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RE-ANALYSIS OF CSNI STANDARD PROBLEM NO.8

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Re-analysis of CSNI Standard Problem No.8

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This report presents the results of computer runs which carried out with the use of ALARM-P1 code. The object of analyses is the Semiscale S-06-3 experiment accepted as the CSNI International Standard Problem 8. According to the preliminary results reported before, the agreement between ALARM-P1 and this experiment was very poor for the key parameters such as the break flow or fuel cladding surface temperature. Hence, much effort has been made to improve the disagreement.

Through the re-examination of both the code and input-data, the agreement between the calculated and measured results for key parameters has been much better than that gained in the foregoing test run.

Keywords: Semiscale Test, Blowdown, Rewet, Heat Transfer Mode,
Subcooled Critical Flow, International Standard Problem

CSNI 標準問題No.8の再解析

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本報は，計算コードALARM－P1を用いて行なったセミスケールS－06－3実験に基づくCSNI国際標準問題No.8の再解析の結果を示す。

以前に報告された解析においては，ALARM－P1と実験値との比較を行なうと破断流量や炉心表面温度といった主要パラメータに対して十分な結果が得られなかった。そこで本解析では，これらのパラメータ改善に向けられた。

予備解析から見出された結論に基づき，入力データと計算コード双方の問題点を調査し，再び計算を行なった結果，炉心表面温度，破断流量等は大きく改善され，実験データをかなり正確に再現した。

CONTENTS

目　　次

List of Figures

List of Tables

1. Introduction

An improved analysis of the Semiscale S-06-3 test was completed using the ALARM-P1 and described in this report. This experiment was designed to duplicate as closely as possible the LOFT nuclear test L2-3. The experiment conducted on May 1977 has been selected as the CSNI International Standard Problem No.8 (ISP8). A preliminary calculation for this exercise was already submitted from Japan to NEA-CSNI (Nuclear Energy Agency-Committee on Safety of Nuclear Installations).(1)*

The blowdown heat transfer test S-06-3 was executed from the initial conditions of 15768 kPa and 598 °K (in the upper-plenum) with a core power of 1.004 MW and simulated a 200 % double-ended offset shear in the cold leg. ECC (Emergency Core Cooling) water was only injected into the intact loop cold leg from HPIS, LPIS (High Pressure Injection System, Low Pressure Injection System) and accumulator. The specific purpose of this experiment was to evaluate the core heat transfer phenomena at the intermediate power.

The results previously submitted to CSNI had included significant disagreements with the experimental data. Based on this experience, efforts have been made to improve the analytical results, by correcting errors and inadequacies in the computer code ALARM-P1, which was used in the previous and present analysis, as well as revising the input data set. Though the experiment covered from blowdown to refill-reflood phase of transient, both previous and present analyses by ALARM-P1 covered only the blowdown portion (0-40 seconds), since this code was originally designed to analyse only the blowdown phase.

Analytical results were compared with selected pertinent thermal-hydraulic data obtained from the experiment(2), being documented in this

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*) Number in bracket designates reference

report with a discussion of modelling changes and corrections of input data. As seen in the following section, the discharge flow or the clad surface temperature response for low-powered rods were excellently assessed in the current runs. However, several parameters were still out of the agreement with the measured data. Using useful information obtained from the current analysis, they are expected to be improved much better by means of the refinements of the analytical methodology and more reasonable input data.

An outline relative to the Semiscale Mod-1 system is given in the Figure 1 and 2. Figure 3 represents the noding scheme of this facility which is the same as that of the previous calculation. In addition, the geometrical data and initial conditions are provided in the Tables 1 through 3.

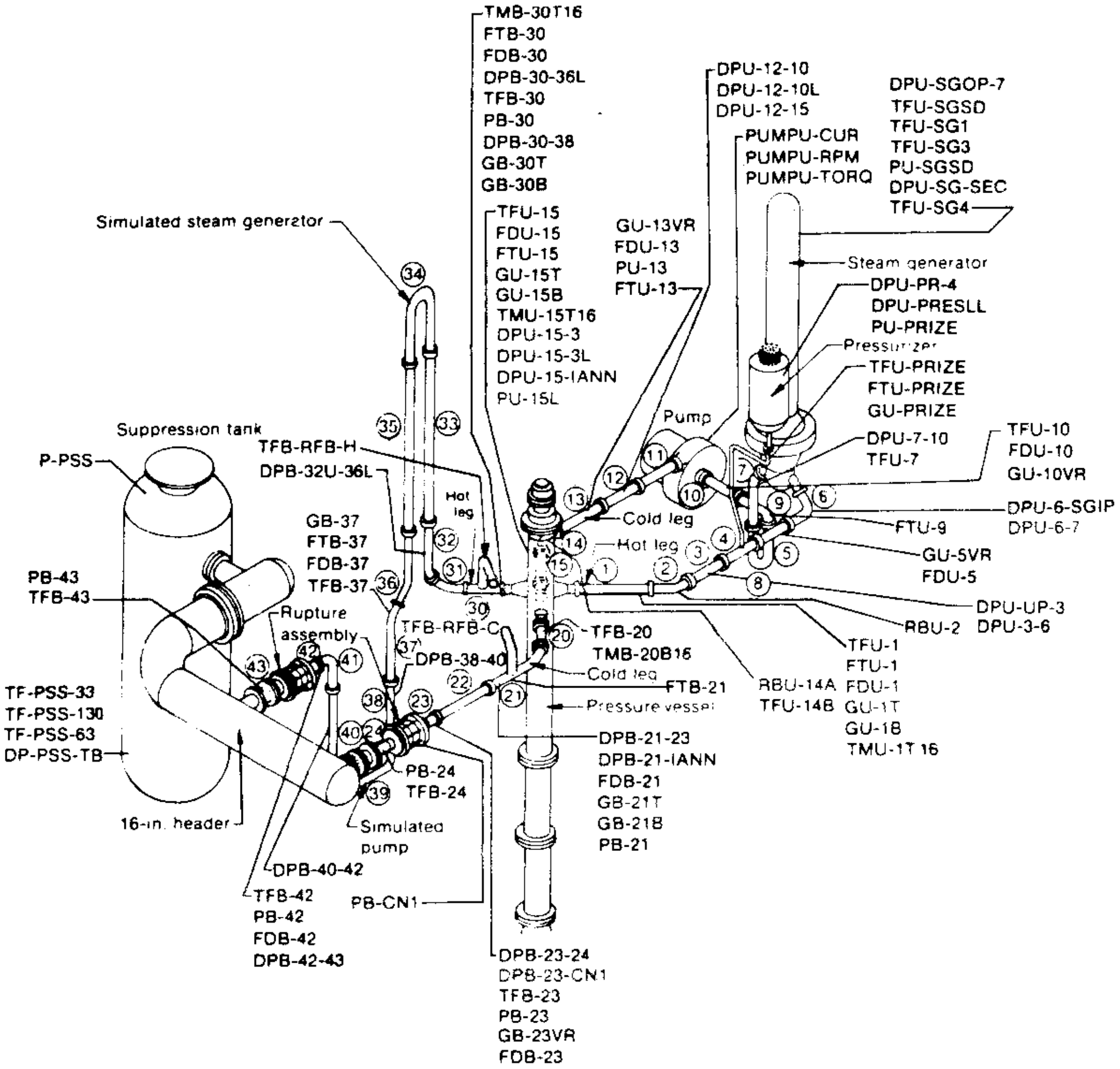

Fig.1 Semiscale Mod-1 system and instrumentation for cold leg break configuration -- isometric.

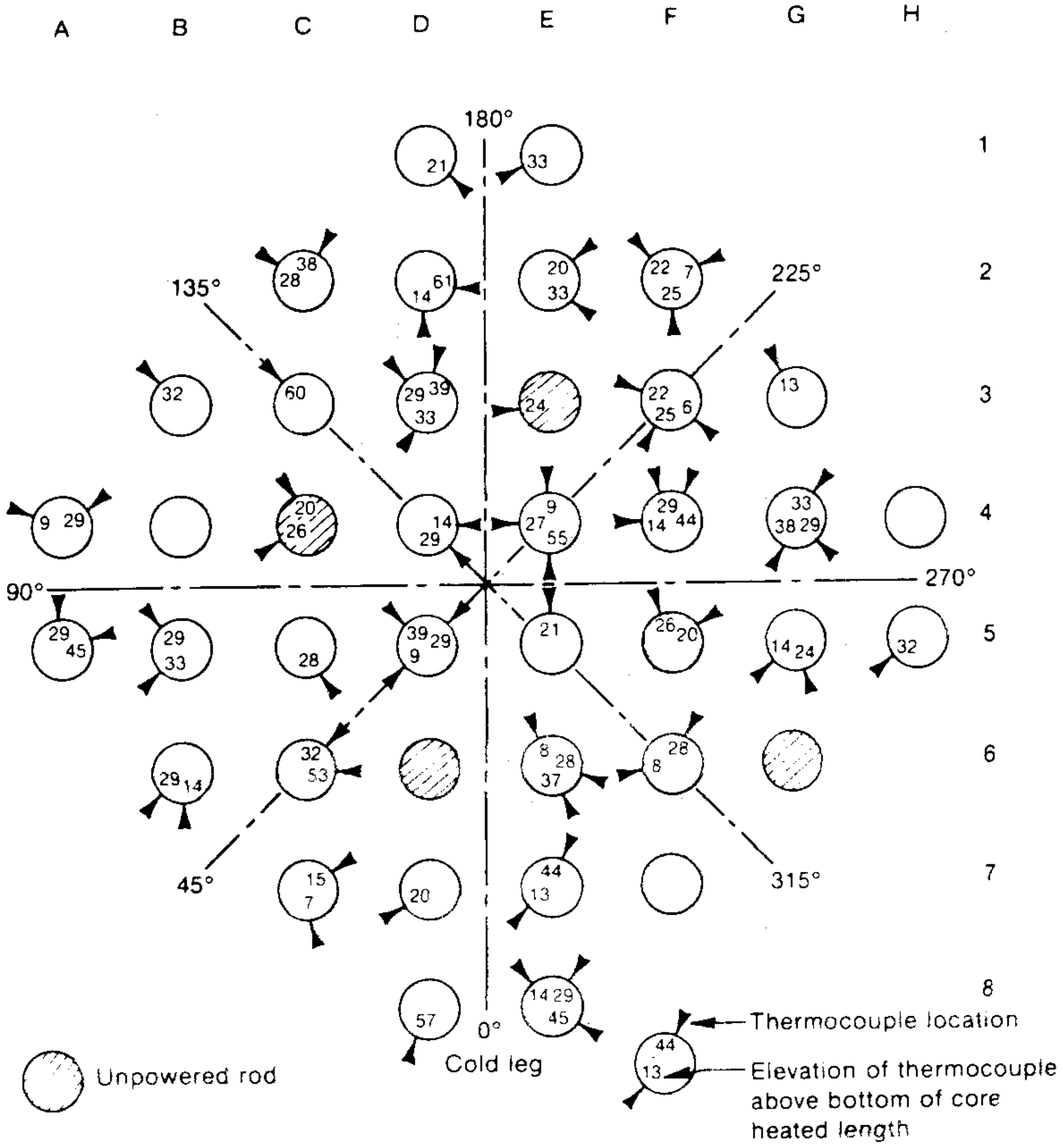

Fig.2 Semiscale Mod-1 heated core Lay-out.

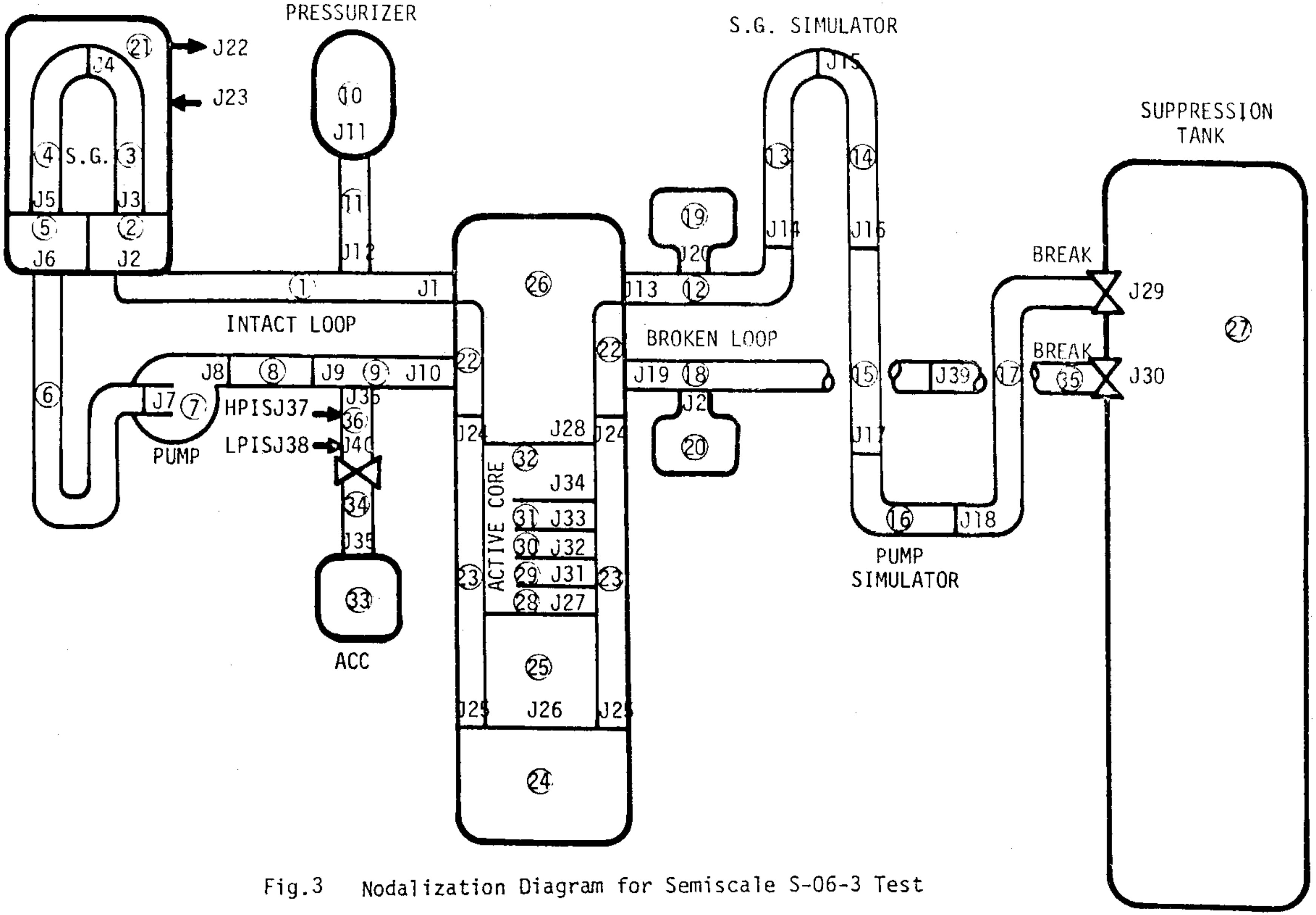

Fig.3 Nodalization Diagram for Semiscale S-06-3 Test

Table 1 Geometrical Description of Semiscale S-06-3 Model Control Volumes

Control volume	Description	Volume(m^3)	Flow Area(m^2)
1	Intact loop hot leg piping	0.01082	0.00349
2	Steam Generator inlet plenum	0.00963	0.01984
3	Steam generator U-tubes	0.01140	0.00442
4	Steam generator U-tubes	0.01140	0.00442
5	Steam generator outlet plenum	0.00963	0.01984
6	Pump suction leg	0.01018	0.00349
7	Primary coolant pump	0.00408	0.00349
8	Cold leg piping	0.00425	0.00349
9	Cold leg piping	0.00425	0.00349
10	Pressurizer	0.02741	0.02466
11	Pressurizer surge line	0.00037	4.3E-5
12	Broken loop hot leg piping	0.00315	0.00349
13	S.G. simulator	0.00852	0.00374
14	S.G. simulator	0.00852	0.00374
15	Outlet piping from S.G. simulator	0.00252	0.00158
16	Pump simulator	0.00147	0.00198
17	Break node	0.00227	0.00145
18	Broken loop cold leg	0.00461	0.00349
19	Reflood assist by-pass piping	0.00538	0.00349
20	Reflood assist by-pass piping	0.00640	0.00349
21	Secondary side of steam generator	0.19820	0.04255
22	Upper annular region of the vessel inlet region	0.00504	0.00548
23	Downcomer region	0.02183	0.00534
24	Lower plenum	0.02161	0.00623
25	Turbine flowmeter housing	0.00371	0.00713
26	Upper plenum	0.02620	0.00713
27	Pressure Suppression tank	3.17549	0.70205

Table 1 (continued)

Control volume	Description	Volume(m^3)	Flow Area(m^2)
28	Active core region	0.00137	0.00492
29	Active core region	0.00137	0.00492
30	Active core region	0.00137	0.00492
31	Active core region	0.00137	0.00492
32	Active core region	0.00274	0.00492
33	ECCS-accumulator	0.1145	0.03812
34	ECCS-injection line	0.00244	0.00046
35	Break node	0.00161	0.00349
36	ECCS-injection line	0.00244	0.00046

Table 2 Junction Description of ALARM-P1 Model

Junction	Volumes		Flow Area	Form Loss Coefficients			
				Forward		Reverse	
	(From)	(To)	(m^2)	(Run 1)	(Run 2,3)	(Run 1)	(Run 2,3)
1	26	1	0.00183	1.0E-6	0.0*	1.0E-6	0.0*
2	1	2	0.00349	0.0	6.198	0.0	6.198
3	2	3	0.00442	0.0	0.0	0.0	0.0
4	3	4	0.00442	0.0	0.0	0.0	0.0
5	4	5	0.00442	0.0	0.0	0.0	0.0
6	5	6	0.00349	0.0	15.4395	0.0	15.4395
7	6	7	0.00349	5.3	5.3	4.86	4.86
8	7	8	0.00349	1.65	1.65	1.65	1.65
9	8	9	0.00349	0.0	0.467	0.0	0.467
10	9	22	0.00183	1.0E-6	0.658	1.0E-6	1.466
11	10	11	4.3E-5	10.8	10.8	10.8	10.8
12	11	1	4.3E-5	0.0	0.0	0.0	0.0
13	26	12	0.00183	0.677051	0.677051	1.2144	1.2144
14	12	13	0.00024	1.41181	1.41181	1.41146	1.41146
15	13	14	0.00349	285.435	285.435	285.435	285.435
16	14	15	0.00024	1.40405	1.40405	1.41583	1.41583
17	15	16	0.00024	0.844137	0.844137	1.54353	1.54353
18	16	17	0.00024	12.8823	12.8823	12.438	12.438
19	22	18	0.00183	0.677051	0.677051	1.21442	1.21442
20	19	12	0.00349	0.0	0.0	0.0	0.0
21	20	18	0.00349	0.0	0.0	0.0	0.0
22	21	0	0.00203	0.0	0.0	0.0	0.0
23	0	21	0.00113	0.0	0.0	0.0	0.0
24	22	23	0.00534	0.0	3.9706E-2	0.0	2.2542E-3
25	23	24	0.00534	0.0	4.6518E-2	0.0	0.1465
26	24	25	0.00713	0.0	19.569	0.0	19.569
27	25	28	0.00492	0.0	10.5899	0.0	10.5898
28	32	26	0.00492	0.0	7.2754	0.0	7.2754
29	17	27	0.00024	1.00777	1.00777	1.13360	1.13360
30	35	27	0.00024	1.38245	1.38245	1.15464	1.15464
31	28	29	0.00492	0.0	0.0	0.0	0.0
32	29	30	0.00492	0.0	0.0	0.0	0.0

Table 2 (continued)

	Volumes			Form Loss Coefficients			
				Forward		Reverse	
Junction	(From)	(To)	Flow Area (m^2)	(Run 1)	(Run 2,3)	(Run 1)	(Run 2,3)
33	30	31	0.00492	0.0	0.0	0.0	0.0
34	31	32	0.00492	0.0	0.0	0.0	0.0
35	33	34	0.00046	0.0	71.095	0.0	1.0E-6
36	36	9	0.00046	284.38	71.095	1.0E-6	1.0E-6
37	0	36	0.00015	0.0	0.0	0.0	0.0
38	0	36	0.00028	0.0	0.0	0.0	0.0
39	18	35	0.00349	1.0E-10	1.0E-10	1.0E-10	1.0E-10
40	34	36	0.00046	0.0	142.19	0.0	1.0E-6

*) "0.0" denotes automatic calculation option incorporated in ALARM-P1 code

Table 3 Initial Conditions

Pressure (kg/cm^2)		
Upper-plenum		160.8298
Pressurizer		160.6254
Steam Generator Secondary		Sat. at 284.65 °C
Accumulator		45.007
Pressure suppression		2.482
Fluid Temperature (°C)		
Core inlet fluid temperature		290.889
Core outlet fluid temperature		326.444
Broken loop cold leg		288.80
Broken loop hot leg		322.96
Broken loop hot leg break node		316.97
Accumulator tank		27.778
Pressure suppression		16.35
Feed water supply system		204.8
HPIS, LPIS		27.778
Reflood bypass line	Hot leg side	315.85
	Cold leg side	288.85
ECC Injection		
Accumulator:		
Water volume		0.04958 (m^3)
Gas volume		0.06492 (m^3)
Initiation pressure		43.1914 (kg/cm^2)
HPIS:		
Injection initiation		126.5823 (kg/cm^2)
Injection rate		0.0149 (kg/s)($0.0 \le t \le 30.0$) 0.0817 (kg/s)($30.001 \le t \le 50.0$)
LPIS:		
Injection initiation		17.58 (kg/cm^2)
Injection rate		0.299 (kg/s)($0 \le t \le 50.0$)
	(t : time after tripping)	
Others		
Core power		1.0058 (MW)
Core flow rate		4.899 (kg/s)
Primary pump speed		1618.9 (rpm)
Pressurizer liquid level		0.062547 (m)
Steam generator liquid level		2.9 (m)

Table 4 Parameters Requested for ISP8 Comparisons

Required Parameters	Location
(1) Pressures (kPa)	
PU-PRIZE	Pressurizer pressure
PB-42	Upstream of break nozzle (pump side)
PB-23	Upstream of break nozzle (reactor vessel side)
PV-UP+10	Upper plenum
PU-ACC	Intact loop accumulator
PU-SGSD	Steam generator secondary side
(2) Differential pressures (kPa)	
DPU-12-10	Across pump
DPU-7-10	Across pump suction
DPB-32U-36L	Across simulated steam generator
DPB-38-40	Across simulated pump
DPV-LP-UP	Across core
(3) Flow rates (KG/s, ℓ/s)	
FTV-COREIN	Core inlet flow
FDB-42, GB-42VR	Break nozzle flow (pump side)
FDB-23, GB-23VR	Break nozzle flow (reactor vessel side)
FTU-15	Intact loop cold leg flow
FTU-PRIZE	Pressurizer surge line flow
FTU-LPIS	Intact loop LPIS flow
FTU-HPIS	Intact loop HPIS flow
FTU-ACC	Intact loop accumulator flow
FDU-10, GU-10	Mass flow rate in spool 10
(4) Fluid density (kg/m^3)	
GB-42VR	Break volume density (pump side)
GB-23VR	Break volume density (reactor vessel side)
GU-15C	Intact loop cold leg density
GU-10	Pump inlet density
GVCOR-150HZ	Core inlet density
GV161-192D	Lower plenum density
(5) Fluid temperature (°K)	
TFU-PRIZE	Pressurizer surge line fluid temperature
TFB-23	Fluid temperature upstream of break
TFV-UP+13	Fluid temperature in upper plenum
(6) Metal temperatures (°K)	
Rod surface temperatures on average rod (7.59 KW/ft)	Elevations of 8", 14", 28", and 39" above bottom of heated length

Table 4 (continued)

Required Parameters	Location
(7) Quality and heat transfer coefficient (MW/m^2*K)	
	Same elevations in core corresponding to the thermocouples for the heater rod temperatures
(8) Mass Inventory (kg)	
FDB-23, FDB-42	Integrated mass leaving the system through break junctions

Table 5 Description of Checkout Runs

RUN 1 Physical Time 26.6 sec CPU Time 8.3 hr	Initial results for CSNI Exercise Findings: 1. Poor Prediction for Subcooled Critical Flow 2. Underprediction of Clad Surface Temperature for Low-Powered Rods 3. Others
RUN 2 Physical Time 28.7 sec CPU Time 9.9 hr	Post-test Calculation (NO.1) Principal Items of Checkout Works Performed on the Basis of the Drawn Conclusions of RUN 1 Concerning Input-data 1. An increase of Flow Length (in Pump Simulator) and Change of Form-loss Coefficient (K-value) Across the Pump Simulator. 2. To Tune up the Fill-Leak Data Table for Steam Generator Secondary Side Behaviors 3. Correction of the Gas Volume in the Accumulator Tank 4. Junction Level Modification at the Pressurizer Outlet Concerning Code Model 5. Modification in the Temperature Conversion ($^\circ C \rightleftarrows {}^\circ F$) 6. Assumption of a Constant speed prior to Pump Tripping
RUN 3 Physical Time 26.4 sec CPU Time 11.2 hr	Post-test calculation (NO.2) Concerning Input-data 1. Correction of Heat Transfer Area and Slab Volumes in the Core Region 2. Change of Form-loss Coefficient at the Pressurizer Surge Line Concerning Code Model 3. Application of Contraction Coefficient C_D in the Subcooled Critical Flow and Interpolation method in the Transition Region between the Zaloudek Flow at Zero Quality and Moody Choked Flow at 2 % Quality 4. Replacement of Berenson Model with Modified Bromley's at the Pool Film Boiling Heat Transfer Mode 5. Removal of Miscoding in the Routine of Calculating the Junction Enthalpy

2. Results Presentation and Discussions

The results of the present runs are shown in the Figure 4 through 45, where comparisons are made and discussed with the experimental and previous analytical results. However, the comparisons with experimental data were made with only those which had been specified by CSNI (see Table 4).

