| 1 7 | NUMBER: 0 0 0 (37) | TYPE: Z (38) | DESCRIPTION (39): NA

PERSONNEL INJURIES

| 1 8 | NUMBER: 0 0 0 (40) | DESCRIPTION (41): NA

LOSS OF OR DAMAGE TO FACILITY (43)

| 1 9 | TYPE: Z (42) | DESCRIPTION: NA

PUBLICITY

| 2 0 | ISSUED: N (44) | DESCRIPTION (45): NA | NRC USE ONLY

NAME OF PREPARER: M. A. Schoppman

PHONE: (305) 552-3802

ADDITIONAL EVENT DESCRIPTION

During review of the ECCS parameters for the Cycle 3 reload safety analysis, it was determined that an error had been made in the input to the St. Lucie ECCS analysis concerning the containment spray flow rate. The flow rate used was the value for 1 pump, not the required 2-pump flow rate. To evaluate the impact of this error, an analysis was performed for Cycle 2 by the NSSS vendor using the corrected spray pump flow. Whereas, the prior ECCS analyses has used reflood heat transfer coefficients derived from COMPRERC-II based upon spray pump flow of 3375 gpm and a Peak Linear Heat Generation Rate (PLHGR) of 17.0 kw/ft, the new analysis used reflood heat transfer coefficients based on a spray pump flow of 6750 gpm and the current PLHGR Technical Specification limit of 14.8 kw/ft. In each case the Peak Clad Temperature (PCT) was determined using STRIKIN-II with a PLHGR of 14.8 kw/ft and the respective reflood heat transfer coefficients. The increase in reflood heat transfer coefficients resulting from the reduction in PLHGR from 17.0 to 14.8 kw/ft more than offset any decrease in heat transfer coefficients due to the doubling of spray pump flow. As a result the PCT calculated by STRIKIN-II decreased from the value of 2035°F determined for Cycle 2 to a revised value of 2022°F. This completes the renalysis on this item and confirms that St. Lucie 1 does not exceed the Appendix K limit.

St. Lucie 1 Cycle 2 ECCS Performance
Performance Results
(Revision 1, October 5, 1978)

1.0 Introduction and Summary

Reference 1 presents the ECCS performance analysis performed for St. Lucie 1, Cycle 2. This report presents a supplementary analysis performed to assess the impact of an increase in containment spray flow on ECCS performance. The results of this supplementary evaluation support continued operation of St. Lucie 1 at a peak linear heat generation rate (PLHGR) of 14.8 kw/ft and demonstrate compliance with the NRC Acceptance Criteria [2]. The method of analysis and detailed results are presented in the following sections.

2.0 Method of Analysis

The analysis presented in Reference 1 was performed with a total containment spray flow of 3375 gpm. This supplementary analysis was performed with an increased total containment spray of 6750 gpm. The method of analysis utilized the CE Large Break Evaluation Model described in Reference 3. The evaluation was performed for the limiting break, the 0.8 DES/PD*, defined in Reference 1.

The increase in containment spray flow does not affect the blowdown transient so no new blowdown calculations were performed. The increase in total containment spray flow does affect the containment pressure during the reflood transient, however. To evaluate the effect of the increase in

*DES/PD = Double Ended Slot in Pump Discharge containment spray flow on ECCS performance, a new COMPERC-II[4] refill-reflood hydraulics calculation was performed. The results were then used to generate new refill-reflood heat transfer coefficients. The STRIKIN-II[5] hot rod transient calculation was then performed using the newly generated refill-reflood heat transfer coefficients to identify the hot rod clad temperature response.

3.0 Results

The increased containment spray flow resulted in a containment pressure approximately 2 psi lower than that of the Reference 1 analysis at the time of the peak clad temperature. The time of peak clad temperature occurs at about 250 seconds. The Reference 1 analysis employed the COMPERC-II refill reflood analysis reported in Reference 6. In this analysis the reflood period is described by three reflood rates. For the Reference 1 analysis and this new supplementary evaluation, the first two reflood rates remained the same since the containment back pressure is essentially the same during this time period. The new third reflood rate was reduced since the increased containment spray flow reduced the containment pressure during the time period associated with the third reflood rate. The new containment pressure response is shown in Figure 1 along with the Reference 1 response for comparison. Figure 2 compares the resulting reflood mass added responses and defines the associated reflood rates.

The results of this analysis as compared to the Reference 1 analysis are presented in Table 1. Despite the decrease in containment pressure and third reflood rate, the clad temperature was calculated to be lower in this supplementary analysis. The explanation for these results are discussed in section 4.0 of this report.

Table 2 presents a list of the significant parameters displayed graphically for the 0.8 DES/PD break.

4.0 Evaluation of Results

In the Reference 1 analysis, the hot rod refill-reflood heat transfer coefficients calculated by the COMPERC-II code and used in the STRIKIN-II temperature code, were generated at the very conservative PLHGR of 17.0 kw/ft. These conservative refill-reflood heat transfer coefficients were originally generated in the ECCS performance evaluation presented in Reference 6. In performing the re-evaluation presented herein, the refill-reflood heat transfer coefficients were generated at the cycle 2 PLHGR limit of 14.8 kw/ft. The use of the lower PLHGR resulted in a lower peak clad temperature (2022°F vs 2035°F of Table 1) for this re-evaluation since the improved heat transfer realized during the first two reflood rates more than compensated for the potential detrimental effects of the lower third reflood rate.