The present analysis consists of two runs, thus including the previous one, three runs were made for this ISP8. These runs are shown in the Table 5 together with brief explanations. As indicated in the Table 5, RUN 1 is the one which was submitted to CSNI and referred to as the base case in the following discussion, while RUN 2 and 3 are the post test calculations with various improvements based on the experiences of RUN 1. In the comparison plot, the ALARM-P1 computation is indicated by the A's, while the Semiscale S-06-3 data by the function codes which were defined in the previous report(1). The post test calculations were conducted on FACOM-230-75 machine by using the ALARM-P1 (Mod 2 / Version 2), being terminated at approximately 26~29 seconds into the transient due to the occurrence of the reverse flow at the break plane. A complete listing of the input data in the post test calculations is given in Appendices 1 to 2.

Figure 4 shows the comparison of the calculated and the measured differential pressure across the simulated pump. Form the first item of modification for the RUN 2 indicated in the Table 5, an increase of the flow length (in the simulated pump volume) led to the good agreement with the observed data. In addition, the form-loss coefficient (K-factor) was adjusted lest the residual friction term is predominant in the total ΔP. However, in RUN 3 the deviation from the measured data became somewhat larger during the latter portion of the comparison period, of which the cause has not been fully identified. In general, the calculated pressure difference dropped rapidly in consequence of ECC water injection beyound 20 seconds while that indication was not clearly seen in the experimental data.

The pressure difference across the simulated steam generator is much smaller than that across the simulated pump (see Figure 5). This implies that the pump simulator resistance was very high compared with that in the simulated steam generator.

As the result of modification to the fill-leak input data, the steam generator secondary pressure fell closer to the experimental data as seen in the Figure 6. At the present analysis, a feed water reservior temperature was assumed to be 73.6 degrees from the hand calculations of the energy balance since it was not provide in the initial conditions.

A slight increase in the pressure appearing in RUN-2 and 3, at the early period of the blowdown, suggests to need a further examination toward the improvement. Heat flux reversal occurred at 16 seconds in the calculation (RUN 2).

The accumulator pressure history was much better reproduced in RUN 2 than in RUN 1 (see Figure 7). This is due to a change of the gas volume in the tank. It was reduced to 0.0346 (m^3) from 0.0649 (m^3).

The model of the accumulator injection was slightly modified in RUN 2 and 3. In these runs the onset of injection was controlled by time (18.2 seconds) while in RUN 1 it was controlled by the pressure.
The injection rate is highly sensitive to the system pressure which was calculated slightly lower than the measurement, hence the calculated injection rate was significantly higher (see Figure 8).

Due to a homogeneous equilibrium model of the ALARM-P1, an unphysically severe transient was calculated when subcooled accumulator water was injected. Various attempts have been made to avoid this difficulty, however, so far not successful.

In the Figure 9 to 11, the pressurizer analysis was made with the use of new junction data. Figure 9 shows the pressure history comparison in the pressurizer vessel. While the initial depressurization rate up to a steam discharge was relatively close to the experimental data, the computed pressure in RUN 1 indicates emptying to occur at approximately 13 seconds compared to 8 seconds in the measured data. Since emptying time is highly dependent upon the liquid level (more exactly speaking, the depth of the surgeline inlet below the surface of the water) in the pressurizer, the effort was directed to modify the geometrical junction elevation at surge line entrance. Although the liquid level in the pressurizer can be tuned up by changing the bubble velocity, this method was not used here. Additionally, for RUN 3, a more reasonable K-factor through the surge line was given. As a result, the ALARM-P1 result approached the Semiscale data more closely.

Figure 10 compares the calculated fluid temperature in the surge line to the test data. The fluid in this volume was initially subcooled, then reaching saturation at about 8 seconds in the observation. On the other hand, the computation showed the saturation around one seconds.

This difference is due to the modelling of the pressurizer. The figure explains that significant subcooled water was present near the pressurizer bottom. Contrary to this, the computation was assumed to be saturated prior to a rupture because of having no regard for the partial existence of the subcooled water in the two phases mixture. At the later portion of the transient, the fluid temperature obtained from the measured data shows to be superheated (e.g., P = 1000 kPa, T = 518 °K at 36 seconds). No explanation for the discrepancy after 14 seconds from the break has so far been given.

Similarly, it is noticed that in the surge line flow, the difference in emptying time was reflected in this flow behavior (see Figure 11).

Admitting that the volumetric flow rate was slightly over-calculated up to 8 seconds from the reason stated above, then the result of RUN 2 was nearly identical to the measurement until approximately 20 seconds.

From RUN 3, the cladding surface temperature histories for the low-powered core heater rods are shown in the Figures 12 to 15 together with the data measured by the thermocouples. In the current analysis, the core was simulated by a single-average channel, where the active heater pins were changed from fourty into thirty-six according to the data report(2).

Looking at these figures, the effect on the four un-powered rods removed was found to be significant. By means of modification of the heat transfer area in the core region, the ALARM-P1 post-test analysis was excellently improved so that the clad temperatures were within the spread in the experimental data except elevation 8". Through all the test runs, the predicted time of DNB, as indicated by a sharp temperature rise, was slightly earlier than the measured, resulting in an over-estimation of a peak cladding temperature.

In the Figure 12, the computed rod heat up rate falls down drastically around 8 seconds due to a rapid increase of heat transfer, which falls into the nucleate boiling mode from this time (see RUN 1 or 2 in the Figure 20). As seen in RUN 1 or 2 in the Figure 12, these two predictions were the furthest compared with the experimental data. An unrealistic rewet occurred at about 22.5 seconds due to the core flow reversal extended the difference further (RUN 1).

On the other hand, in RUN 3, a sharp rise in temperature up to about 8 seconds occurs in the mode 6 (Bromely correlation), then passing through the transition boiling with a temperature drop by 60 °K, the heat transfer

was calculated again using the correlation in the pool film boiling region (mode 6). So, the temperature decrease beyond 8 seconds was markedly arrested in contrast with RUN 1 or RUN 2. During the remainder of the transient (RUN 3), the heat transfer was in mode 8 (forced convection in superheated vapor). In the absence of this rewet around 8 seconds, the difference in the temperature would have appeared to be much smaller.
The pool film boiling Berenson correlation used for RUN 1 or RUN 2 was:

$$h = 0.425 \left[\frac{k_g^3 \, \rho_g(\rho_f - \rho_g) g \, h_{fg}}{\mu_g \, \Delta T_{sat} \sqrt{\dfrac{g_0 \, \sigma}{g(\rho_f - \rho_g)}}} \right]^{1/4}$$

For RUN 3, it was replaced by a modified Bromley's(4)

$$h = \frac{0.62}{\sqrt[4]{2\pi}} \left[\frac{k_g^3 \, \rho_g(\rho_f - \rho_g) g \, h_{fg}}{\mu_g \, \Delta T_{sat} \sqrt{\dfrac{g_0 \, \sigma}{g(\rho_f - \rho_f)}}} \right]^{1/4}$$

As seen in the figures of the heat transfer coefficient (see Figures 20 to 23) there was little difference between the two correlations mentioned above. For example, until 5 to 7.5 seconds in the Figure 20 the modified Bromley's model predicted a slightly lower coefficient than the Borenson's. For the core heater rods at elevation 39", DNB was calculated in RUN 3 at 1.8 seconds, while the test data experienced it later. Consequently the peak cladding temperature in this zone was conservatively predicted beyond the observed data (see Figure 15). The overall temperature profile, however, was calculated reasonably well at this level. Between 8" and 39", the predicted maximum clad surface temperatures were slightly high to the experimental data, but subsequently within the measured data scatter (see Figures 13 to 14).

For clad surface temperature curve shown, the reason why the calculated temperature was lower than the Semiscale data at the steady state is because: the thermocouples used in the experiment were located inside the composite sheath while the calculation was estimated at the fuel rod surface.

In the Figures 16 to 19, the behaviors of the fluid quality were influenced strongly by the core fluid flow direction. It suggests the core fluid conditions of RUN 3 were somewhat different from that of RUN 1 or RUN 2.

Figures 24 to 30 show the comparative results in the broken loop. Herein, it was scrutinized as to how the item 3 specified in RUN 3 was reflected in the computed results (see Table 5).

Apart from the calculated results made in RUN 3, the ALARM-P1 break flow through the cold leg produced the most significant disagreement with the measured data during the first 3.5 seconds of the transient because the discharge flow multiplier selected was too small. Thus, the predicted time of saturation was late. In order to reduce this disparity between the prediction and measurement, the analytical technique for RUN 3 was so extended that respective contraction coefficients were applied separately to the two different flow regions. Accordingly the cold leg break flow was obviously improved getting nearer the measured data in the trend as can be seen in the Figure 24.

The Zaloudek's critical flow formula used is as follows:

$$\text{mass flux } G_{crit} = C_Z \sqrt{2g_c \rho (P - C_2 P_{sat})}$$

where $C_Z \triangleq$ (Zaloudek experimental constant) × (contraction coefficient)

C_2 = a constant related to a bubble delay time

In the present analysis, arbitrary constant C_Z and C_2 were assumed to be

0.6 and 0.4 respectively. By selecting these two parameters appropriately, the subcooled choked flow could approach the measured data more closely.

As can be seen in this experimental data, the identical transition from a subcooled flow into the two-phase flow is predicted distinctly. This change to saturation can be controlled by the transition quality, which was in the ALARM-P1 model assumed to be 0.02. According to the reference$^{(5)}$, it suggests this value is smaller than 0.02.

Although the present prediction for RUN 3 was greatly improved on the cold leg break flow, the corresponding pressure transient was underestimated (see Figure 25). There was an apparent parodox about the results gained from the pressure and the break flow. The cause of this disagreement is considered to occur from a wide variety of sources:

i.e. (1) Low heat transfer in the core region.

(2) Incomplete break flow predictions that have something yet to be improved.

(3) Significant influence from the pressurizer or the steam generator.

(4) Ignorance of energy stored in the structure.

(5) Mixing effect of ECC water with the primary coolant.

At any rate it requires further examinations.

Figure 26 compares the broken loop cold leg density data with the calculated results. In case of RUN 3, the calculated density was somewhat reformed throughout the transient. The resulting generation time of void in the piping came near the experimental data. Beyond 20 seconds, the calculated behavior shows the presence of ECC water passing through the cold leg, while the measured data is delayed by 3~4 seconds.

In the Figure 27, the calculated fluid temperature was somewhat lower corresponding to the underpredicted pressure. Around 26 seconds, the result of RUN 3 differs with the observed data by 70 °K. A sudden anomaly in temperature caused by a reverse flow from the containment resulted in the termination of computation.

The major results in the broken loop hot leg are demonstrated in the Figures 28 through 30. Unlike the cold leg, there were similar trends between the experimental and calculated values. For the RUN 3, the hot leg pressure and break flow were, in general, below the measured data during most of the transient (see Figures 28 and 29). Rather, the computed results obtained from RUN 1 or RUN 2 agreed with the S-06-3 data relatively well. Regarding the measured flow data, the calibration of the fluid flow is generally considered to contain a large extent of errors produced by the measurement of momentum flux and the fluid density. At the present stage, it suffices to assess the code ability, if the predicted flows followed the trends of the measured data.

Next, the comparisons between the predictions and the experiment in the pressure vessel are given in the Figures 31 through 36. The calculated upper-plenum pressure representative of the whole system pressure was considerably low. The pressure was understimated by 500 kPa at 4 seconds, 750 kPa at 16 seconds and 1250 kPa at 20 seconds in RUN 3. At the last portion of the calculation, the divergence was enhanced by the mixing effect of ECC injection. As encountered in the break pressure presentation, a fast pressure decay should be checked on the basis of the possible reasons mentioned above.

The core inlet flow is illustrated in the Figure 32. In the RUN 3, it is strongly influenced by the high flow rate of the initial subcooled fluid, thereby showing a large negative flow after the rupture. The core inlet density for RUN 3 (see Figure 33) behaves differently from the other runs after 5 seconds. It was in the close agreement with the experimental value except for a spike caused by the high density fluid from the lower-plenum.

An influence on the core flow reversal was more or less reflected in the RUN 3. Likely, the lower-plenum density for the RUN 3 (see Figure 34) showed a different trend compared with the others. The downcomer flow was perhaps responsible for such a faster reduction of density. The pressure difference across the core is presented in the Figure 35. The calculated results remains slightly positive near or at zero from 2.5 to 26 seconds, while the measured value remained negative throughout the transient. The difference between the two is under investigation.

Figure 36 shows the fluid temperature history in the upper-plenum. All the prediction decreased with time like that in the broken loop cold leg. Beyond approximately 10 seconds, the departure of the calculated fluid temperature from the measured data was enhanced particularly in RUN 3.

Figure 37 to 44 provide the comparison plot related to the system behaviors in the intact loop. The intact loop pump behavior prior to a coast-down in the post-test analysis was calculated under the assumption that an electrical torque is equal to a hydraulic one in order to keep the regular revolution during the blowdown. The pump characteristics was calculated using the single phase homologous curves. The frictional torque and the energy added to the fluid were neglected in the ALARM-P1 code. As can be seen in the Figure 41, the pump head began decreasing at about 7 seconds while pretty earlier in the prediction. The pump degradation exclusively depends on the faster system decompression. Large oscillations shown near the end of the computation are ascribable to the effect of the ECC water injection.

Parameters other than those identified so far were practically identical through three test runs. In the Figure 42, the fluid temperature in the accumulator line was recovered to a realistic value by mending the computation logic of the junction enthalpy. With respect to HPIS and LPIS behaviors, these remained nearly unchanged. Finally for the RUN 3, a total mass accumulated in the suppression tank was somewhat overpredicted due to the high critical flow rate in the early portion of blowdown.

(see Figure 45)

3. Conclusions

The post-test analysis following the initial calculation for ISP8 was made with the use of the ALARM-P1 code. Several conclusions were drawn from the code-data comparisons. In the present analysis, the first target was successfully accomplished which was intended to improve behaviors of a few key parameters.

Some of results obtained were in good agreement with Semiscale S-06-3 test data. Defects discovered in the calculated results will be made up in further calculations. Findings were classified in the following.

(A) Improved Items

(1) Fuel cladding surface temperature

The temperature response for a low-powered zone was excellently improved by the severe degradation of the heat transfer. Provided that more exact core hydraulic conditions were traced, the clad temperature at 8" elevation would have been adequately predicted. The difference between the Berenson and modified Bromley model was not significant.

(2) Discharge flow at early part of depressurization

The discharge flow through the cold leg was not complete, but the similarity between the calculated and measured result was exhibited to be much better than the initial trial. Furthermore, it was proved that the discharge flow has a large influence on the hydraulic and thermal response in the core region.

(B) Unsolved Items

(1) Underpredicted system pressure

In every case, the calculation underpredicted the experimental data during most of the transient.

(2) Early CHF prediction and rod surface rewetting

In general, the prediction of a core heater rod thermal response experienced early DNB, resulting in the overprediction of the clad temperatures. Therefore, it is required to fully investigate the capability of currently used CHF correlations. It should be noted that the occurrence of a rewetting at some of a low-powered zone was predicted by the analysis as opposed to the S-06-3 experimental data.

(3) Pressurizer behavior

Some significant thermal stratification observed in the pressurizer vessel during the early period of the experiment was not sufficiently tracked by the code.

(4) Lower-plenum density and core differential pressure

The code-data comparisons about these two parameters were not good. From the measured curves in the lower-plenum, the effect of using two or more control volume is worthy investigating.

(5) Others

The present homogeneous equilibrium model (1V - 1T) which causes an unphysically severe transient must be substituted by the more realistic models. The development is under way. Moreover, refinements for the critical flow models are expected to reproduce the accurate break flow rate over the every range of thermodynamical condition.

References

1. S. Sasaki and F. Araya, "An Analysis of CENI Standard Problem NO.8", JAERI-M 8746, March 1980.
2. B.L. Collins, et al., "Experimental Data Report for Semiscale Mod-1 Test S-06-3 (LOFT Counterpart Test)", NUREG/CR-025/TREE-1123, July 1978.
3. F.R. Zaloudek, "The Critical Flow of Hot Water through Short Tubes", HW-77594, May 1966.
4. RELAP4 / MOD5: A computer Program for Transient Thermal-Hydraulic Analysis of Nuclear Reactor and Related Systems, User's Manual Volume 1 (p.75), ANCR-NUREG 1335, September 1976.
5. J.R. White, W.H. Grosh and C.D. Keeler, "Preliminary Post test Analysis of LOFT Loss-of-Coolant Experiment L2-2, Appendix B", LTR20 - 103, June 1979.

Acknowledgement

Much appreciation is expressed to Mr. K. Sato, Chief of Reactor Safety Code Development Laboratory who critically read a draft of the paper and made useful suggestions.

References

1. S. Sasaki and F. Araya, "An Analysis of CENI Standard Problem NO.8", JAERI-M 8746, March 1980.
2. B.L. Collins, et al., "Experimental Data Report for Semiscale Mod-1 Test S-06-3 (LOFT Counterpart Test)", NUREG/CR-025/TREE-1123, July 1978.
3. F.R. Zaloudek, "The Critical Flow of Hot Water through Short Tubes", HW-77594, May 1966.
4. RELAP4 / MOD5: A computer Program for Transient Thermal-Hydraulic Analysis of Nuclear Reactor and Related Systems, User's Manual Volume 1 (p.75), ANCR-NUREG 1335, September 1976.
5. J.R. White, W.H. Grosh and C.D. Keeler, "Preliminary Post test Analysis of LOFT Loss-of-Coolant Experiment L2-2, Appendix B", LTR20 - 103, June 1979.