5.0 Computer Code Version Identification

The following versions of the Combustion Engineering ECCS Evaluation Model computer codes were used in this analysis:

COMPERC-II: Version No. 75097

STRIKIN-II: Version No. 76234

6.0 References

1. Reload Safety Evaluation, Attachment 2 to FP&L letter No. L-78-99 of March 22, 1978, subject: Proposed Amendment to Facility Operating License DPR-67 (Docket No. 50-335).

2. Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Cooled Nuclear Power Reactors, Federal Register, Vol. 39, No. 3, Friday, January 4, 1974.

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).

4. CENPD-134, "COMPERC-II, A Program for Emergency Refill-Reflood of Core", April 1974 (Proprietary).

   CENPD-134, Supplement 1, "COMPERC-II, A Program for Emergency Refill-Reflood of the Core (Modification)", December 1974 (Proprietary).

5. CENPD-135, "STRIKIN-II, A Cylindrical Geometry Fuel Rod Heat Transfer Program," April 1974 (Proprietary).

   CENPD-135, Supplement 2, "STRIKIN-II, A Cylindrical Geometry Fuel Rod Heat Transfer Program (Modification)", February 1975 (Proprietary).

   CENPD-135, Supplement 4, "STRIKIN-II, A Cylindrical Geometry Fuel Rod Heat Transfer Program", August 1976 (Proprietary).

6. St. Lucie Nuclear Power Plant (formerly Hutchinson Island) Unit 1, Final Safety Analysis Report in Support of Docket No. 50-335 License No. DPR-67.

Table 1

St. Lucie I ECCS Performance Results
with Increased Containment Spray Flow

	Reference Cycle 2 Results	Re-analysis With Increased Containment Spray Flow
Break size,	0.8 DES/PD	0.8 DES/PD
Peak Clad Temperature, °F	2035	2022
Peak Local Clad Oxidation, %	12.0	12.0
Core-Wide Clad Oxidation; %	<.63	<.63
Hot Rod Rupture Time, sec.	54.9	55.1

Table 2

Variables Plotted as a Function of Time

Variable	Figure No.
Containment Pressure	1
Mass Added to Core During Reflood	2
Peak Clad Temperature	3
Water Level in Downcomer During Reflood	4
Gap Conductance	5
Local Clad Oxidation	6
Clad Temperature, Centerline Fuel Temperature, Average Fuel Temperature and Coolant Temperature for Hottest Node	7
Hot Spot Heat Transfer Coefficient	8
Hot Rod Internal Gas Pressure	9
Combined Spillage and Spray into Containment	10

FIGURE 1

ST LUCIE I CYCLE 2 WITH
INCREASED CONTAINMENT SPRAY FLOW,
CONTAINMENT PRESSURE

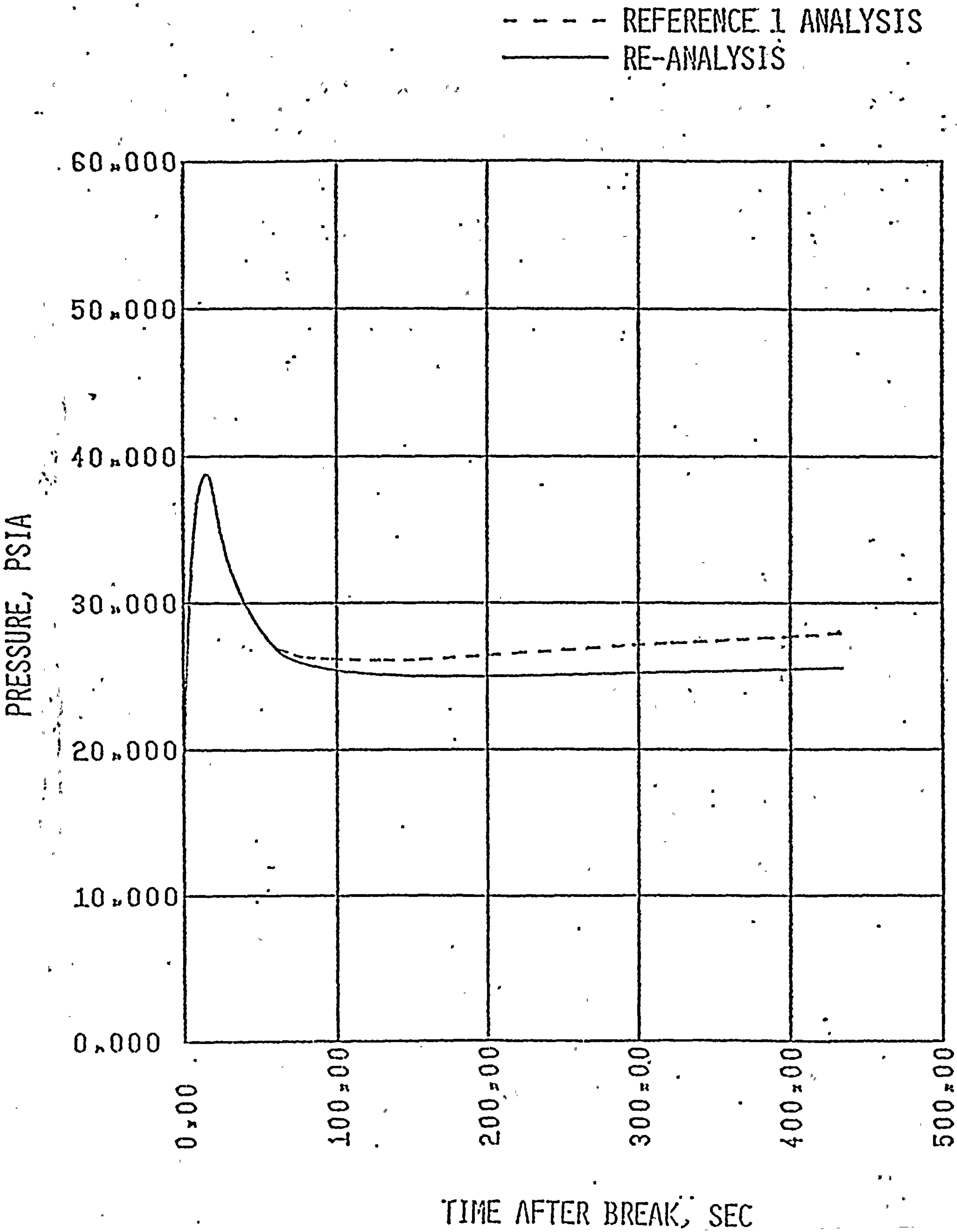
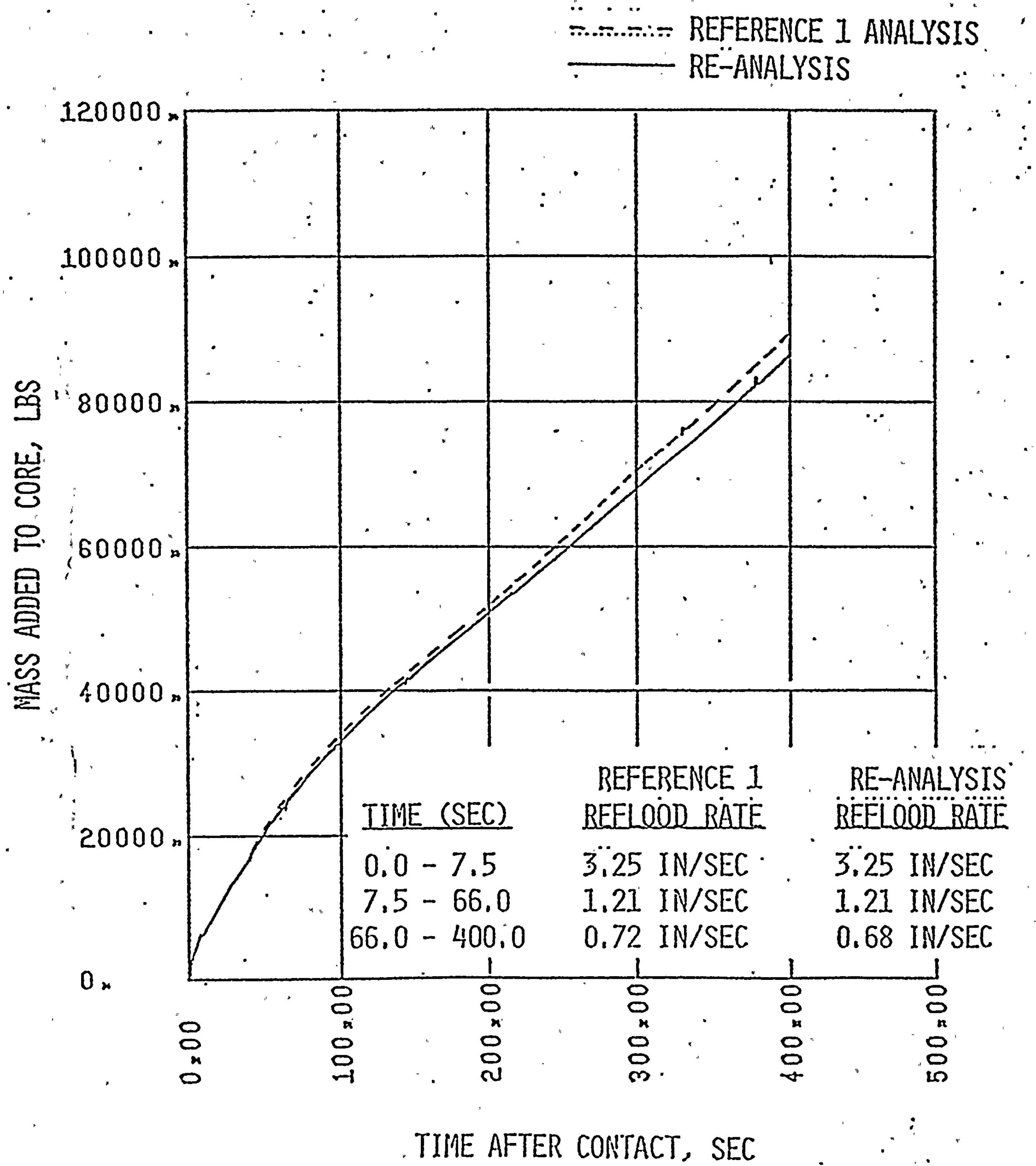