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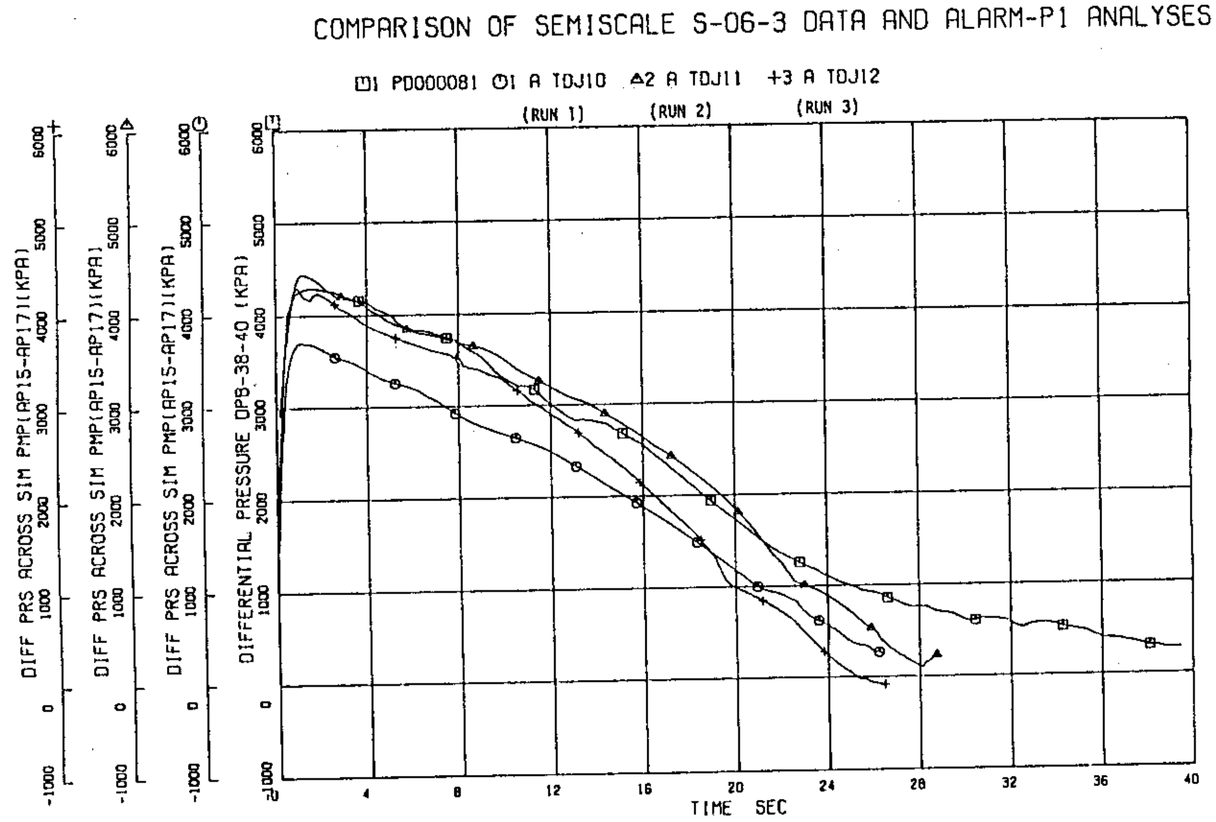
COMPARISON OF SEMISCALE S-06-3 DATA AND ALARM-P1 ANALYSES

Figure 4 Pressure Difference Across the Simulated Pump (DPB-38-40)

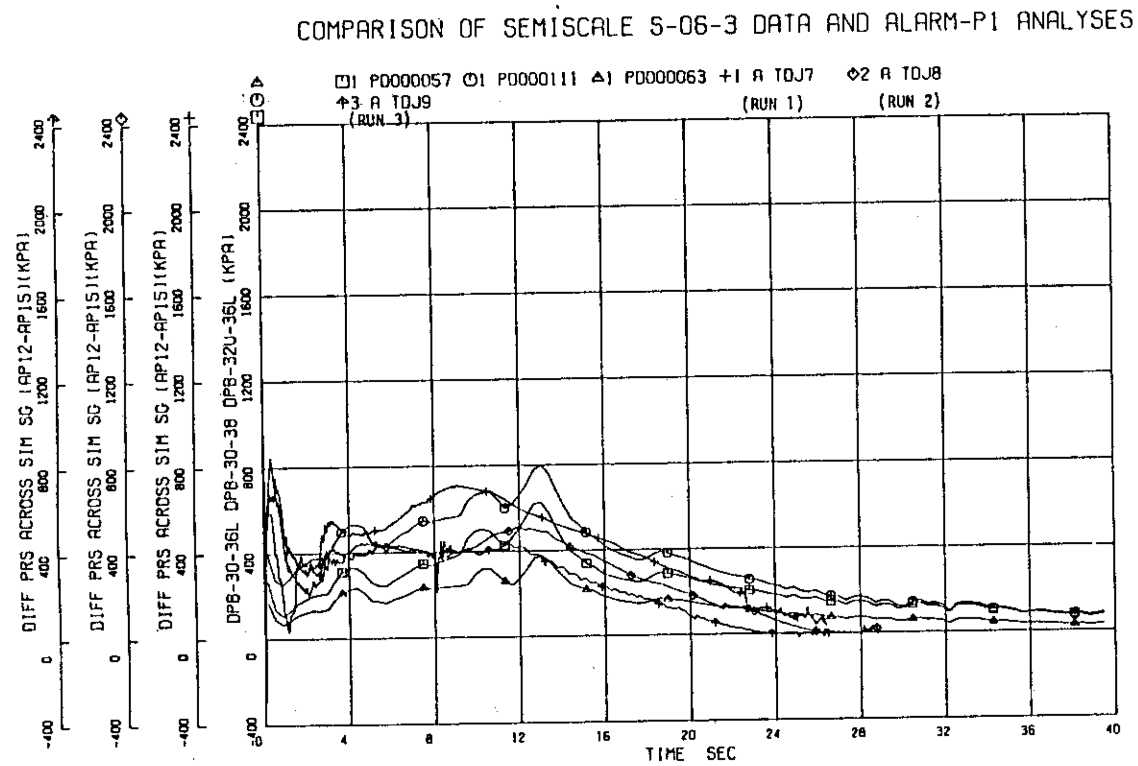
COMPARISON OF SEMISCALE S-06-3 DATA AND ALARM-P1 ANALYSES

Figure 5 Pressure Difference Across the Simulated Steam Generator
(DPB-32U-36L, DPB-30-36L, DPB-30-38)

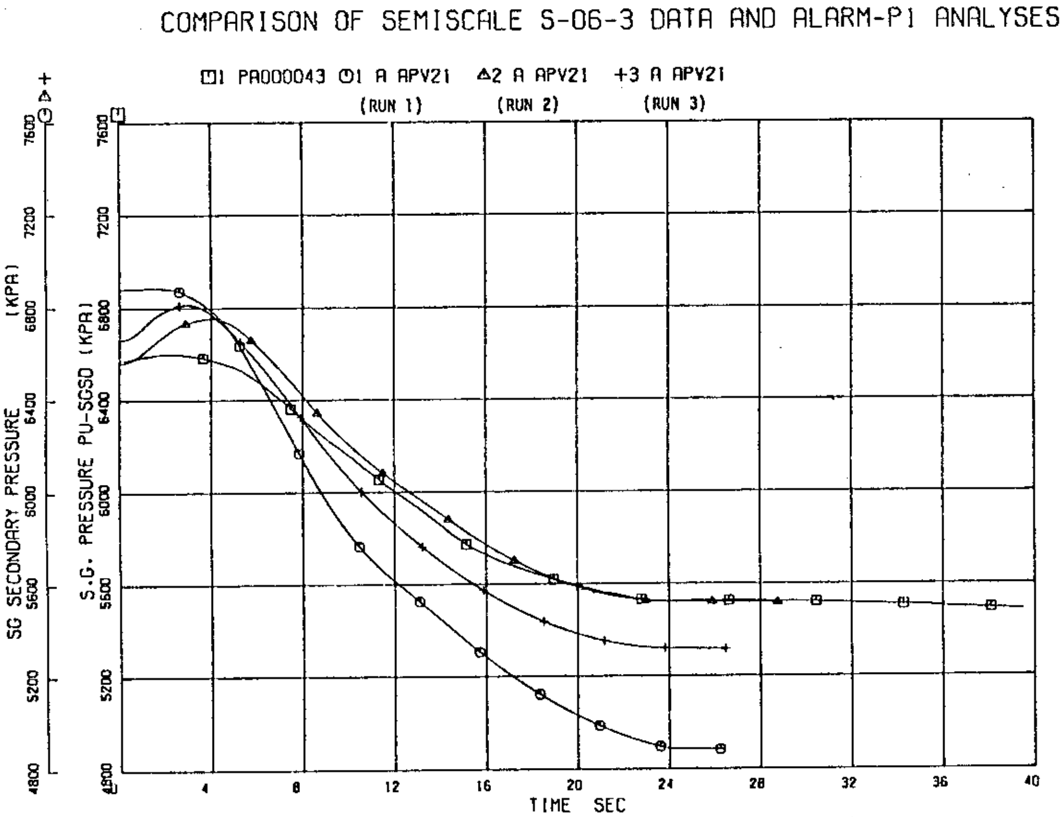

Figure 6 Pressure History in the Steam Generator Secondary System (PU-SGSD)

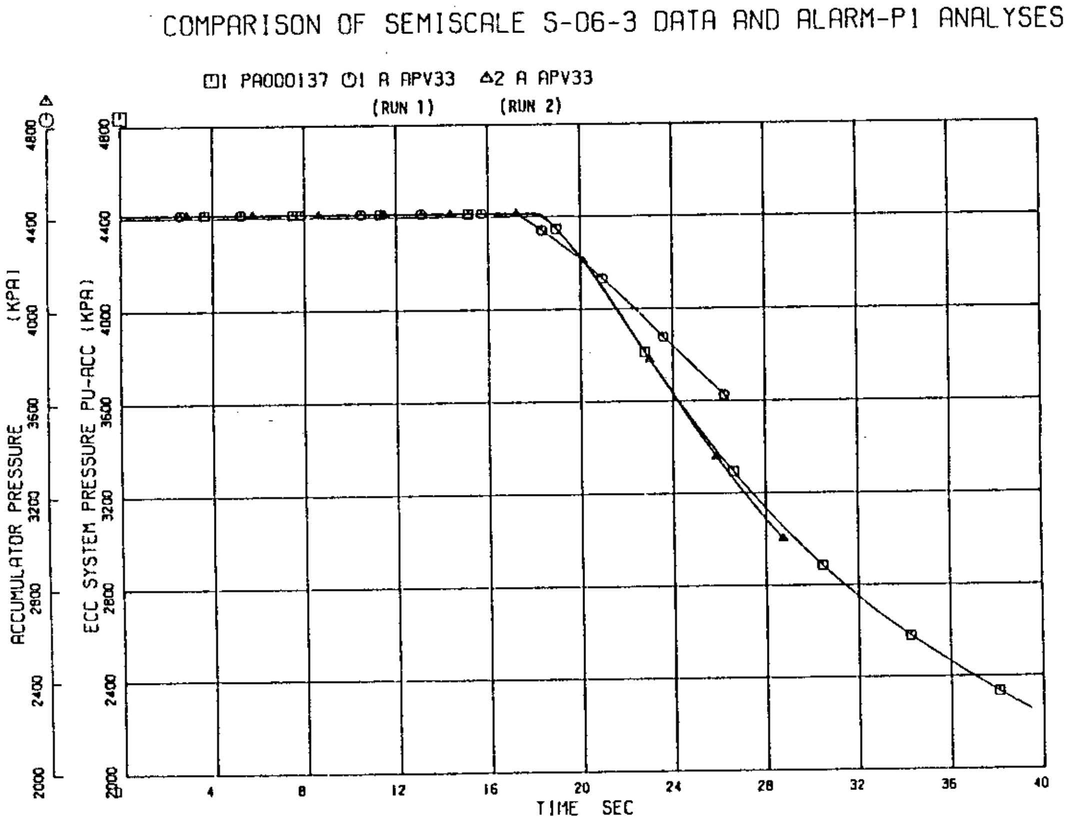

Figure 7 Intact Loop Accumulator Pressure History (PU-ACC)

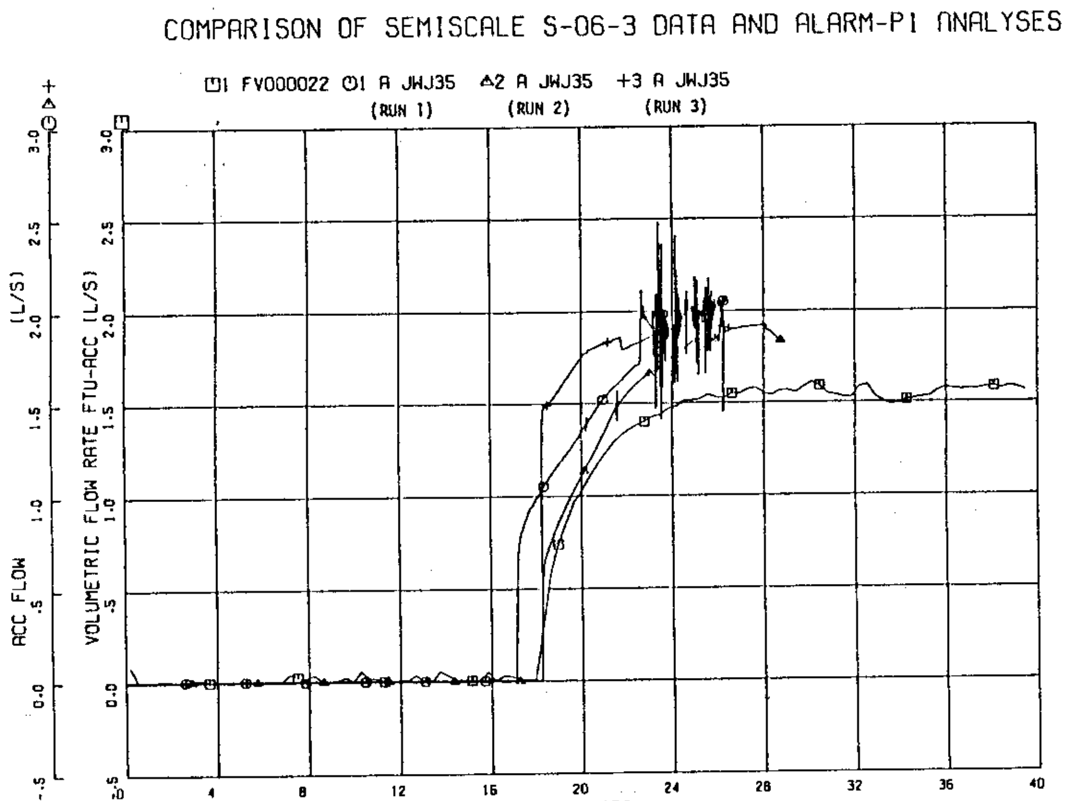

Figure 8 Volumetric Flow Rate in Accumulator Tank (FTU-ACC)

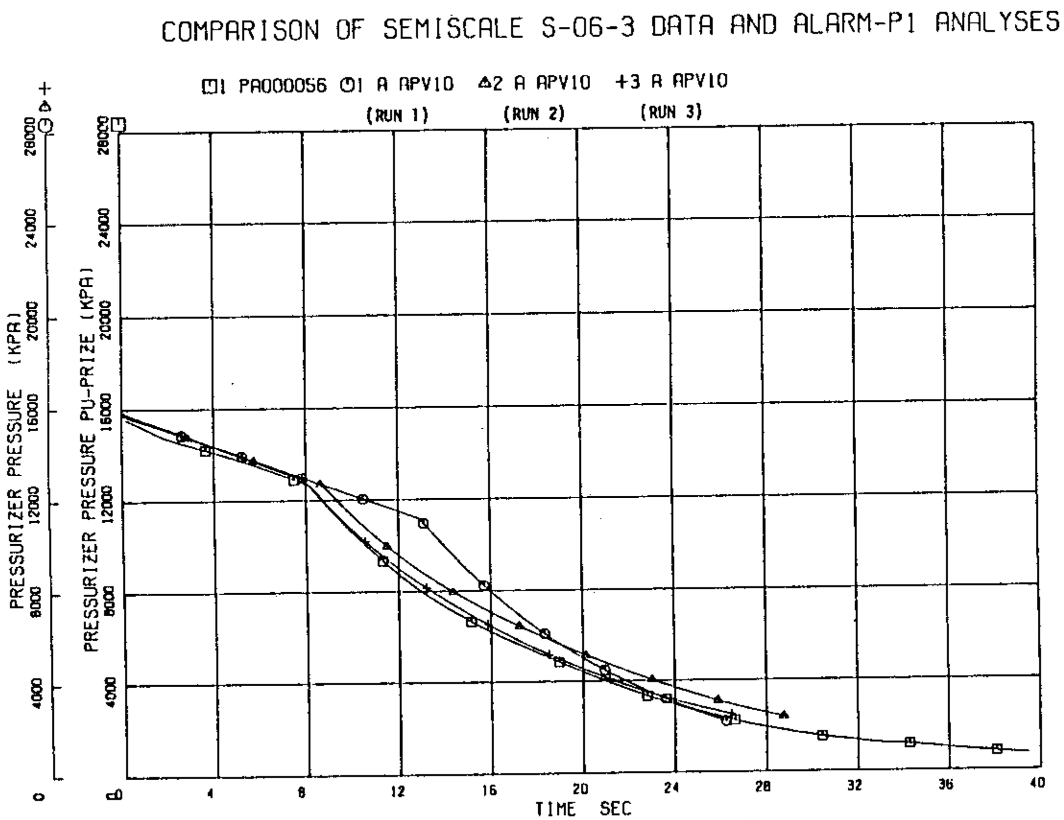

Figure 9 Pressurizer Pressure History (PU-PRIZE)

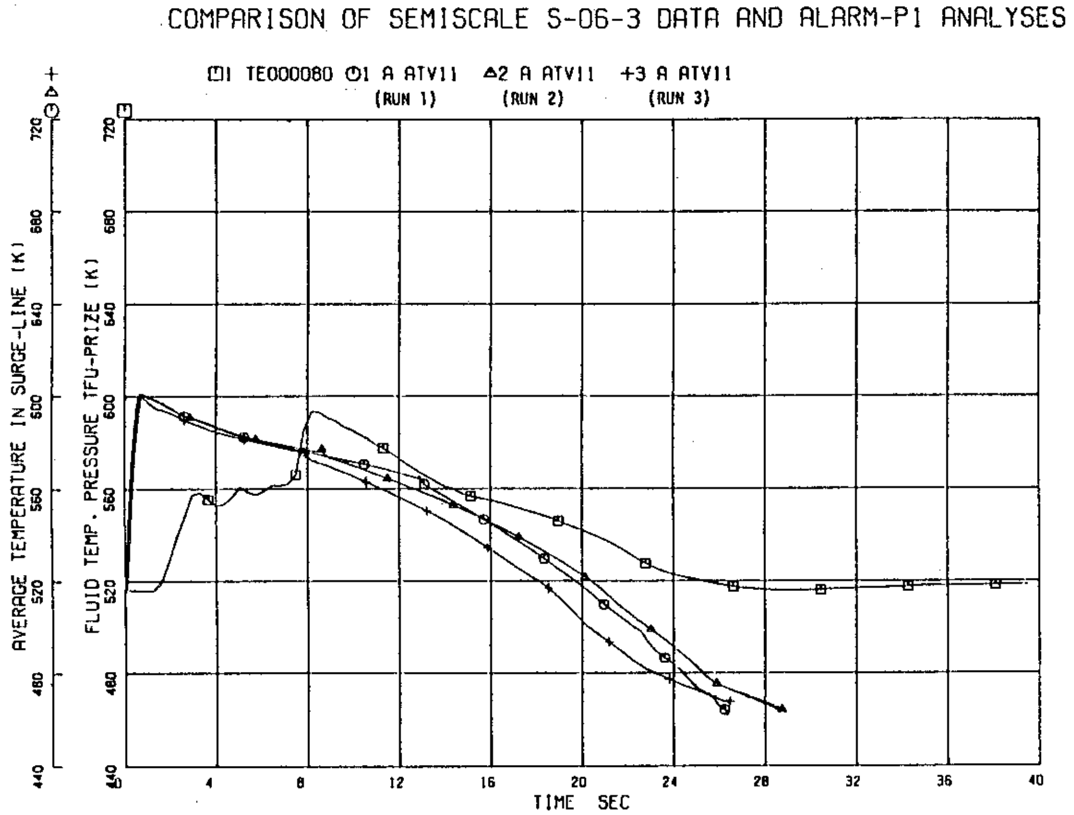

Figure 10 Fluid Temperature History in Pressurizer Surge Line (TFU-PRIZE)

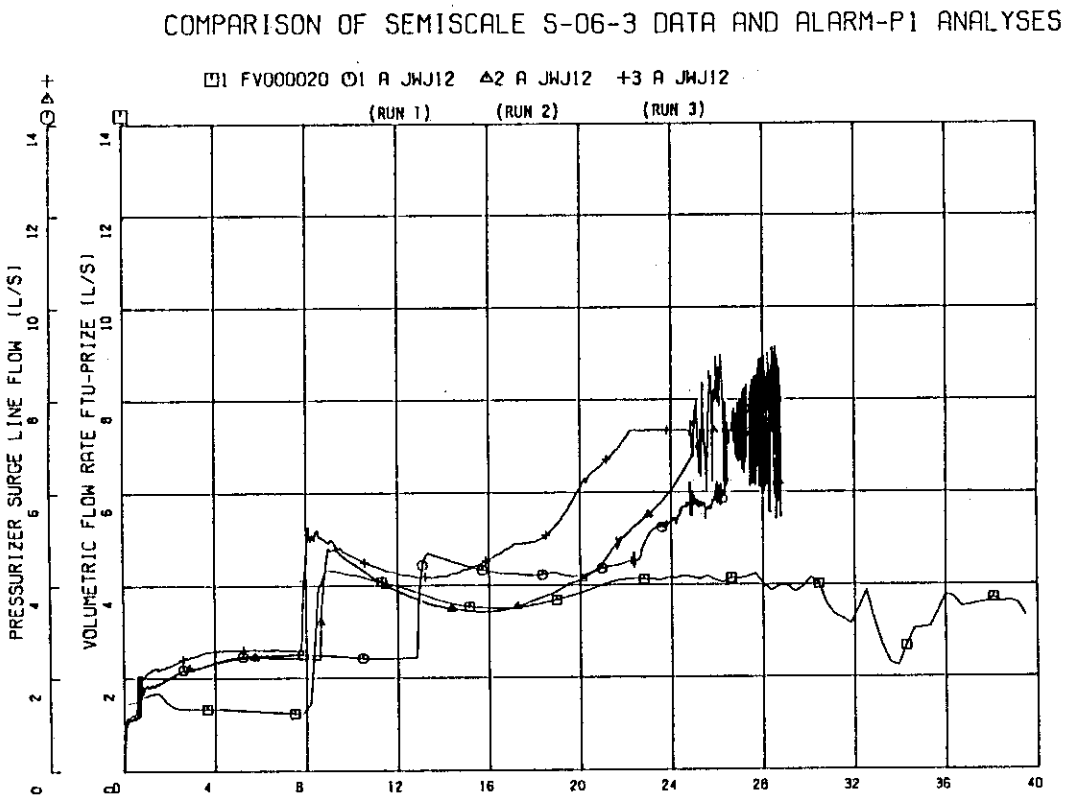

Figure 11 Volumetric Flow Rate in Pressurizer Surge Line Outlet (FTU-PRIZE)

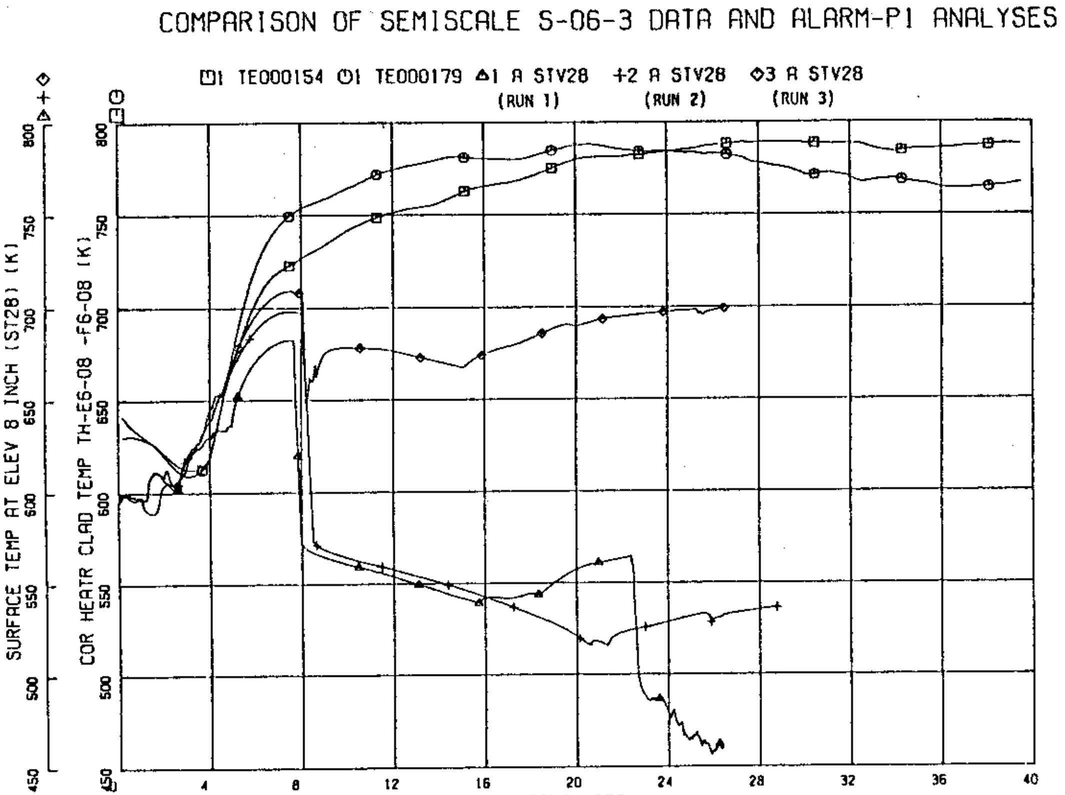

Figure 12 Clad Surface Temperature History for Low-Powered Rods
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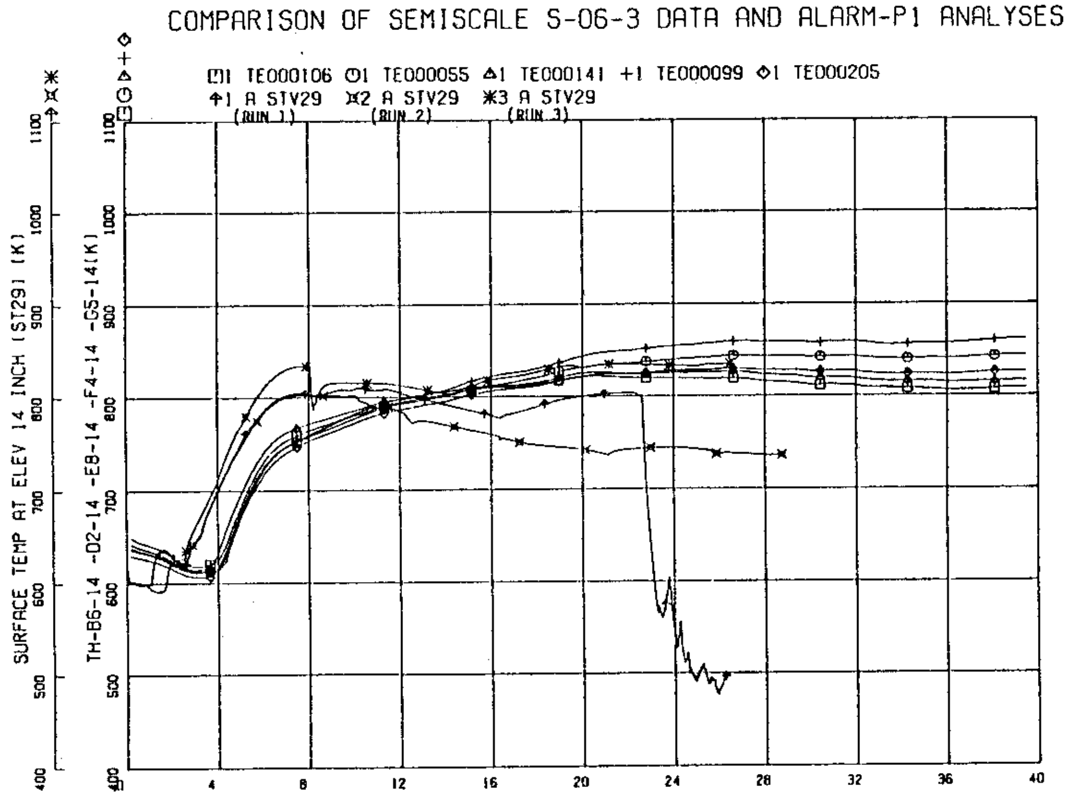