FIGURE 2

ST LUCIE I CYCLE 2 WITH INCREASED CONTAINMENT SPRAY FLOW, MASS ADDED TO CORE DURING REFLOOD



ST LUCIE 1 CYCLE 2 WITH INCREASED CONTAINMENT SPRAY FLOW, PEAK CLAD TEMPERATURE

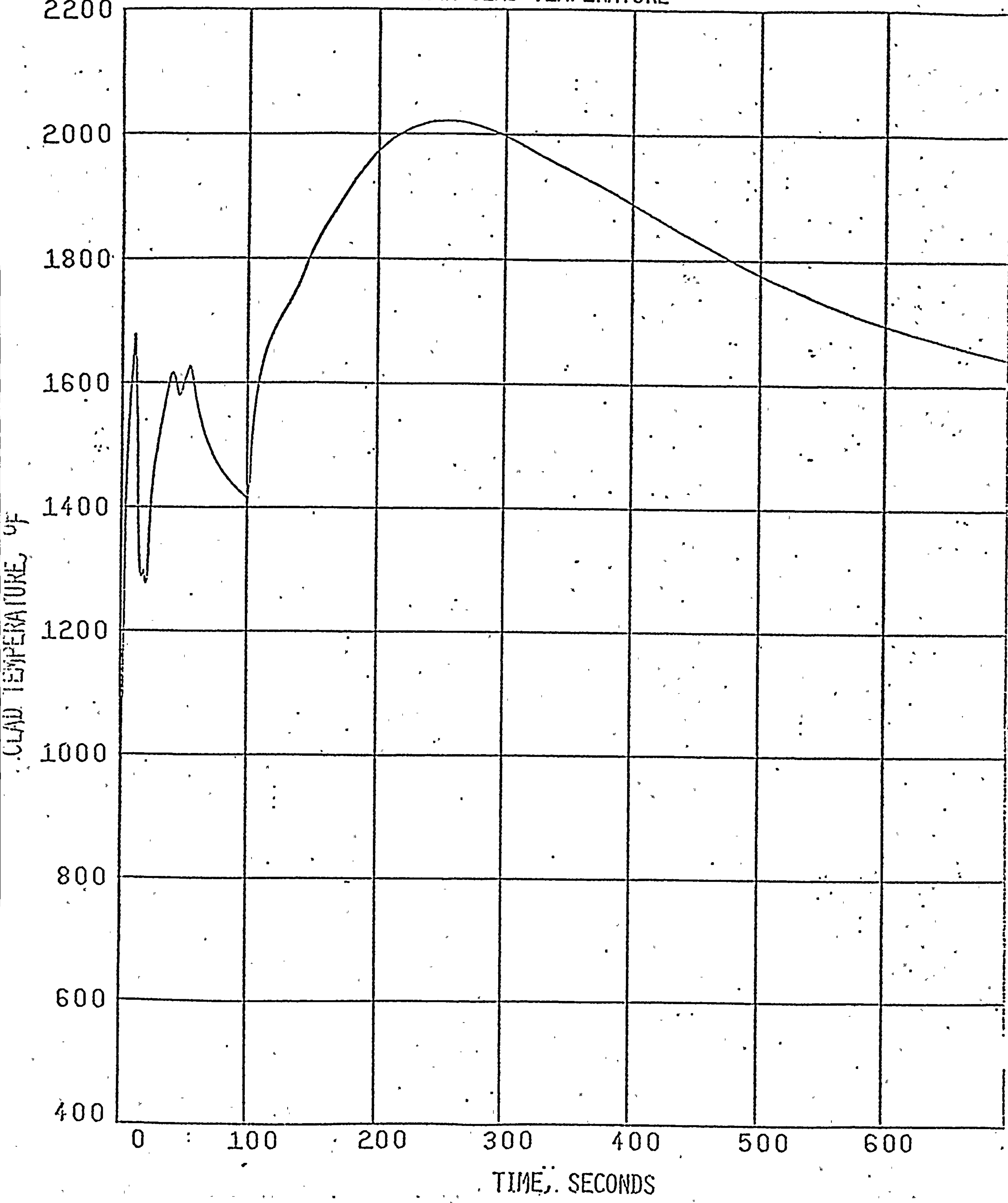


FIGURE 4

ST LUCIE I CYCLE 2 WITH
INCREASED CONTAINMENT SPRAY FLOW,
WATER LEVEL IN DOWNCOMER DURING REFLOOD

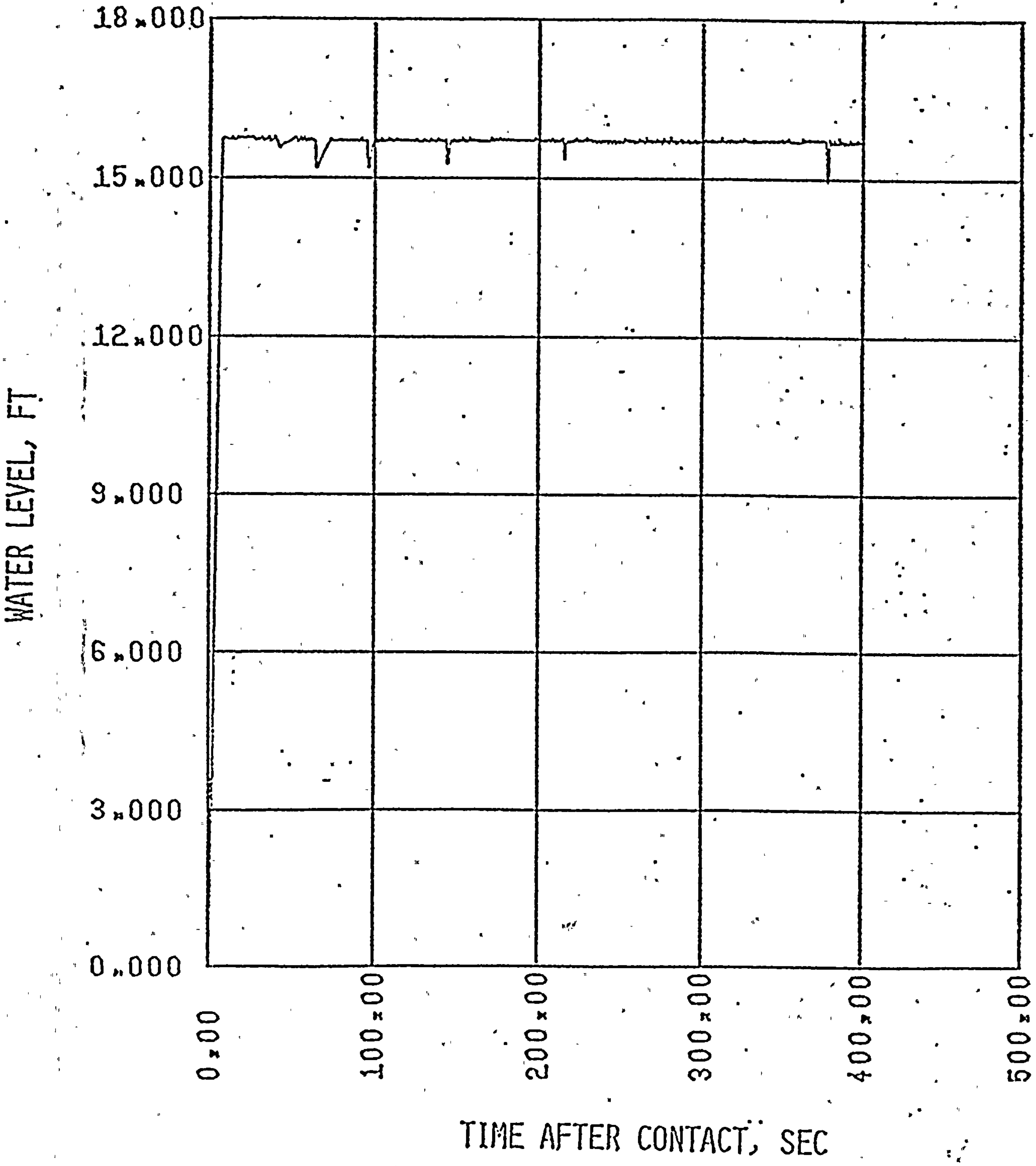
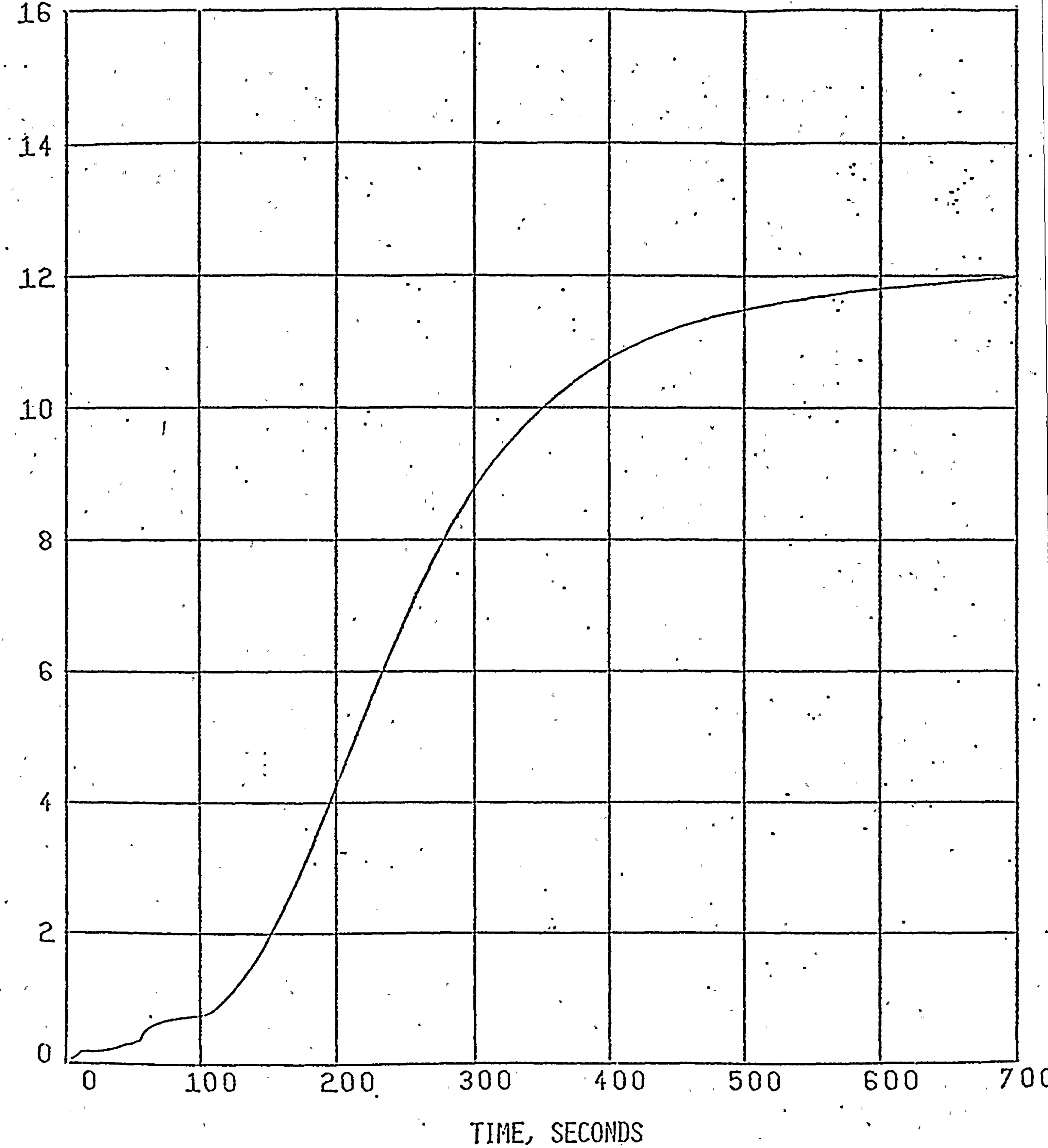


FIGURE 6

ST LUCIE I CYCLE 2 WITH
INCREASED CONTAINMENT SPRAY FLOW,
LOCAL CLAD OXIDATION.