Figure 13 Clad Surface Temperature History for Low-Powered Rods
(Elevation of 14" above Bottom of Heated Length)

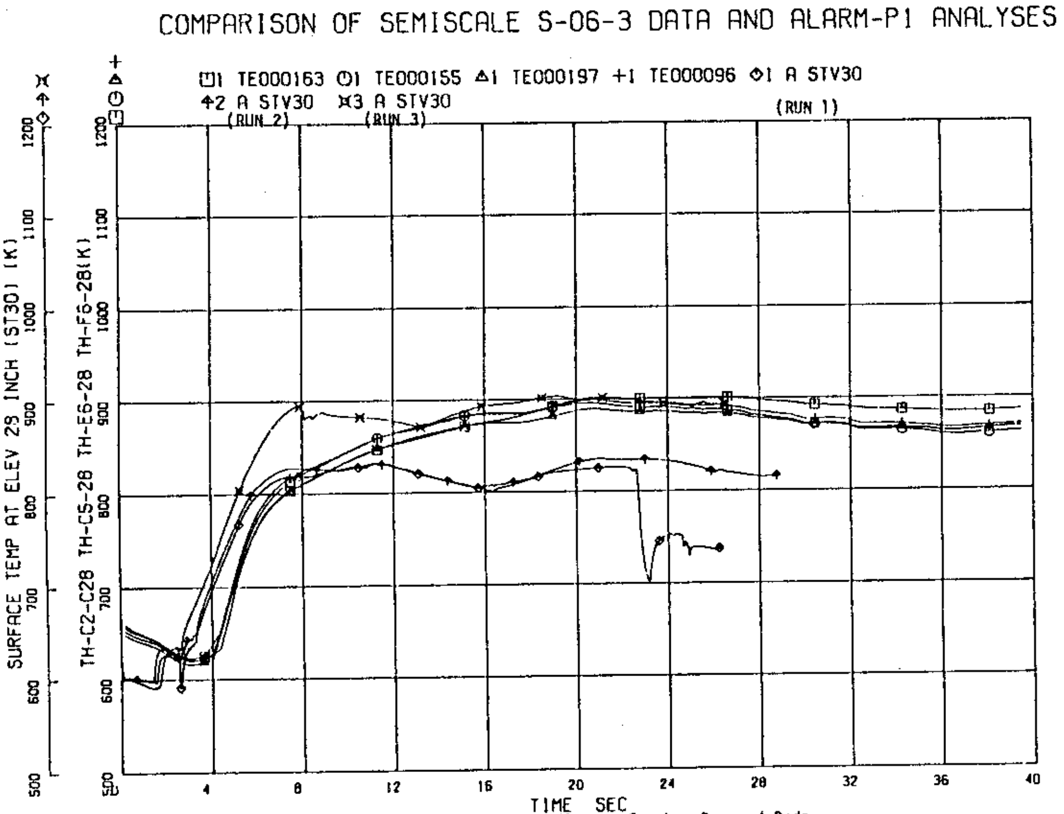

Figure 14 Clad Surface Temperature History for Low-Powered Rods (Elevation of 28" above Bottom of Heated Length)

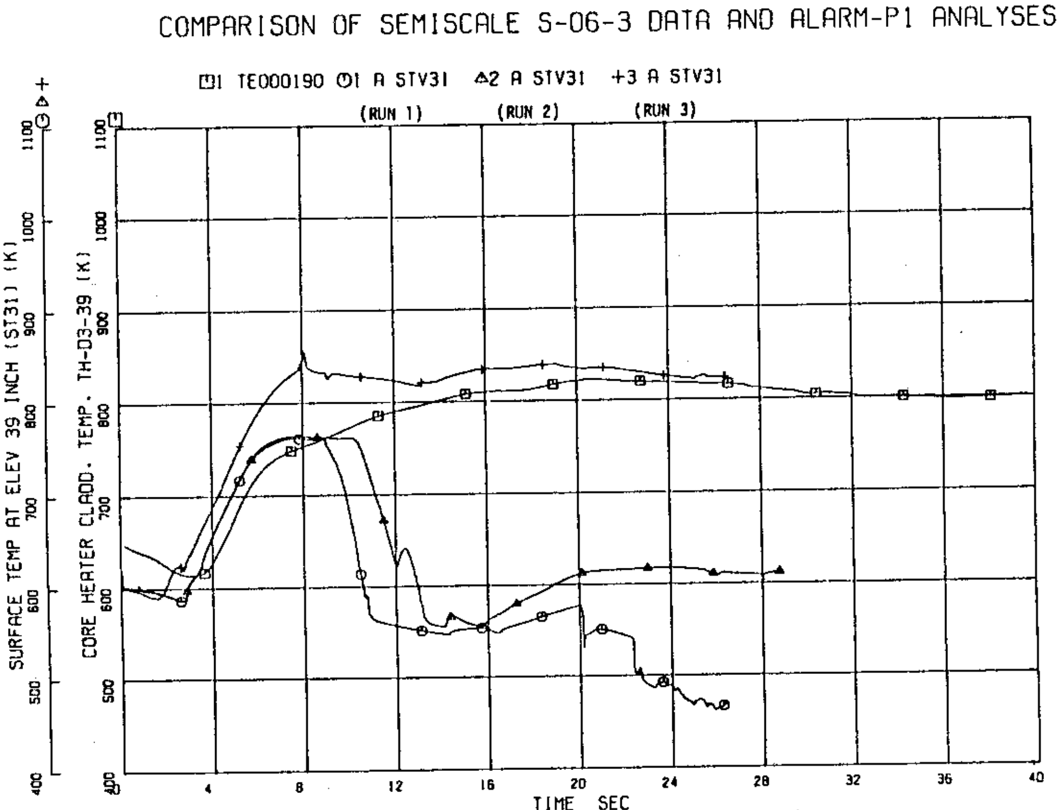

Figure 15 Clad Surface Temperature History for Low-Powered Rods (Elevation of 39" above Bottom of Heated Length)

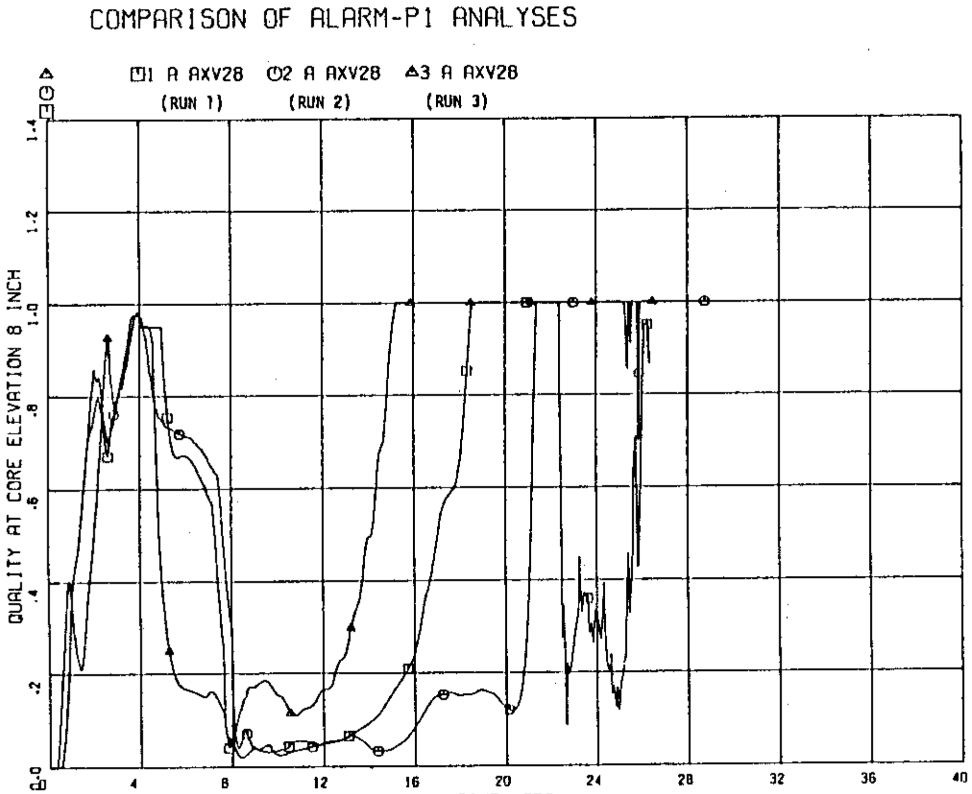

Figure 16 Fluid Quality History (Elevation of 8" above Bottom of Core)

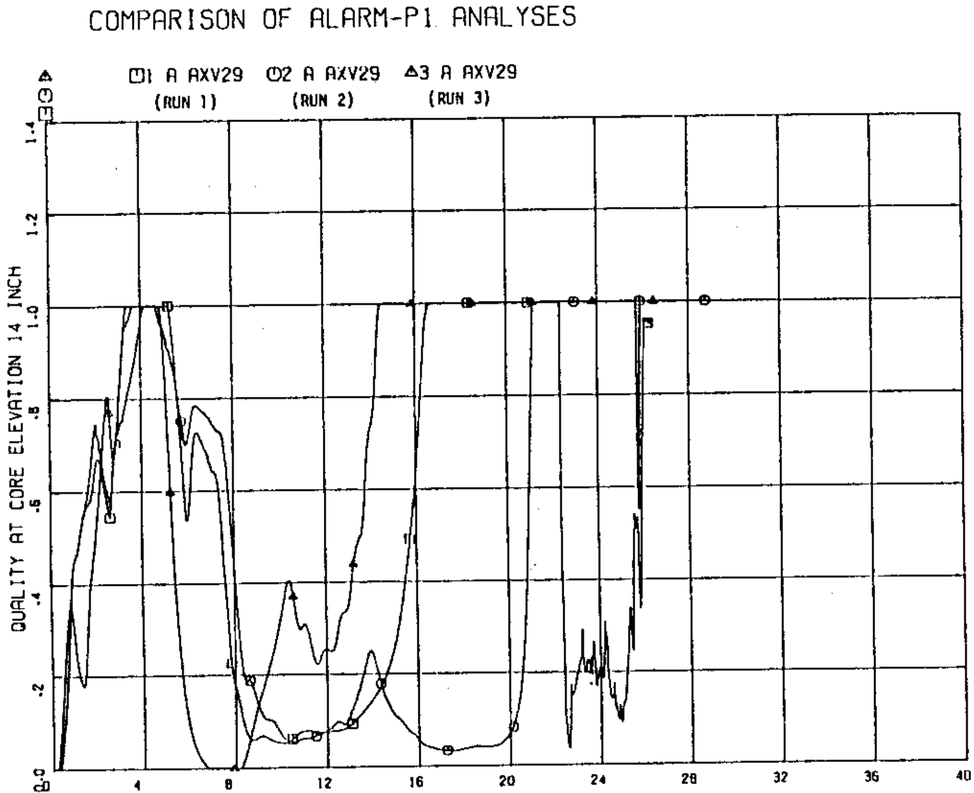

Figure 17 Fluid Quality History (Elevation of 14" above Bottom of Core)

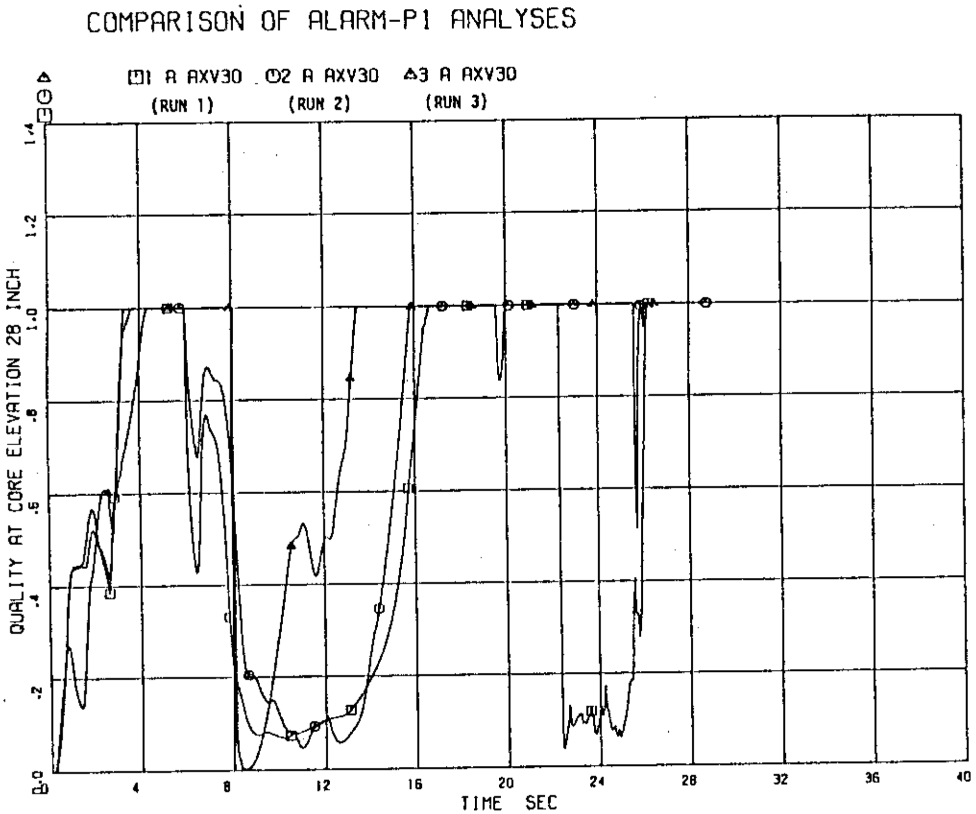

Figure 18 Fluid Quality History (Elevation of 28" above Bottom of Core)

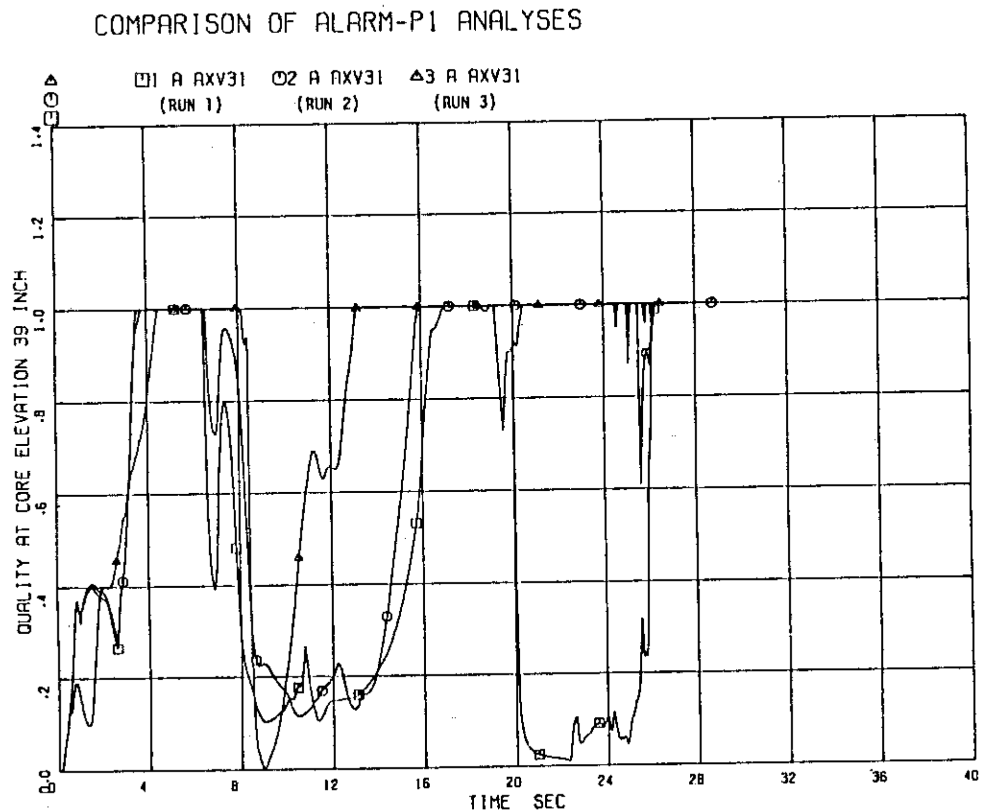

Figure 19 Fluid Quality History (Elevation of 39" above Bottom of Core)

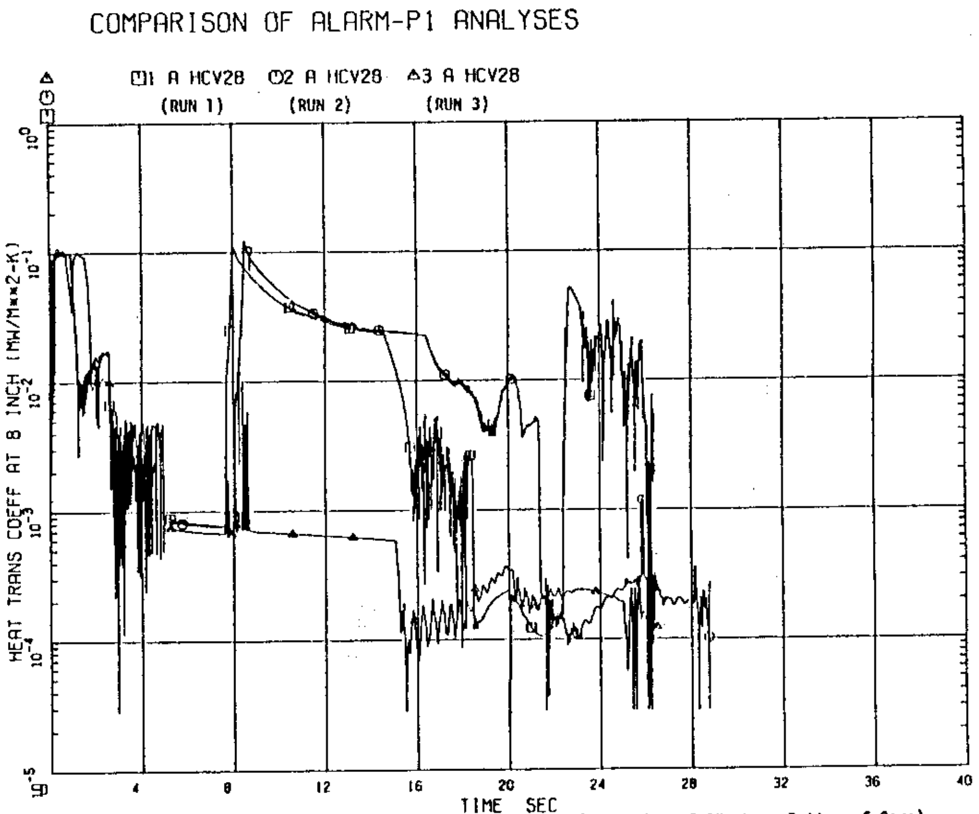

Figure 20 Heat Transfer Coefficient History (Elevation of 8" above Bottom of Core)

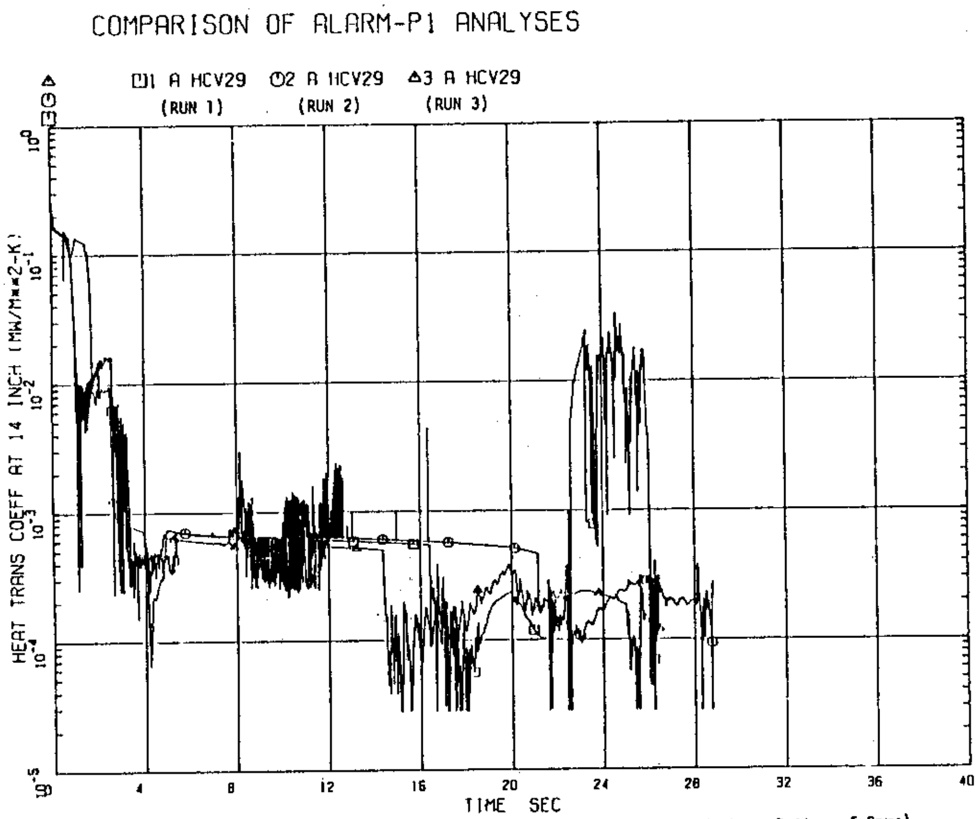

Figure 21 Heat Transfer Coefficient History (Elevation of 14" above Bottom of Core)

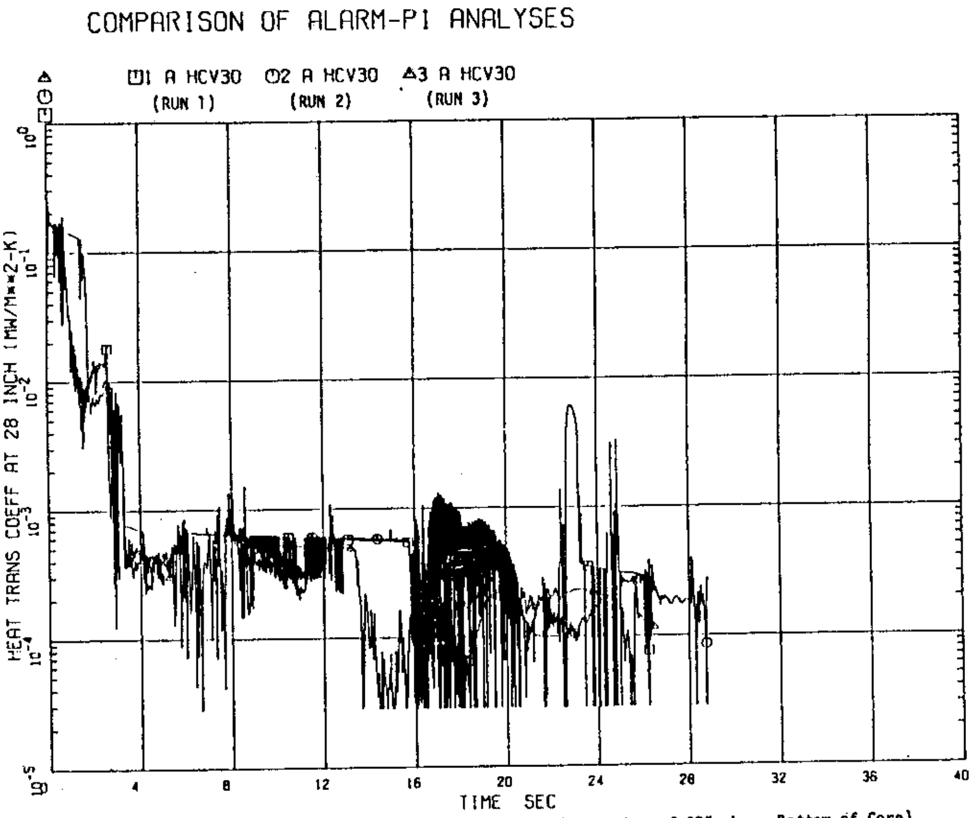

Figure 22 Heat Transfer Coefficient History (Elevation of 28" above Bottom of Core)

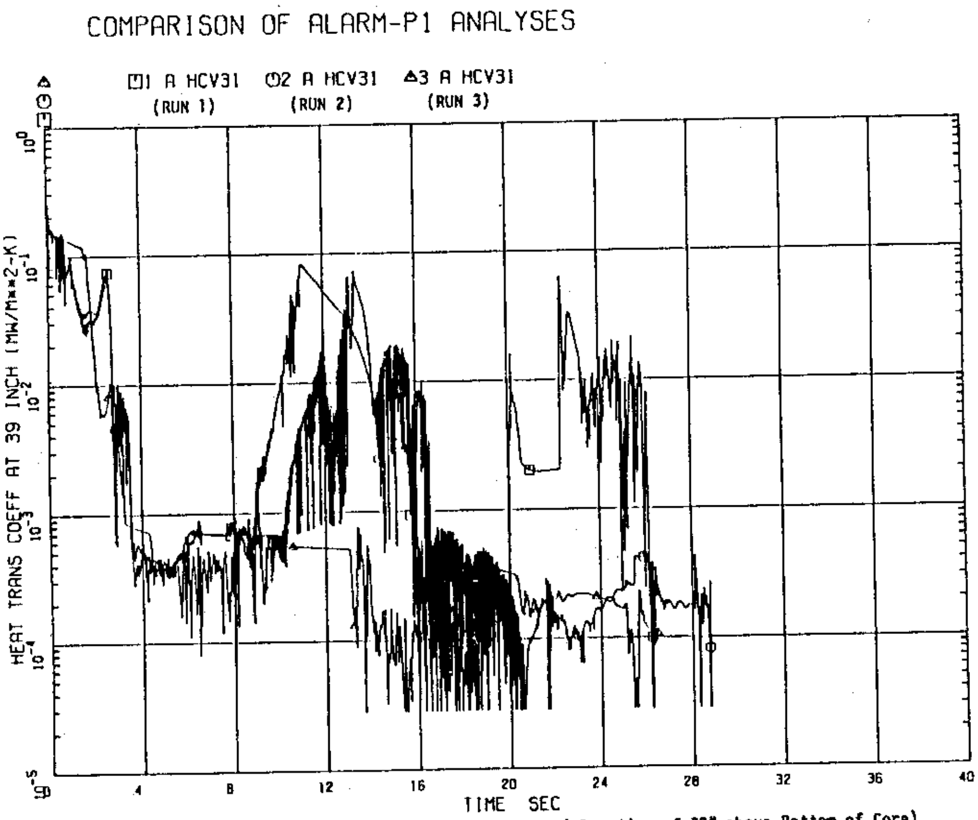

Figure 23 Heat Transfer Coefficient History (Elevation of 39" above Bottom of Core)

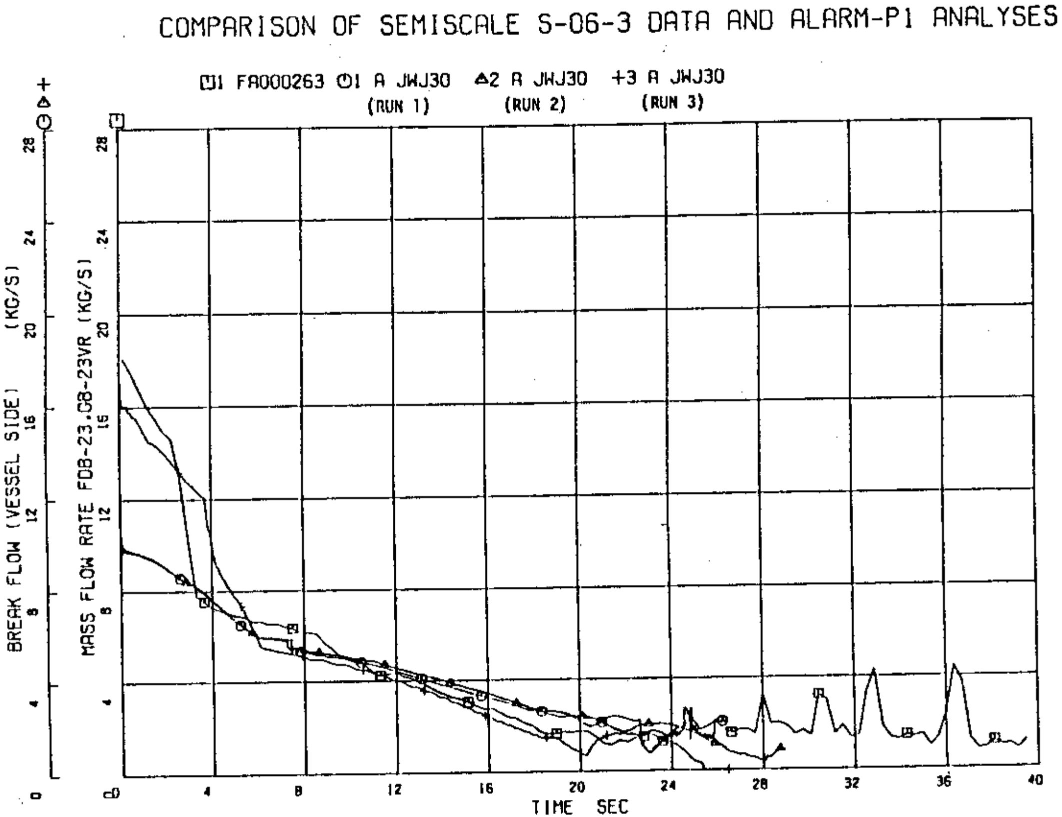

Figure 24 Mass Flow Rate at Break Nozzle — Reactor Vessel Side (FDB-23, GB-23 VR)

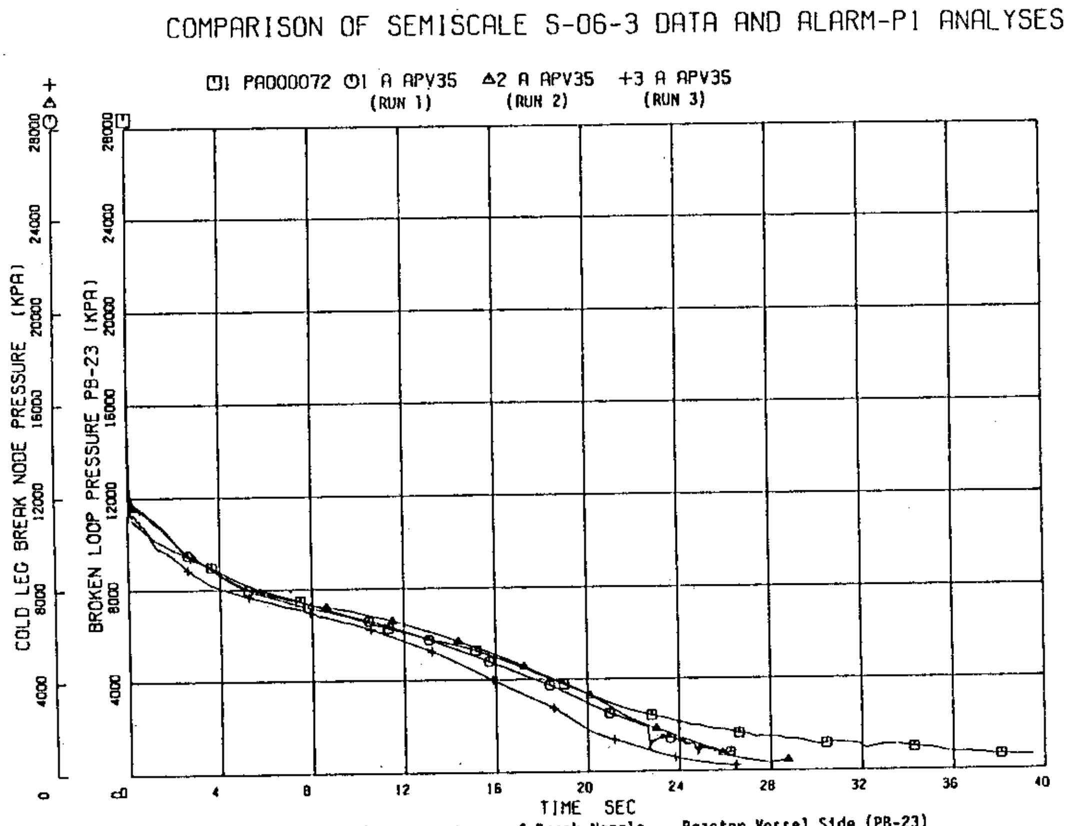

Figure 25 Pressure History upstream of Break Nozzle — Reactor Vessel Side (PB-23)

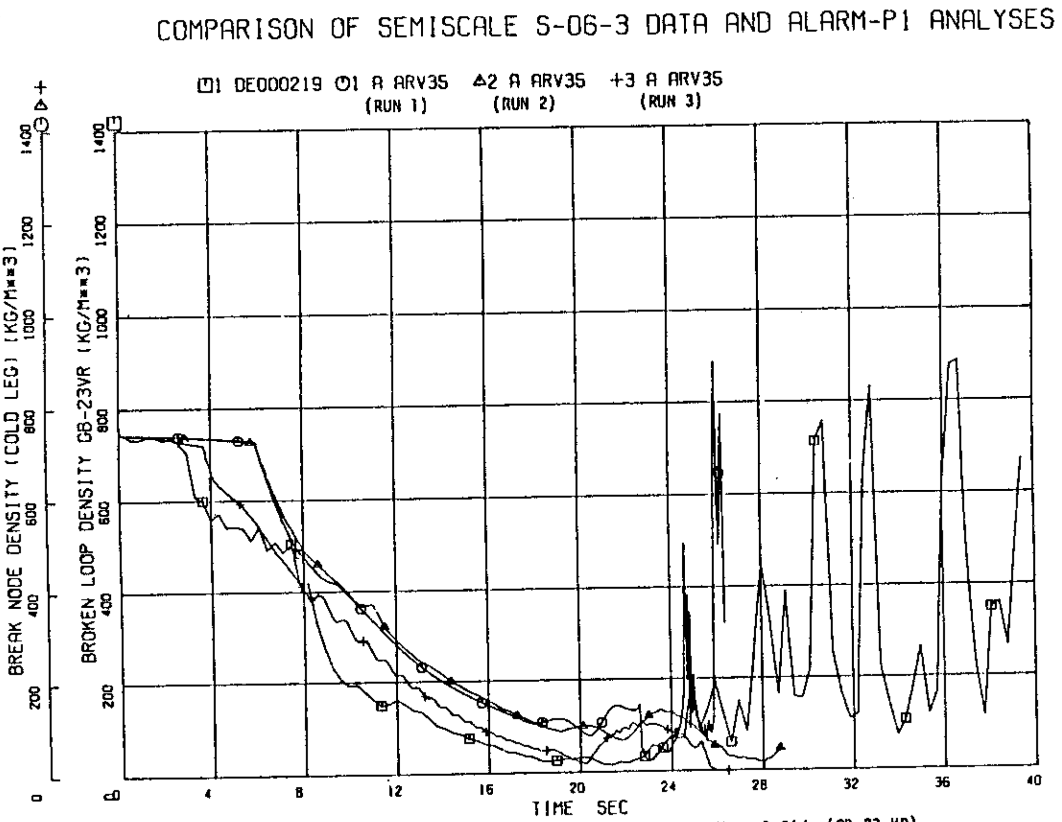

Figure 26 Fluid Density History in Break Volume — Reactor Vessel Side (GB-23 VR)

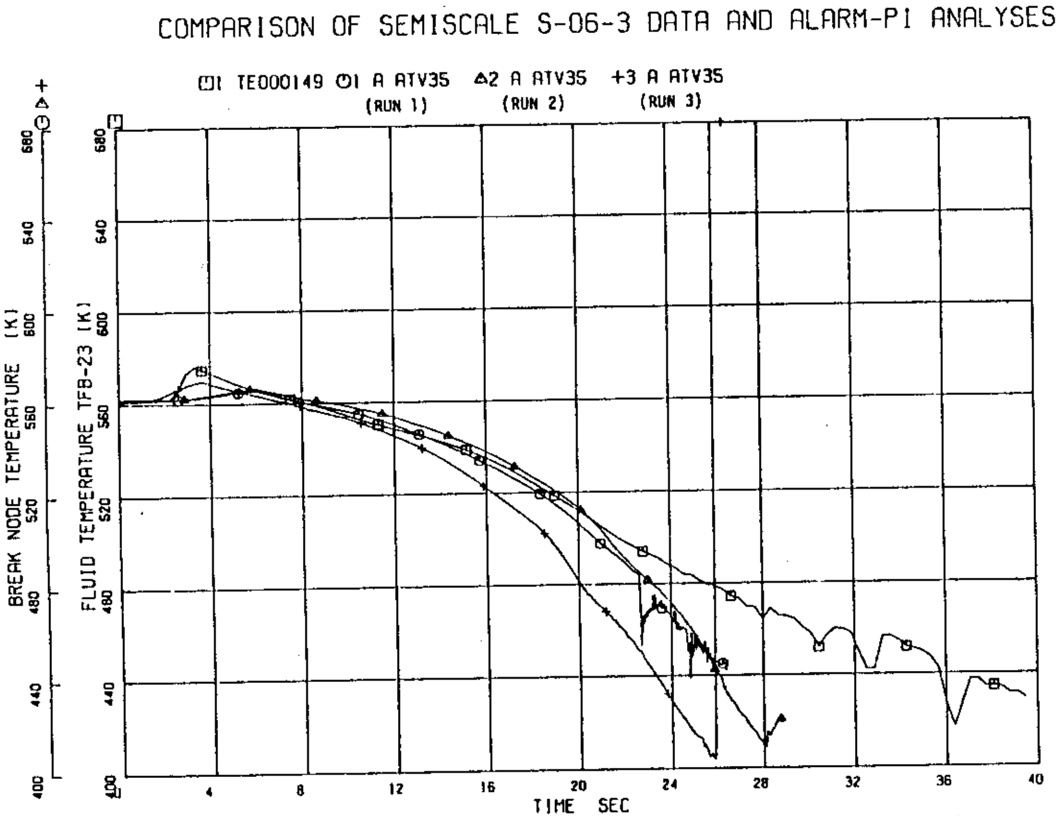

Figure 27 Fluid Temperature History upstream of Break — Reactor Vessel Side (TFB-23)

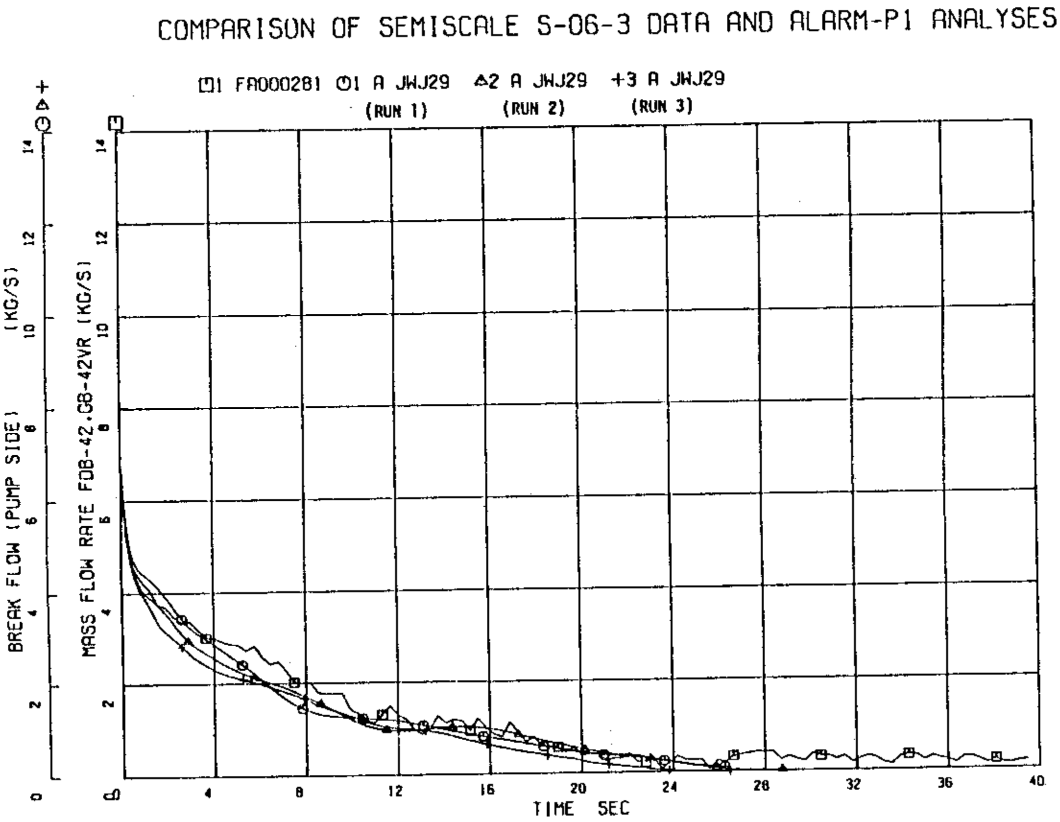

Figure 28 Mass Flow Rate at Break Nozzle — Pump Side (FDB-42, GB-42 VR)

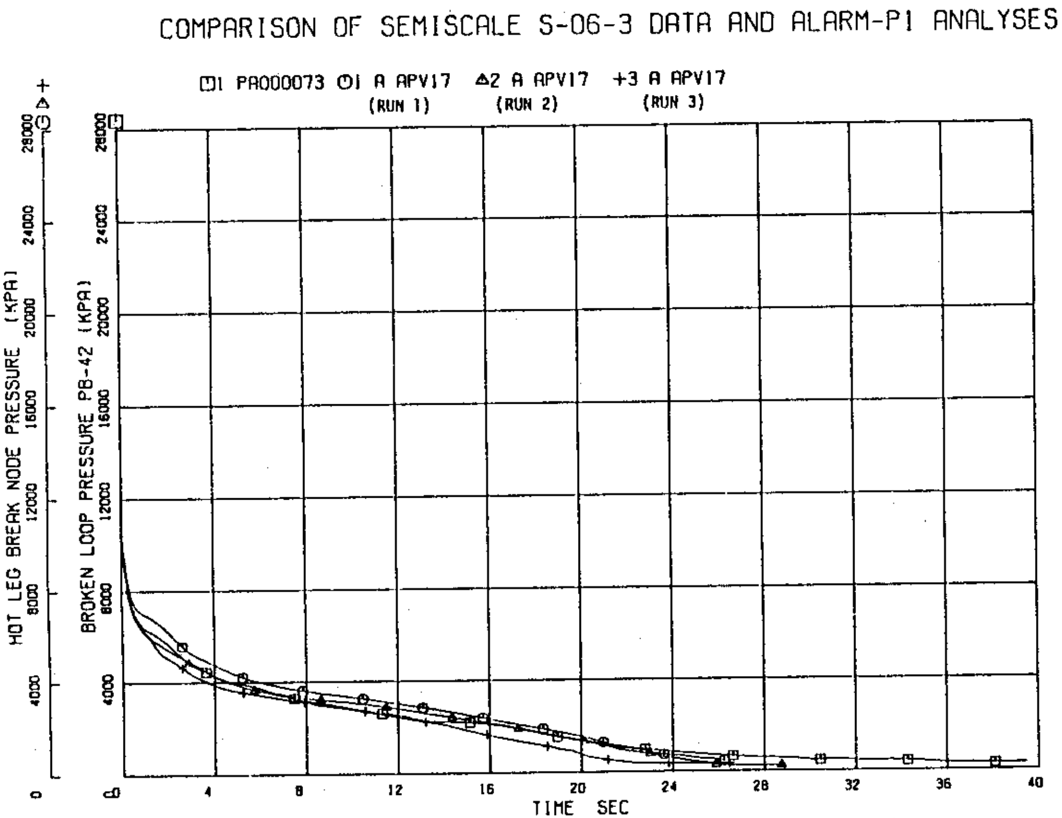

Figure 29 Pressure History upstream of Break Nozzle — Pump Side (PB-42)