[illegible]

[illegible]

[illegible]

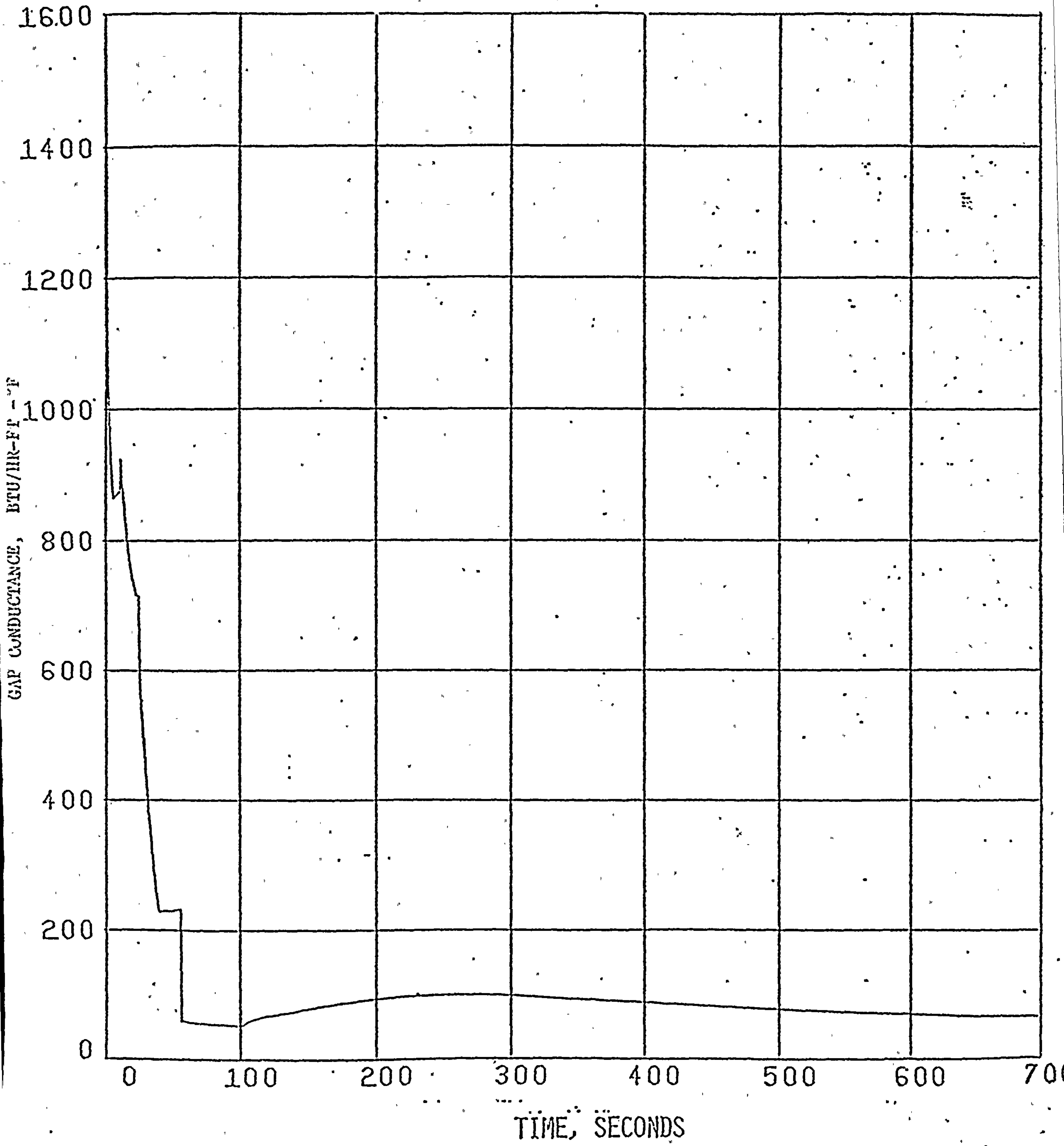
[illegible]

[illegible]

[illegible]

FIGURE 5

ST LUCIE I CYCLE 2 WITH INCREASED CONTAINMENT SPRAY FLOW, HOT SPOT GAP CONDUCTANCE



[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

FIGURE 7

ST LUCIE I CYCLE 2 WITH
INCREASED CONTAINMENT SPRAY FLOW;
CLAD TEMPERATURE, CENTERLINE FUEL TEMPERATURE, AVERAGE FUEL TEMPERATURE AND COOLANT TEMPERATURE FOR HOTTEST NODE