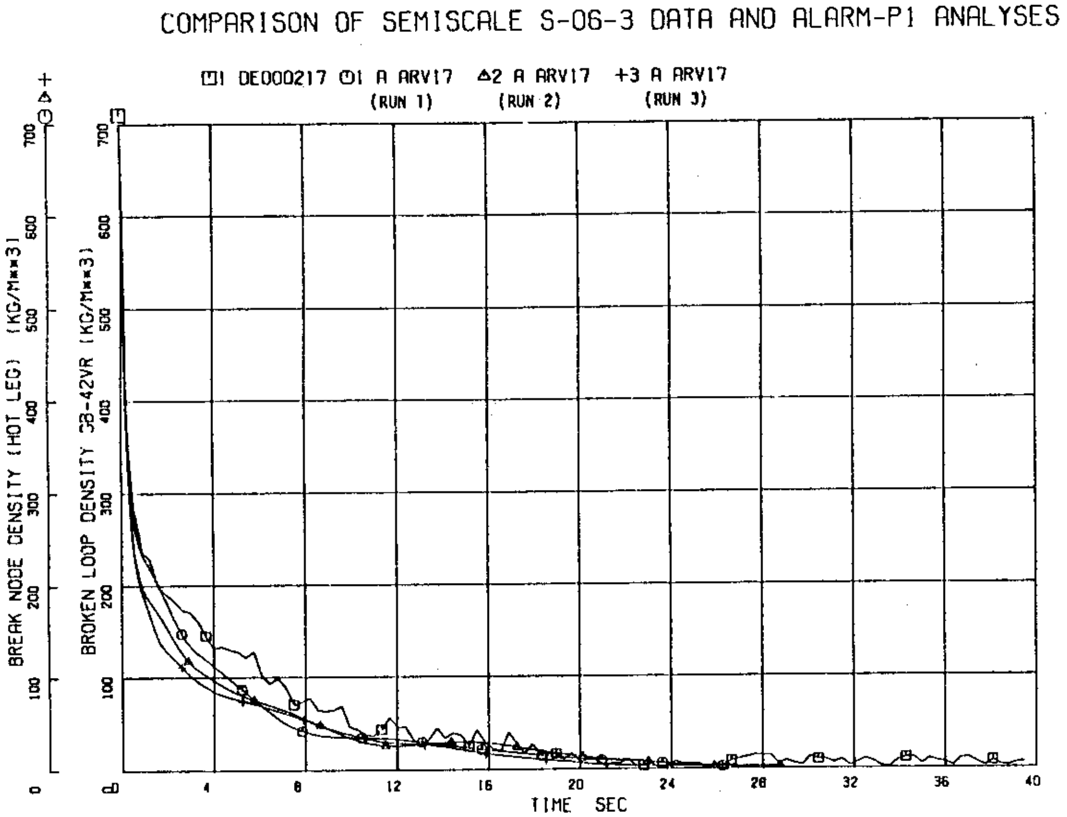

Figure 30 Fluid Density History in Break Volume — Pump Side (GB-42 VR)

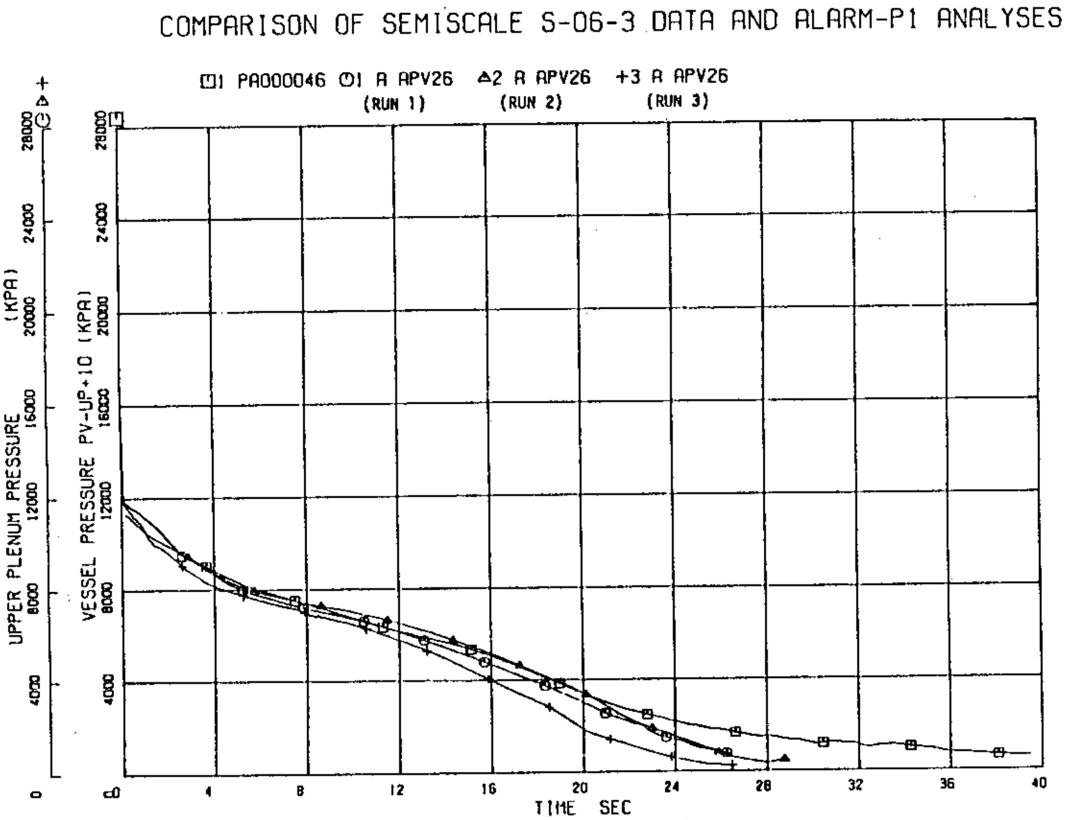

Figure 31 Upper-plenum Pressure History (PV-UP+10)

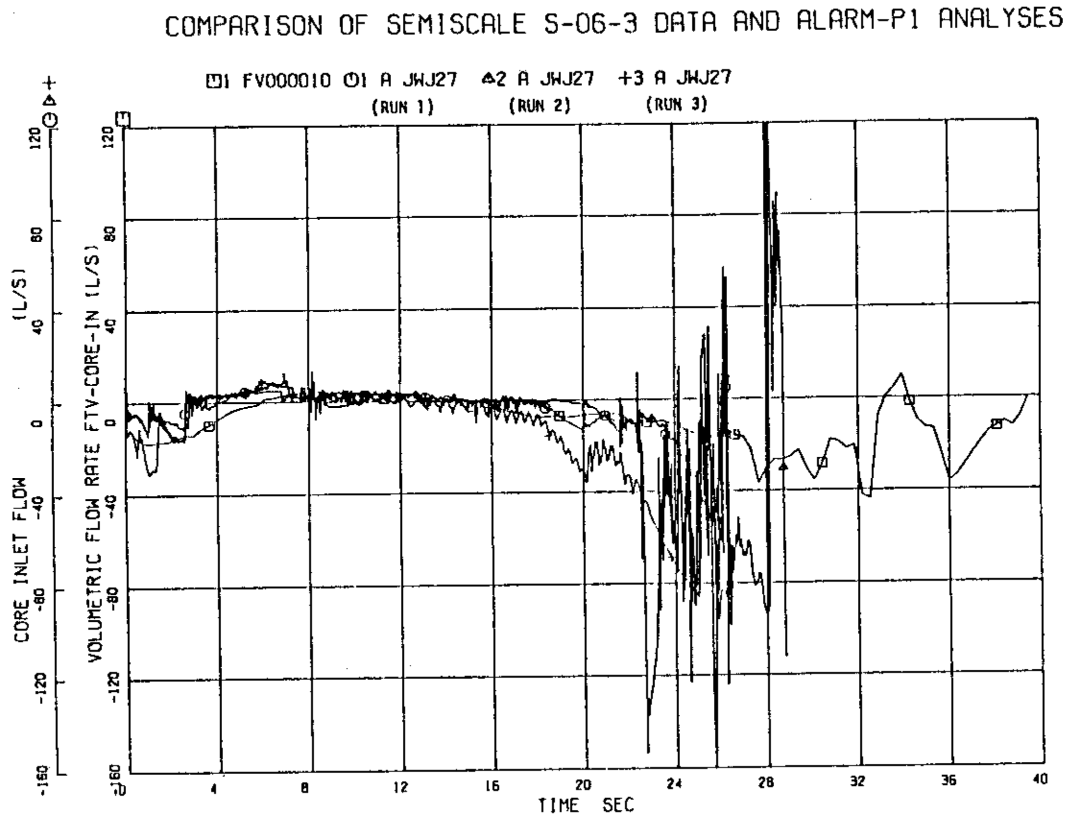

Figure 32 Volumetric Flow Rate at Core Inlet (FTV-COREIN)

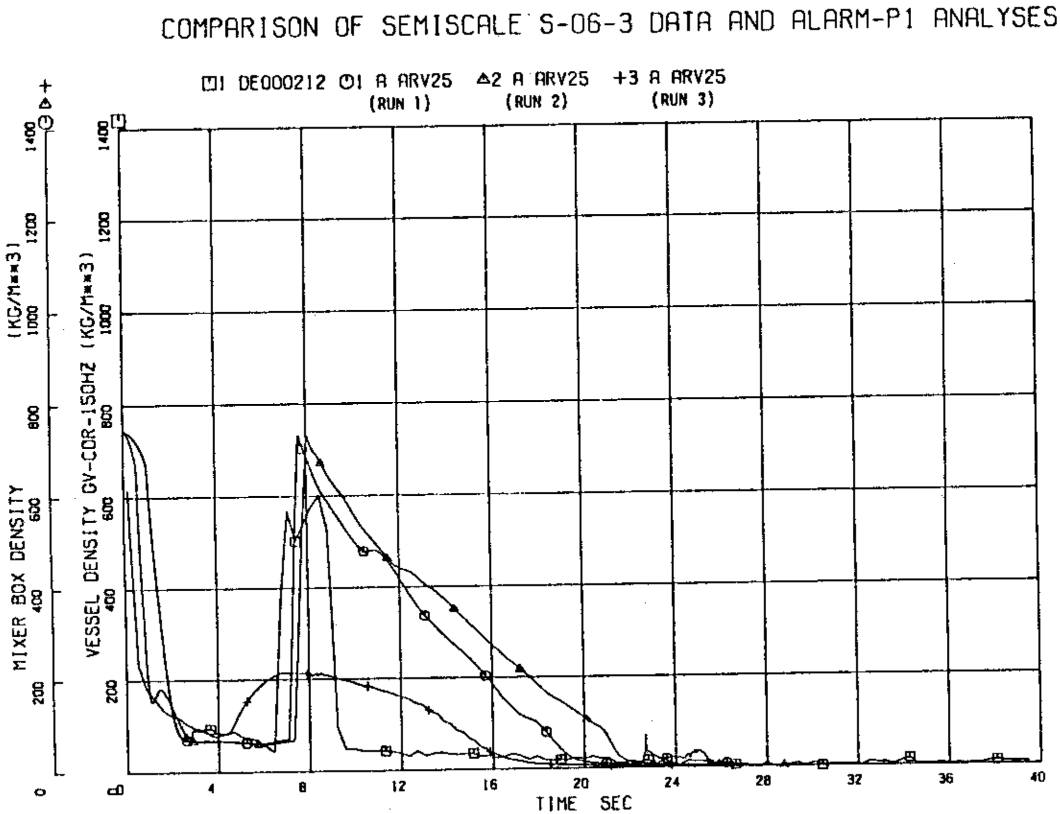

Figure 33 Fluid Density History at Core Inlet (GVCOR-150 HZ)

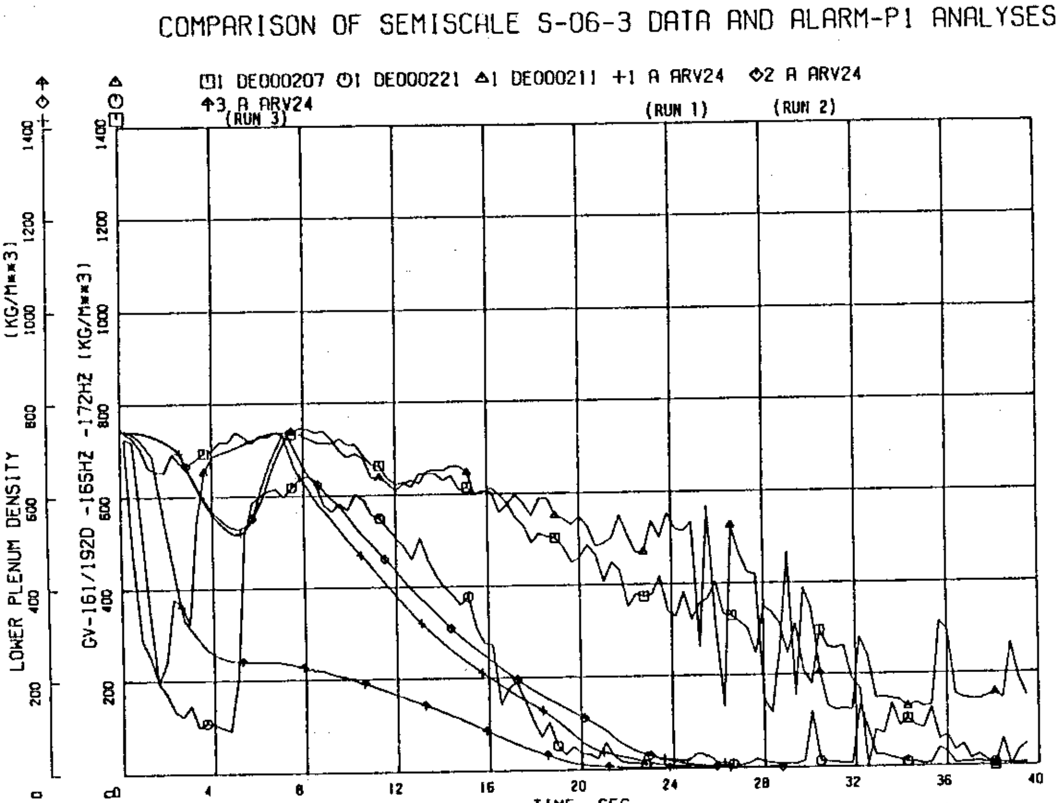

Figure 34 Fluid Density History in Lower-plenum (GV161/192D, GVLP-165HZ, GVLP-172HZ)

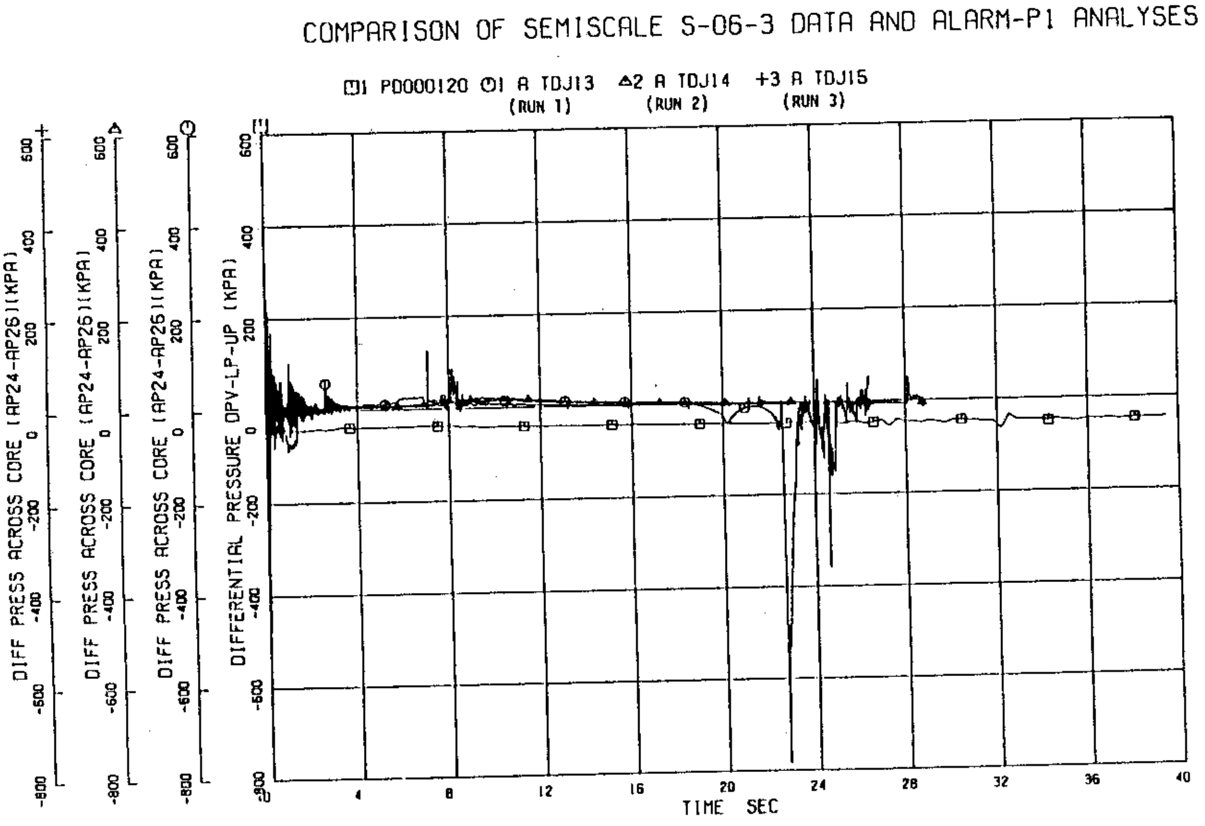

Figure 35 Pressure Difference Across Core (DPV-LP-UP)

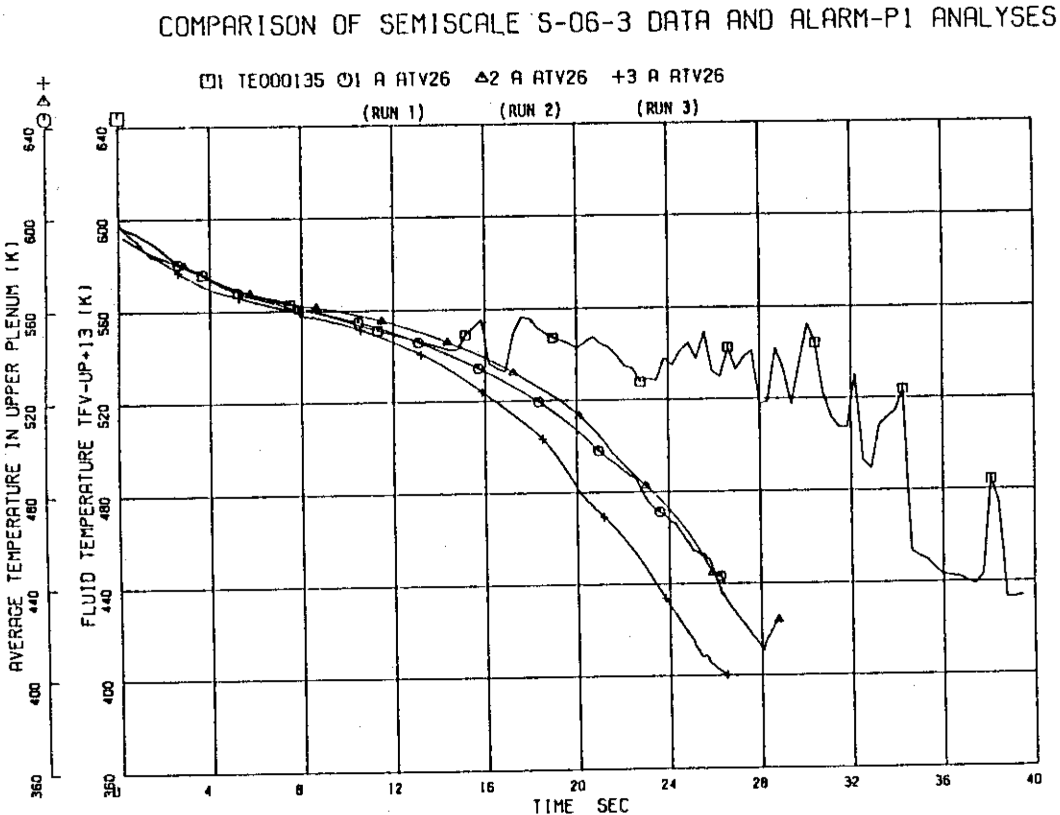

Figure 36 Fluid Temperature Hostory in Upper-plenum (TFV-UP+13)

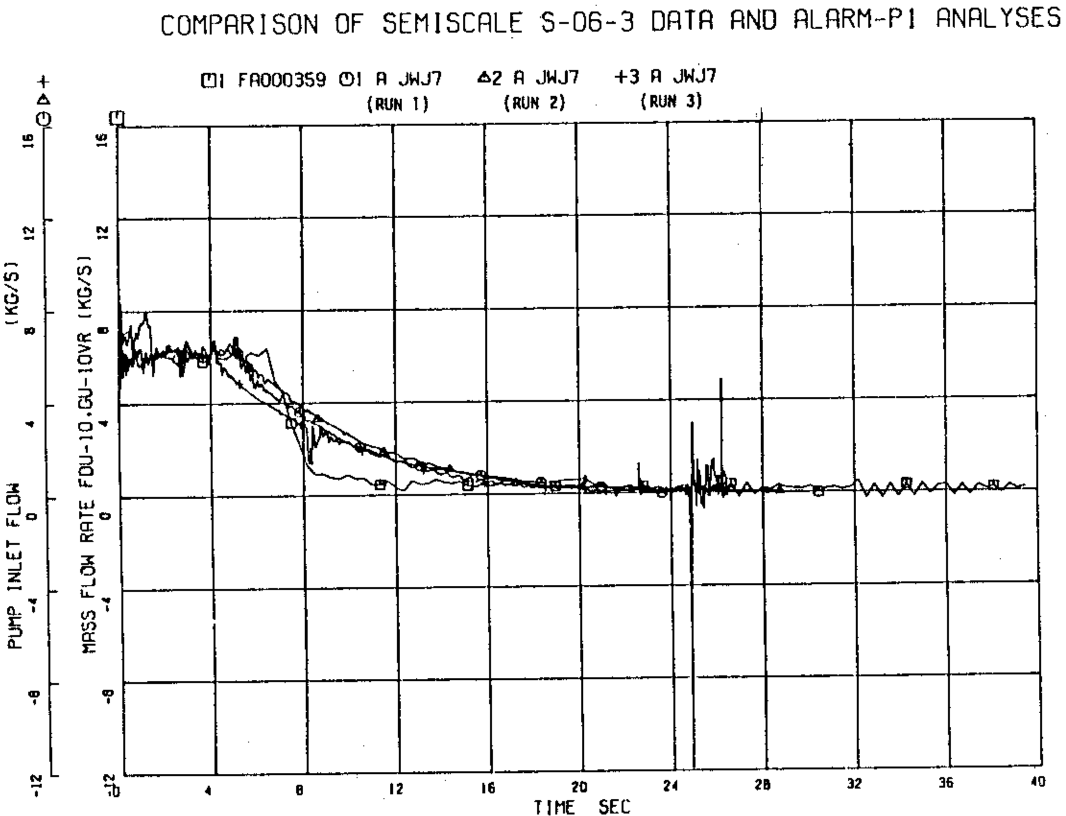

Figure 37 Mass Flow Rate in Spool 10 — Pump Inlet Flow (FDU-10, GU-10 VR)

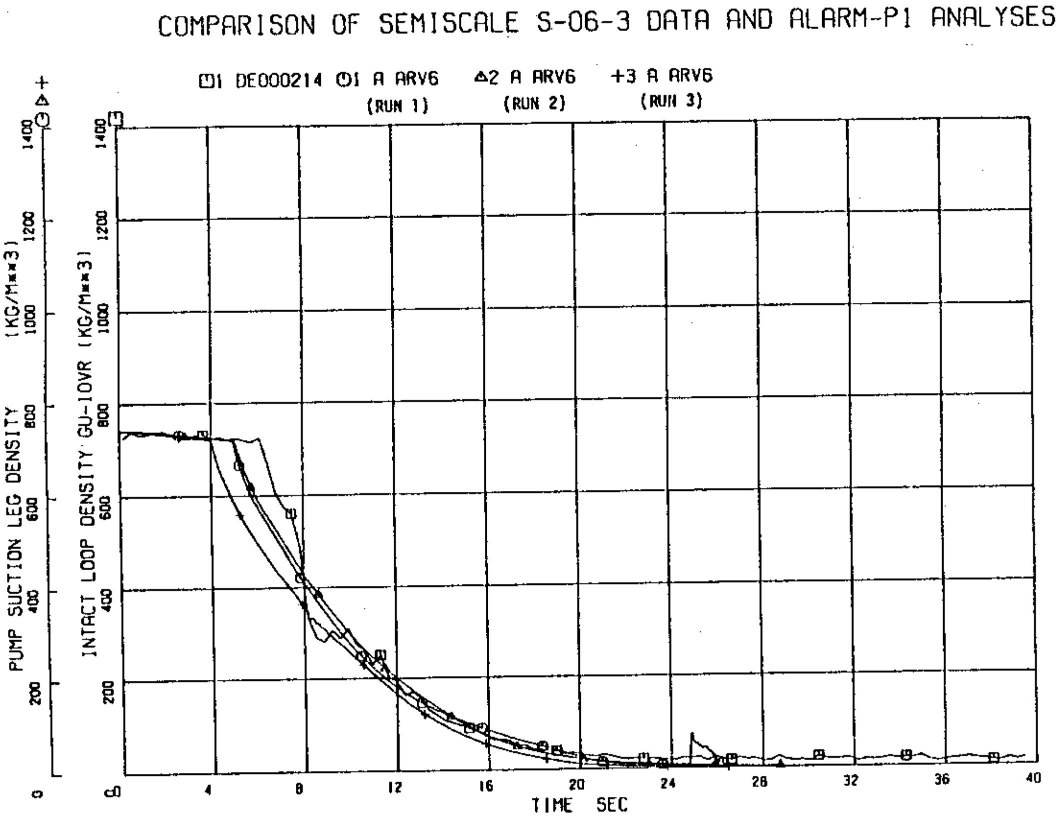

Figure 38 Fluid Density History at Pump Inlet (GU-10 VR)

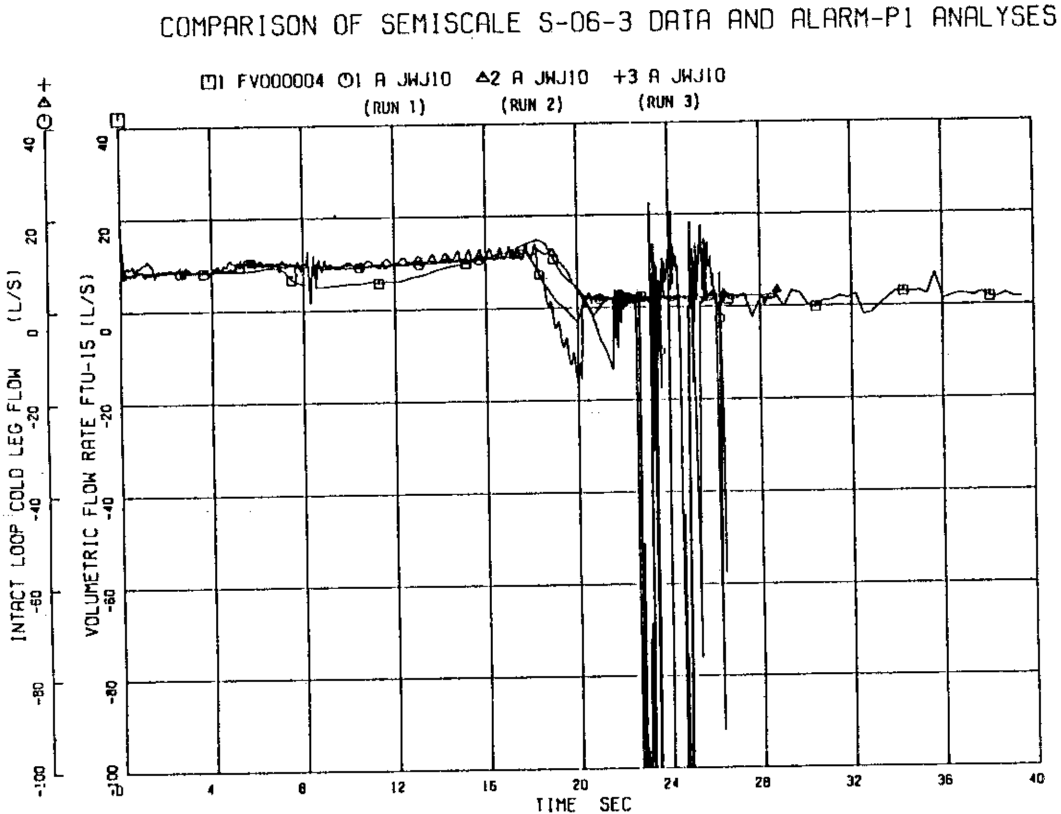

Figure 39 Volumetric Flow Rate in Intact Loop Cold Leg (FTU-15)

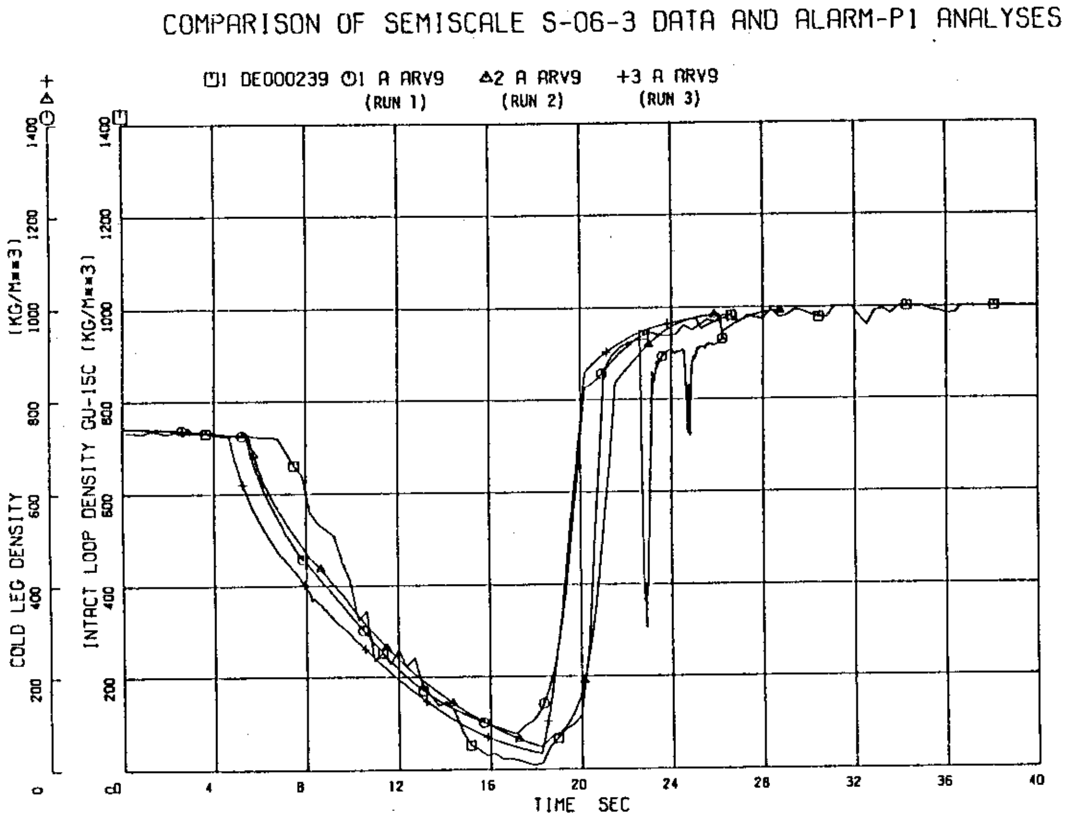

Figure 40 Fluid Density History in Intact Loop Cold Leg (GU-15C)

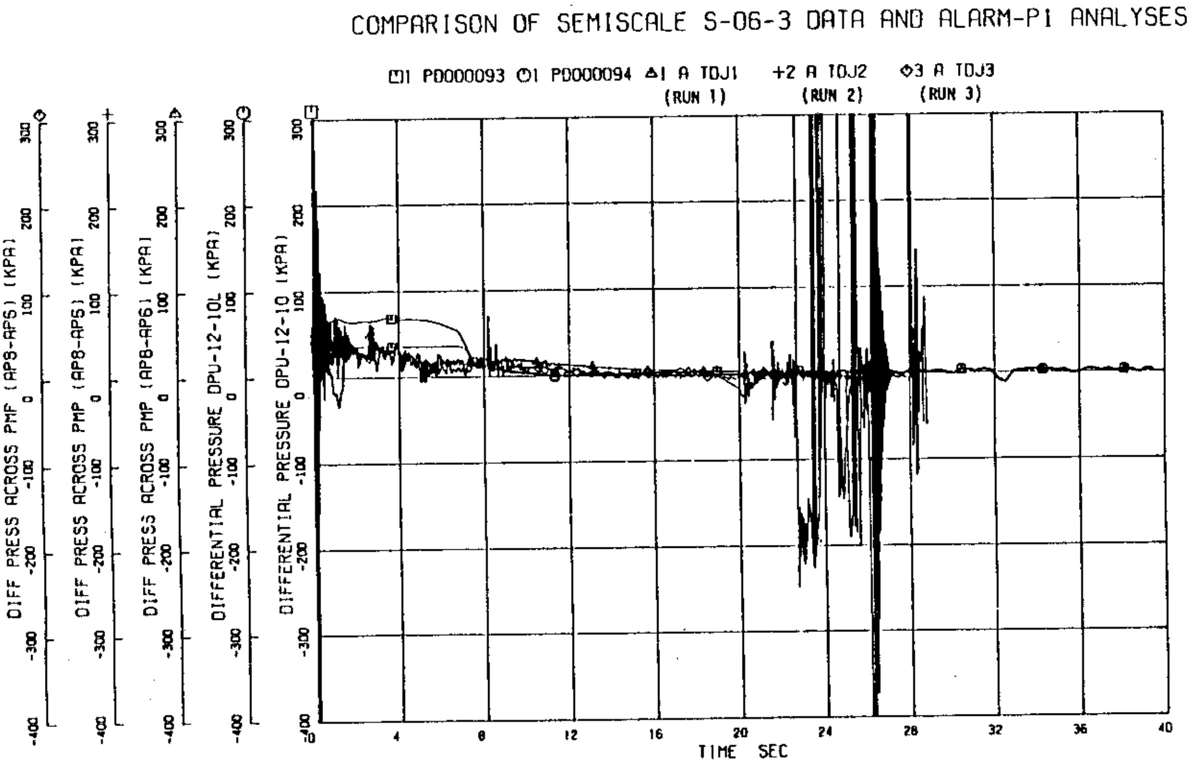

Figure 41 Pressure Difference Across Pump (DPU-12-10)

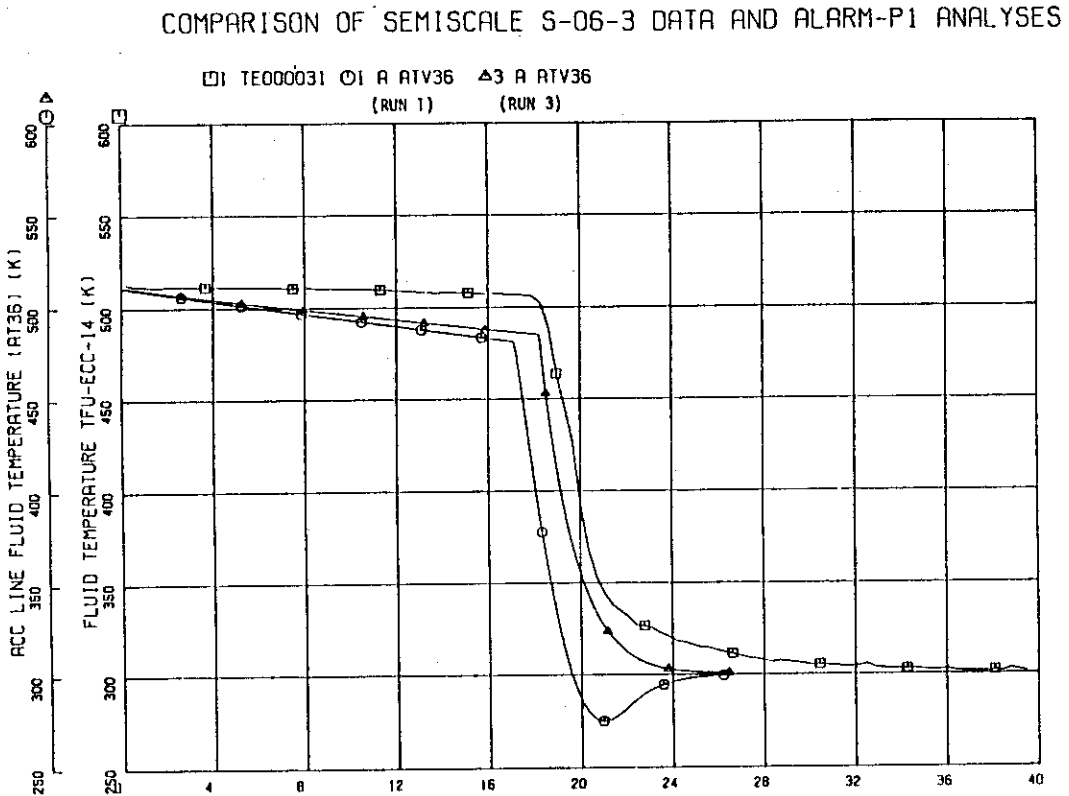

Figure 42 Fluid Temperature History in Accumulator Line (TFU-ECC-14)

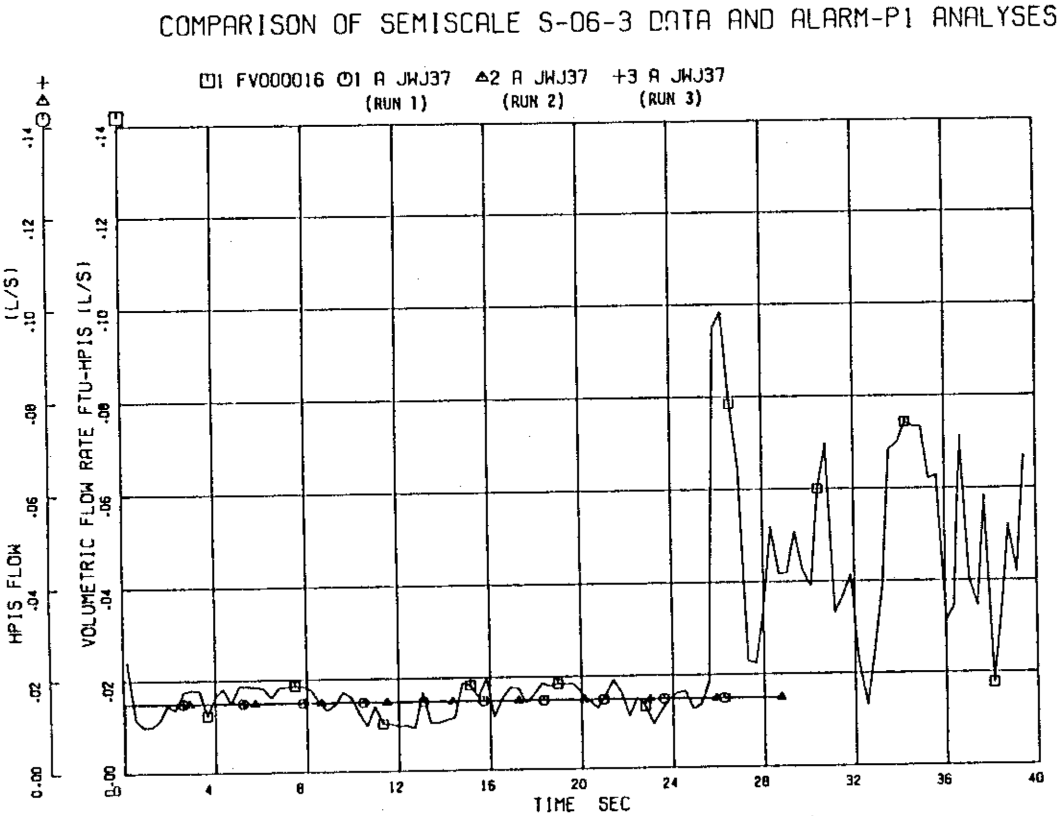

Figure 43 Volumetric Flow Rate in Intact Loop HPIS (FTU-HPIS)

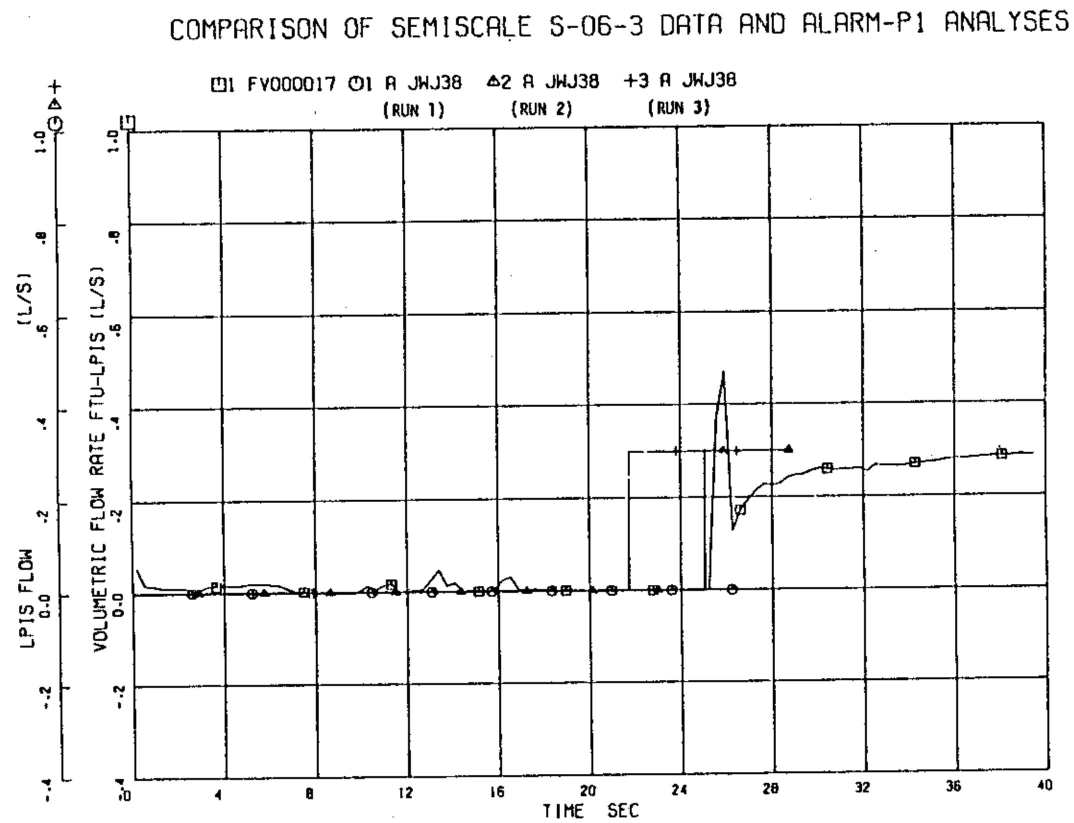
COMPARISON OF SEMISCALE S-06-3 DATA AND ALARM-P1 ANALYSES

Figure 44 Volumetric Flow Rate in Intact Loop LPIS (FTU-LPIS)

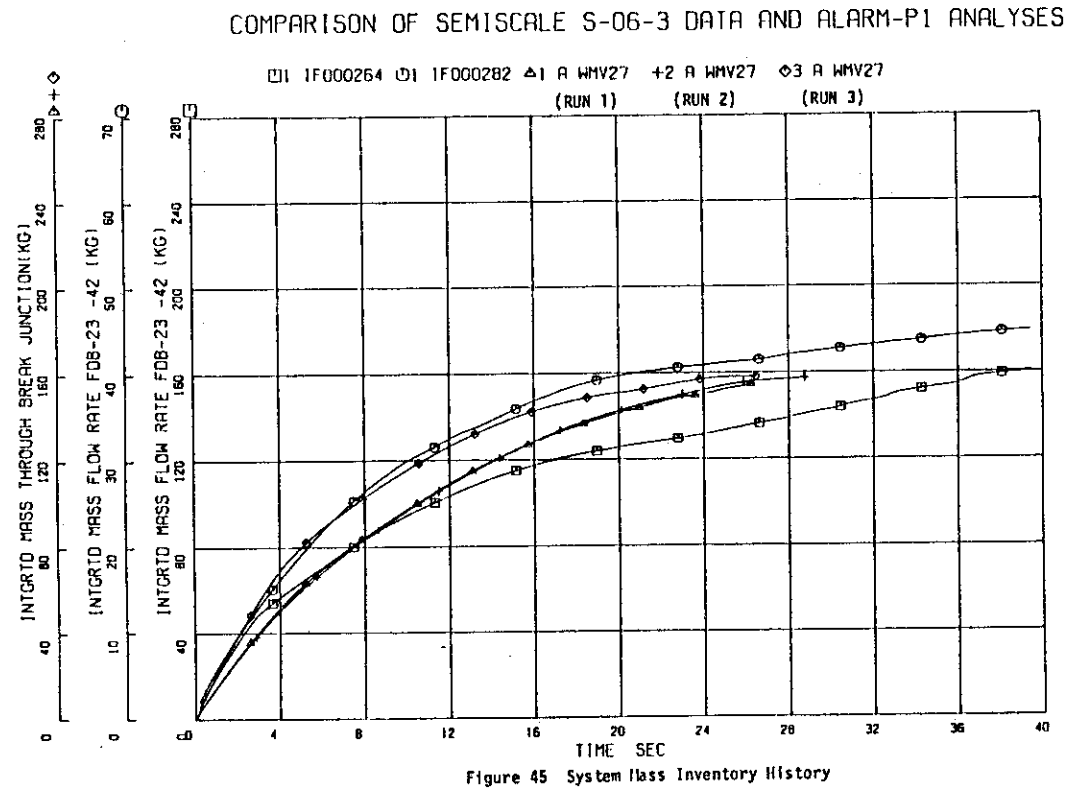
COMPARISON OF SEMISCALE S-06-3 DATA AND ALARM-P1 ANALYSES