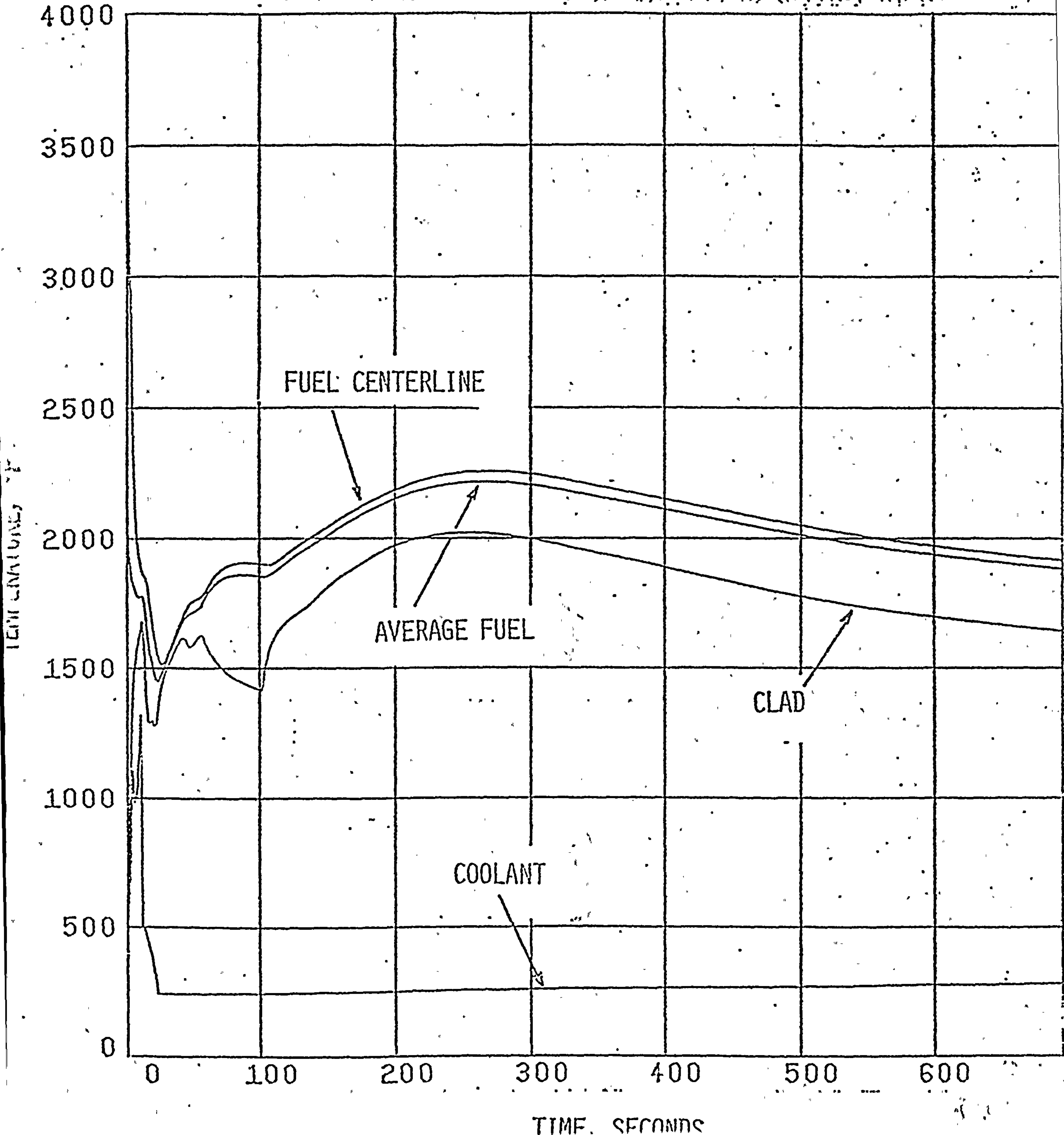


FIGURE 8

ST LUCIE I CYCLE 2 [redacted]TH
INCREASED CONTAINMENT SPRAY FLOW,
HOT SPOT HEAT TRANSFER COEFFICIENT

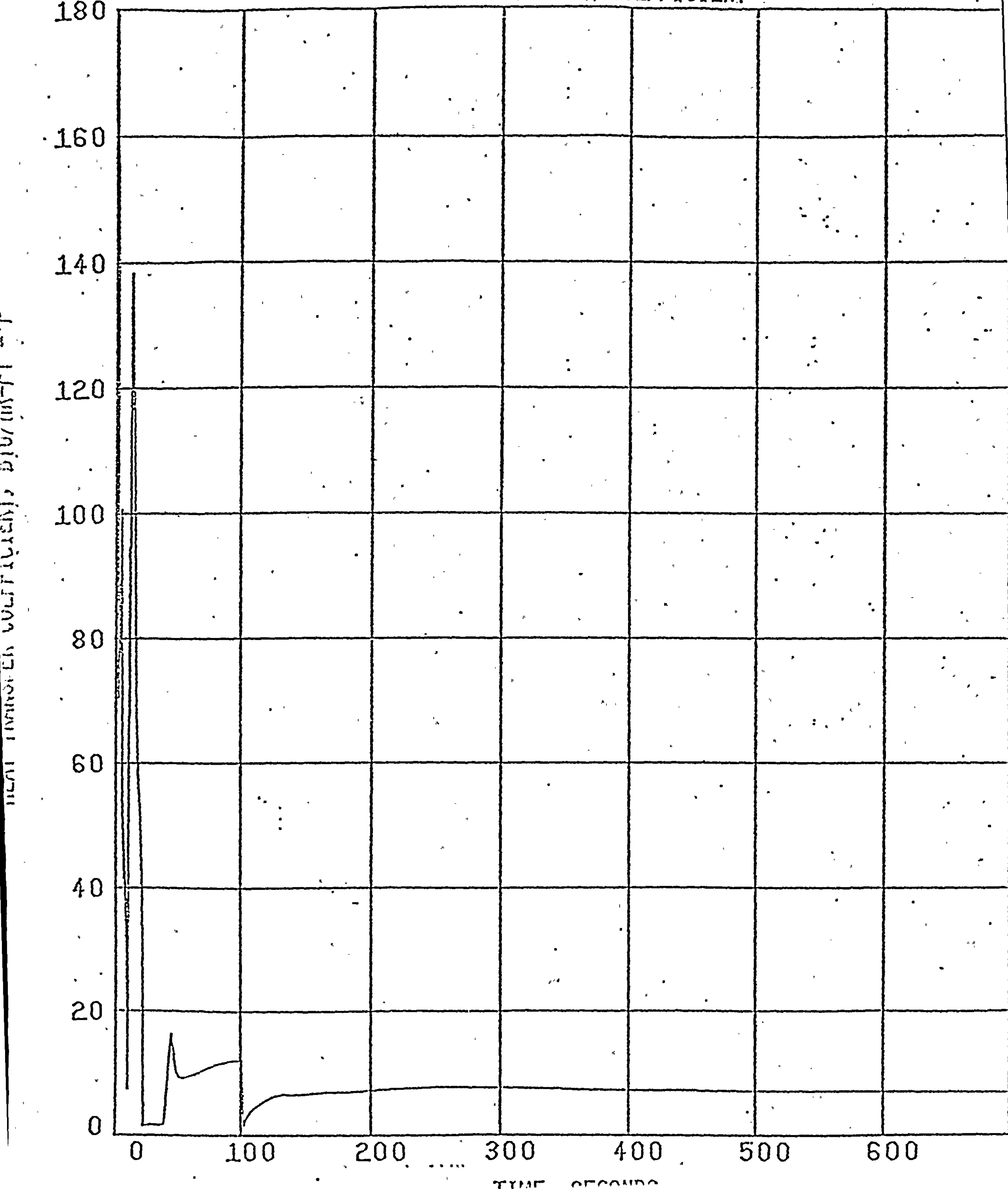


FIGURE 9

ST LUCIE I CYCLE 2 WITH
INCREASED CONTAINMENT SPRAY FLOW,
HOT ROD INTERNAL GAS PRESSURE

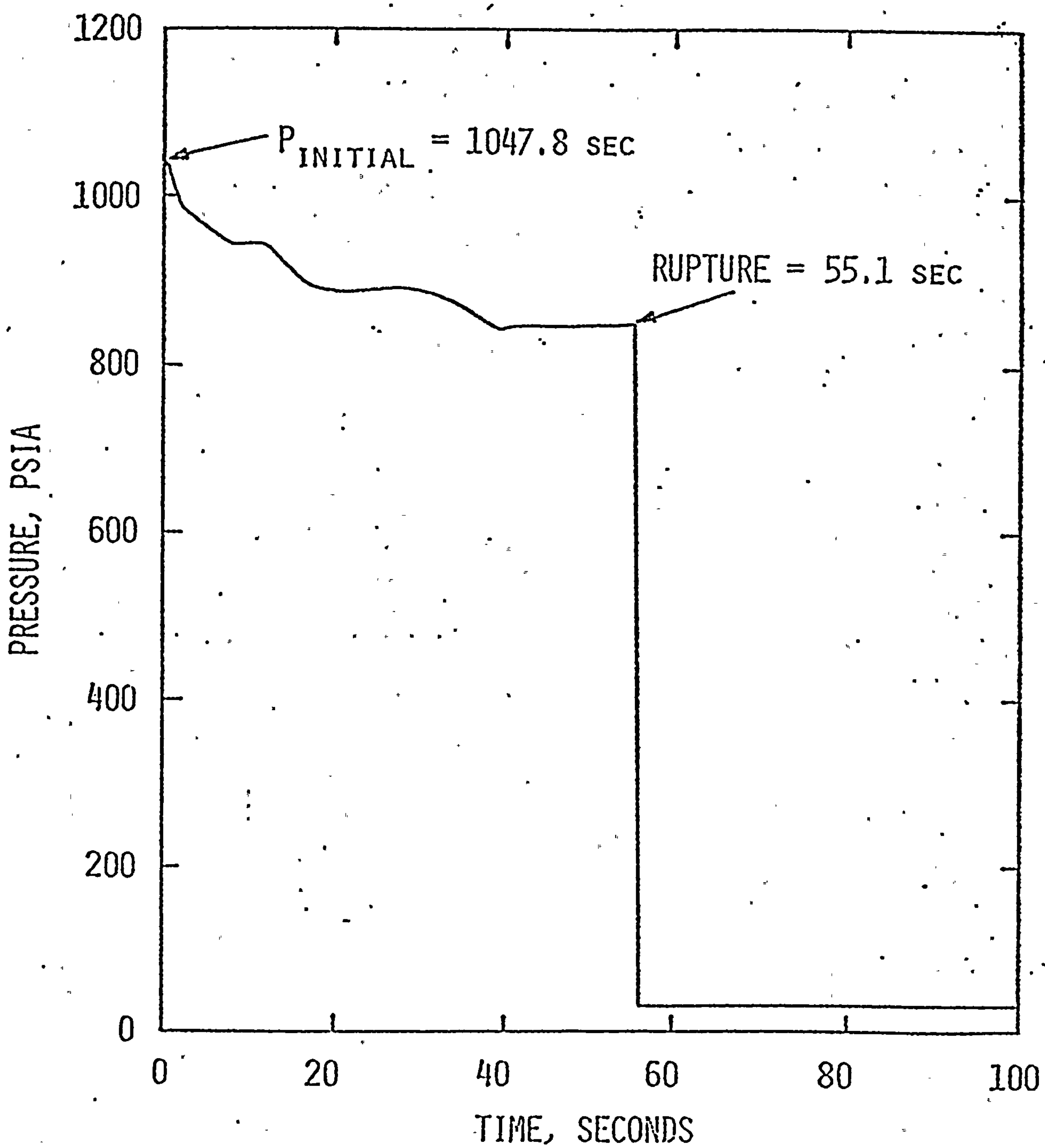


FIGURE 10

ST LUCIE I CYCLE 2 WITH INCREASED CONTAINMENT SPRAY FLOW, COMBINED SPILLAGE AND SPRAY FLOW INTO CONTAINMENT