Figure 45 System Mass Inventory History

Appendix 1 List of Input-data (RUN 2)

```
/*                                                                        ISP80010
/*      AN ANALYSIS OF SEMISCALE S-06-3 TEST BY ALARM-P1 CODE             ISP80020
/*                                                                        ISP80030
     ALARM-P1 PREDICTION OF CSNI STANDARD PROBLEM NO.8                    ISP80040
/*                                                                        ISP80050
/*   PROBLEM DIMENSION                                                    ISP80060
/*                                                                        ISP80070
/*  LDMP NEDI NTC  NTRP  NVOL NBUB NJUN NPMP NPMPC NCKV NLK NFLL          ISP80080
/*   NSLB NOCOR NGOM  NMAT NHTX     POWRO                                 ISP80090
    -3   18     9    10   36    2    40   1     1     3   1   3           ISP80100
     7     5     2    4     0      1.0058                                 ISP80110
/*                                                                        ISP80120
/*   EDIT VARIABLE                                                        ISP80130
/*                                                                        ISP80140
JW  J29 JW  J30 AP  N10 AP  N17 AP  N35 AP  N21 AP  N26 ST  N28 ST  N29 ISP80150
ST  N30 ST  N31 JW  J7  AT  N11 AT  N18 AT  N26 WM  N27 TM  N27 HC  N28 ISP80160
/*                                                                        ISP80170
/*   TIME STEP SIZE                                                       ISP80180
/*                                                                        ISP80190
    100    20   1   2000      0.000005      0.01                          ISP80200
    100    10   1   1000      0.00001       0.05                          ISP80210
    100     4   1    400      0.000025      0.3                           ISP80220
    100    20   1    200      0.00005       0.5                           ISP80230
    100    10   1    100      0.0001        5.0                           ISP80240
    100    20   1     40      0.00025      10.0                           ISP80250
    100    10   1     20      0.0005       18.0                           ISP80260
    200    10   1     40      0.00025      24.0                           ISP80270
    100    50   1    100      0.0001       50.0                           ISP80280
/*                                                                        ISP80290
/*   TRIP CONTROL                                                         ISP80300
/*                                                                        ISP80310
      1     1   0     0      40.0           0.0    / END OF PROBLEM       ISP80320
     21     1   0     0       0.0           0.0    / STEAM OUTLET J22ISP80330
      3     1   0     0       0.0           0.0    /  POWER               ISP80340
      4     1   0     0     100.0           0.0    / PUMP TRIP            ISP80350
     51     1   0     0       0.0           0.0    / FEED WATER      J23ISP80360
     52    -4  36     0     126.5448E4      0.0    / HPIS  J37            ISP80370
     53    -4  36     0      17.5796E4      0.0    / LPIS  J38            ISP80380
      6     1   0     0       0.00001       0.0    / BREAK                ISP80390
      7     1   0     0       0.00001       0.0    / BREAK                ISP80400
      8     1   0     0      18.2           0.0    / ACC VALVE       J40ISP80410
/*                                                                        ISP80420
/*   VOLUME DATA                                                          ISP80430
/*                                                                        ISP80440
/*  IBUB NPUMP      P              TEMP    HORX        V          ZVOL    ISP80450
/*        ZM              FLOWA    DIAMV          ELEV        FLOWL       ISP80460
/* **********  VOL.1  INTACT LOOP HOT LEG  **********                     ISP80470
      0   0    160.7410E4         326.444  -1.0     0.01082    0.3086735  ISP80480
       0.3086735        0.00349      0.0667     0.1825625      3.17       ISP80490
/*                                                                        ISP80500
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
/* **********  VOL.2  SG INLET PLENUM  **********                       ISP80510
       0   0    160.6312E4       326.444  -1.0    0.00963   0.48514     ISP80520
         0.48514          0.01984     0.1590      0.491236       0.0    ISP80530
                                                                        ISP80540
/*                                                                      ISP80550
/* **********  VOL.3  SG U-TUBE  **********                             ISP80560
       0   0    160.4933E4      -343.52   -1.0    0.01140   2.629916    ISP80570
        2.629916        0.00442    0.0102     0.976376      0.0         ISP80580
/*                                                                      ISP80590
/* **********  VOL.4  SG U-TUBE  **********                             ISP80600
       0   0    160.4606E4      -320.14   -1.0    0.01140   2.629916    ISP80610
        2.629916        0.00442    0.0102     0.976376      0.0         ISP80620
/*                                                                      ISP80630
/* **********  VOL.5  SG OUTLET PLENUM   **********                     ISP80640
       0   0    160.5583E4       290.889  -1.0    0.00963   0.48514     ISP80650
        0.48514         0.01984    0.1590     0.491236      0.0         ISP80660
/*                                                                      ISP80670
/* **********  VOL.6  PUMP SUCTION LEG  **********                      ISP80680
       0   0    160.4092E4       290.889  -1.0    0.01018   1.543812    ISP80690
        1.543812        0.00349    0.0667    -1.052576      0.0         ISP80700
/*                                                                      ISP80710
/* **********  VOL.7  ACTIVE PUMP  **********                           ISP80720
       0   1    160.7004E4       290.889  -1.0    0.00408   0.2809875   ISP80730
        0.2809875       0.00349    0.0667    -0.24765       0.0         ISP80740
             169.53                                                     ISP80750
/*                                                                      ISP80760
/* **********  VOL.8  INTACT LOOP COLD LEG NEAR PUMP  **********        ISP80770
       0   0    161.0477E4       290.889  -1.0    0.00425   0.066675    ISP80780
        0.066675        0.00349    0.0667    -0.0333375     1.25        ISP80790
/*                                                                      ISP80800
/* **********  VOL.9  INTACT LOOP COLD LEG  **********                  ISP80810
       0   0    161.0384E4       290.889  -1.0    0.00425   0.066675    ISP80820
        0.066675        0.00349    0.0667    -0.0333375     1.25        ISP80830
/*                                                                      ISP80840
/* **********  VOL.10 PRESSURIZER  **********                           ISP80850
       2   0   160.6254E4        -1.0      0.0     0.02741   1.143      ISP80860
        0.62547         0.02466    0.0          1.86055     0.0         ISP80870
/*                                                                      ISP80880
/* **********  VOL.11 PRESSURIZER SURGE LINE  **********                ISP80890
       0   0    160.7034E4       242.850  -1.0    0.00037   1.7888225   ISP80900
        1.7888225       4.3E-5     0.0       0.2492375     3.9000       ISP80910
/*                                                                      ISP80920
/* **********  VOL.12  BROKEN LOOP HOT LEG  **********                  ISP80930
       0   0    160.8332E4       322.960  -1.0    0.00315   0.2190115   ISP80940
        0.2190115       0.00349    0.0667    0.1825625     1.00646      ISP80950
/*                                                                      ISP80960
/* **********  VOL.13  SG SIMULATOR  **********                         ISP80970
       0   0    160.7478E4      -349.762 -1.0    0.00852   2.6099135    ISP80980
        2.6099135       0.00374    0.0690    0.401574      2.57658      ISP80990
/*                                                                      ISP81000
/* **********  VOL.14  SG SIMULATOR  **********                         ISP81010
       0   0    160.7478E4      -346.519 -1.0    0.00852   2.6099135    ISP81020
        2.6099135       0.00374    0.0690    0.401574      2.57658      ISP81030
/*                                                                      ISP81040
/* **********  VOL.15  PUMP SUCTION LEG  **********                     ISP81050
       0   0    160.7948E4       317.800  -1.0    0.00252   1.417574    ISP81060
        1.417574        0.00158    0.0449     -1.016        1.40081     ISP81070
/*                                                                      ISP81080
/* **********  VOL.16  PUMP SIMULATOR  **********                       ISP81090
       0   0    160.8552E4       317.000  -1.0    0.00147   0.2301875   ISP81090
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
          0.2301875          0.00198     0.0016     -1.2461875     23.3            ISP81100
/*                                                                                 ISP81110
/* **********  VOL.17  HOT LEG BREAK NODE  **********                              ISP81120
         0   0    160.8077E4         316.970  -1.0     0.00227     1.4954250       ISP81130
          1.4954250          0.00145     0.0429     -1.2461875      1.50799        ISP81140
/*                                                                                 ISP81150
/* **********  VOL.18  BROKEN LOOP COLD LEG  **********                            ISP81160
         0   0    161.0465E4         290.720  -1.0     0.00461     0.066675        ISP81170
          0.066675           0.00349     0.0667     -0.0333375   100.              ISP81180
/*                                                                                 ISP81190
/* **********  VOL.19  HOT LEG SIDE REFLOOD BYPASS LINE  **********                ISP81200
         0   0    160.8141E4         315.850  -1.0     0.00538     0.552323        ISP81210
          0.552323           0.00349     0.0667      0.1825625     0.0             ISP81220
/*                                                                                 ISP81230
/* **********  VOL.20  COLD LEG SIDE REFLOOD BYPASS LINE **********                ISP81240
         0   0    161.0177E4         288.850  -1.0     0.00640     0.768223        ISP81250
          0.768223           0.00349     0.0667     -0.0333375     0.0             ISP81260
/*                                                                                 ISP81270
/* **********  VOL.21  SG SECONDARY SYSTEM  **********                             ISP81280
         1   0     66.8923E4           0.0     0.03208 0.19820     4.6580          ISP81290
          2.90               0.04255     0.0         0.976376      0.0             ISP81300
/*                                                                                 ISP81310
/* **********  VOL.22  PRESSURE VESSEL INLET PLENUM  **********                    ISP81320
         0   0    161.0066E4         290.889  -1.0     0.00504     0.45847         ISP81330
          0.45847            0.00548     0.0412     -0.2667        0.0             ISP81340
/*                                                                                 ISP81350
/* **********  VOL.23  DOWNCOMER ANNULUS  **********                               ISP81360
         0   0    161.1592E4         290.889  -1.0     0.02183     3.880612        ISP81370
          3.880612           0.00534     0.0214     -4.147312      3.9             ISP81380
/*                                                                                 ISP81390
/* **********  VOL.24  LOWER PLENUM  **********                                    ISP81400
         0   0    161.3225E4         290.889  -1.0     0.02161     0.731774        ISP81410
          0.731774           0.00623     0.0        -4.879086      1.0             ISP81420
/*                                                                                 ISP81430
/* **********  VOL.25  MIXER HOUSING  **********                                   ISP81440
         0   0    161.2122E4         290.889  -1.0     0.00371     0.520446        ISP81450
          0.520446           0.00713     0.0        -4.147312      0.0             ISP81460
/*                                                                                 ISP81470
/* **********  VOL.26  UPPER PLENUM  **********                                    ISP81480
         0   0    160.8298E4         326.444  -1.0     0.02620     2.972816        ISP81490
          2.972816           0.00713     0.0        -1.950466      2.5             ISP81500
/*                                                                                 ISP81510
/* **********  VOL.27  PRESSURE SUPPRESSION SYSTEM  **********                     ISP81520
         1   0      2.4820E4          16.35     0.0  100.          4.5225462       ISP81530
          1.21               0.70205     0.9454     -2.5654        0.0             ISP81540
/*                                                                                 ISP81550
/* **********  VOL.28  CORE REGION #1  **********                                  ISP81560
         0   0    161.1054E4        -311.09   -1.0     0.00137     0.2794          ISP81570
          0.2794             0.00492     0.0113     -3.626866      0.0             ISP81580
/*                                                                                 ISP81590
/* **********  VOL.29  CORE REGION #2  **********                                  ISP81600
         0   0    161.0817E4        -319.99   -1.0     0.00137     0.2794          ISP81610
          0.2794             0.00492     0.0113     -3.347466      0.0             ISP81620
/*                                                                                 ISP81630
/* **********  VOL.30  CORE REGION #3  **********                                  ISP81640
         0   0    161.0582E4        -331.90   -1.0     0.00137     0.2794          ISP81650
          0.2794             0.00492     0.0113     -3.068066      0.0             ISP81660
/*                                                                                 ISP81670
/* **********  VOL.31  CORE REGION #4  **********                                  ISP81680
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
       0   0    161.0352E4      -343.28   -1.0    0.00137   0.2794      ISP81690
        0.2794          0.00492    0.0113     -2.788666      0.0         ISP81700
/*                                                                      ISP81710
/* **********  VOL.32  CORE REGION #5  **********                       ISP81720
       0   0    161.0018E4      -352.64   -1.0    0.00274   0.5588      ISP81730
        0.5588          0.00492    0.0113     -2.509266      0.0         ISP81740
/*                                                                      ISP81750
/* **********  VOL.33  ACCUMULATOR TANK  **********                     ISP81760
       2   0     45.0070E4        27.778   0.0    0.1145    3.0036      ISP81770
        2.096           0.03812    0.2203     0.0576375     0.0         ISP81780
/*                                                                      ISP81790
/* **********  VOL.34  ACCUMULATOR LINE  **********                     ISP81800
       0   0     45.0350E4        27.778  -1.0    0.00244   0.0243      ISP81810
        0.02430         0.00046    0.0243     0.0333375     5.31        ISP81820
/*                                                                      ISP81830
/* **********  VOL.35  COLD LEG BREAK NODE  **********                  ISP81840
       0   0    161.0465E4       288.800  -1.0    0.00161   0.066675    ISP81850
        0.066675        0.00349    0.0667    -0.0333375     0.601748    ISP81860
/*                                                                      ISP81870
/* **********  VOL.36  ACCUMULATOR LINE  **********                     ISP81880
       0   0    161.0359E4       238.850  -1.0    0.00244   0.0243      ISP81890
        0.0243          0.00046    0.0243     0.0333375     5.31        ISP81900
/*                                                                      ISP81910
/*    BUBBLE RISE PARAMETER                                             ISP81920
/*                                                                      ISP81930
      0.0    0.9144                                                     ISP81940
      0.8    0.9144                                                     ISP81950
/*                                                                      ISP81960
/*    PUMP  DESCRIPTION DATA AND CURVE DATA                             ISP81970
/*                                                                      ISP81980
      6  5   9   10   13   12   13   11   2                             ISP81990
          0.0    1.0E-5    997.856     58.522    0.0114     372.8       ISP82000
          4.8111       1.6139        0.3                                ISP82010
/*                                                                      ISP82020
/*    HEAD                                                              ISP82030
/*                                                                      ISP82040
      -1.0    1.5      -0.8     1.275   -0.6    1.375    -0.4     1.375 ISP82050
       0.0    1.2       1.0     1.0                                     ISP82060
/*                                                                      ISP82070
      -1.0    0.175    -0.5     0.65     0.0    0.975     0.5      1.35 ISP82080
       1.0    1.95                                                      ISP82090
/*                                                                      ISP82100
      -1.0    0.175    -0.75  -0.15    -0.55  -0.3      -0.275   -0.4   ISP82110
       0.0   -0.35      0.30  -0.20     0.50   0.0       0.80    0.545  ISP82120
       1.0    1.0                                                       ISP82130
/*                                                                      ISP82140
      -1.0    1.50     -0.80    1.15    -0.60   0.95     -0.40     0.83 ISP82150
      -0.2    0.775     0.0     0.725    0.20   0.725     0.40     0.80 ISP82160
       0.6    1.025     1.0     1.95                                    ISP82170
/*                                                                      ISP82180
/*    TORQUE                                                            ISP82190
/*                                                                      ISP82200
      -1.0    0.62     -0.80    0.68    -0.60   0.53     -0.40     0.46 ISP82210
      -0.20   0.49      0.0     0.54     0.20   0.59      0.40     0.65 ISP82220
       0.60   0.77      0.80    0.95     0.90   0.98      0.95     0.96 ISP82230
       1.0    0.87                                                      ISP82240
/*                                                                      ISP82250
      -1.0   -1.44     -0.80  -1.25    -0.60  -1.08      -0.40    -0.92 ISP82260
      -0.20  -0.77      0.0   -0.63     0.20  -0.51       0.40    -0.39 ISP82270
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
     0.60   -0.29       0.80   -0.20      0.90   -0.16       1.0        -0.13   ISP82280
/*                                                                              ISP82290
    -1.0    -1.44      -0.80   -1.12     -0.60   -0.79      -0.40      -0.52    ISP82300
    -0.20   -0.31       0.0    -0.15      0.20    0.02       0.40       0.22    ISP82310
     0.60    0.46       0.80    0.71      0.90    0.81       0.95       0.85    ISP82320
     1.0     0.87                                                               ISP82330
/*                                                                              ISP82340
    -1.0     0.62      -0.80    0.53     -0.60    0.46      -0.40       0.42    ISP82350
    -0.2     0.39       0.0     0.36      0.20    0.32       0.40       0.27    ISP82360
     0.6     0.18       0.80    0.05      1.0    -0.13                          ISP82370
/*                                                                              ISP82380
     0.0     0.0        1.0E8   0.0                                             ISP82390
/*                                                                              ISP82400
/*  JUNCTION DATA                                                               ISP82410
/*                                                                              ISP82420
/*  IW1 IW2  IP  IV  IA  JEN     WP       AJUN       ZJUN          INERTA ISP82430
/*  FRIFF    FRIFR  ANG ZACOEF  MDCOEF                                          ISP82440
/*  *****  JUN.1   UPPER PLENUM TO HOT LEG  *****                               ISP82450
     26   1    0   0   2   1     4.899    0.00183    0.2159         0.0     ISP82460
      0.0      0.0    0  0.85    1.0                                            ISP82470
/*  *****  JUN.2   SG INLET  *****                                              ISP82480
      1   2    0   0   0   1     4.899    0.00349    0.491236       0.0     ISP82490
       6.198   6.198  0  0.85    1.0                                            ISP82500
/*  *****  JUN.3   INLET PLENUM TO U-TUBE   *****                               ISP82510
      2   3    0   0   0   1     4.899    0.00442    0.976376       0.0     ISP82520
         0.0     0.0  0  0.85    1.0                                            ISP82530
/*  *****  JUN.4   TOP OF U-TUBE  *****                                         ISP82540
      3   4    0   0   0   1     4.899    0.00442    3.531108       0.0     ISP82550
         0.0     0.0  0  0.85    1.0                                            ISP82560
/*  *****  JUN.5   U-TUBE TO OUTLET PLENUM  *****                               ISP82570
      4   5    0   0   0   1     4.899    0.00442    0.976376       0.0     ISP82580
         0.0     0.0  0  0.85    1.0                                            ISP82590
/*  *****  JUN.6   SG OUTLET  *****                                             ISP82600
      5   6    0   0   0   1     4.899    0.00349    0.491236       0.0     ISP82610
       15.4395 15.4395 0  0.85    1.0                                           ISP82620
/*  *****  JUN.7   PUMP INLET  *****                                            ISP82630
      6   7   -1   0   0   1     4.899    0.00349   -0.24765        0.0     ISP82640
         5.30    4.86 0  0.85    1.0                                            ISP82650
/*  *****  JUN.8   PUMP OUTLET  *****                                           ISP82660
      7   8    1   0   0   1     4.899    0.00349    0.0            0.0     ISP82670
         1.65    1.65 0  0.85   -1.0                                            ISP82680
/*  *****  JUN.9   WITHIN COLD LEG  *****                                       ISP82690
      8   9    0   0   0   1     4.899    0.00349    0.0            0.0     ISP82700
       0.467   7.32   0  0.85   -1.0                                            ISP82710
/*  *****  JUN.10  VESSEL INLET *****                                           ISP82720
      9  22    0   0   2   1     4.899    0.00183    0.0            0.0     ISP82730
       0.658   1.466  0  0.85   -1.0                                            ISP82740
/*  *****  JUN.11  PRESSURIZER OUTLET  *****                                    ISP82750
     10  11    0   0   0   1     0.0     4.3E-5      2.03806  0.0           ISP82760
      10.8    10.8    0. 0.90    0.6                                            ISP82770
/*  *****  JUN.12  SURGE LINE OUTLET  *****                                     ISP82780
     11   1    0   0   2   1     0.0     4.3E-5      0.2492375 0.0          ISP82790
         0.0    0.0    0. 0.90    0.6                                           ISP82800
/*  *****  JUN.13  VESSEL TO HOT LEG  *****                                     ISP82810
     26  12    0   0   2   1     0.0      0.00183    0.2159       747.499 ISP82820
      0.677051 1.2144 0  0.85    1.0                                            ISP82830
/*  *****  JUN.14  SG SIMULATOR INLET  *****                                    ISP82840
     12  13    0   0   0   1     0.0      0.00024    0.401574  1012.61    ISP82850
         1.41181 1.41146 0  0.85    1.0                                         ISP82860
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
/*   *****  JUN.15  TOP OF SG SIMULATOR  *****                          ISP82870
      13  14     0   0   0   1    0.0      0.00349   2.9448125 1030.44  ISP82880
        285.435 285.435 0  0.85    1.0                                  ISP82890
/*   *****  JUN.16  SG SIMULATOR OUTLET  *****                          ISP82900
      14  15     0   0   0   1    0.0      0.00024   0.401574  1387.54  ISP82910
          1.40405 1.41583 0  0.85    1.0                                ISP82920
/*   *****  JUN.17  PUMP SIMULATOR INLET  *****                         ISP82930
      15  16     0   0   0   1    0.0      0.00024  -1.016      827.54  ISP82940
          0.844137 1.54353 0  0.85    1.0                               ISP82950
/*   *****  JUN.18  PUMP SIMULATOR OUTLET  *****                        ISP82960
      16  17     0   0   0   1    0.0      0.00024  -1.21285   2018.77  ISP82970
         12.8823 12.438 0  0.85    1.0                                  ISP82980
/*   *****  JUN.19  VESSEL EXIT  *****                                  ISP82990
      22  18     0   0   2   1    0.0      0.00183   0.0        574.74  ISP83000
       0.677051 1.21442 0  0.85   -1.0                                  ISP83010
/*   *****  JUN.20  REFLOOD BYPASS EXIT (HOT LEG)  *****                ISP83020
      19  12     0   0   0   1    0.0      0.00349   0.2492375    0.0   ISP83030
          0.0      0.0  0  0.85    1.0                                  ISP83040
/*   *****  JUN.21  REFLOOD BYPASS EXIT (COLD LEG) *****                ISP83050
      20  18     0   0   0   1    0.0      0.00349   0.0333375    0.0   ISP83060
          0.0      0.0  0  0.85    1.0                                  ISP83070
/*   *****  JUN.22  STEAM OUTLET  *****                                 ISP83080
      21   0     1   0   2   1    0.4082   0.00203   5.345176     0.0   ISP83090
          0.0      0.0  0  0.85    0.6                                  ISP83100
/*   *****  JUN.23  FEED WATER INLET  *****                             ISP83110
       0  21     1   0   2   1    0.4082   0.00113   3.9307262    0.0   ISP83120
          0.0      0.0  0  0.85    0.6                                  ISP83130
/*   *****  JUN.24  DOWNCOMER ANNULUS INLET  *****                      ISP83140
      22  23     0   0   2   1    4.899    0.00534  -0.2667       0.0   ISP83150
       3.9706E-2 2.2542E-3 0  0.85   -1.0                               ISP83160
/*   *****  JUN.25  DOWNCOMER TO LOWER PLENUM  ******                   ISP83170
      23  24     0   0   2   1    4.899    0.00534  -4.147312     0.0   ISP83180
       4.6518E-2 0.1465 0  0.85    0.0                                  ISP83190
/*   *****  JUN.26  LOWER PLENUM TO MIXER BOX  ******                   ISP83200
      24  25     0   0   2   1    4.899    0.00713  -4.147312     0.0   ISP83210
       19.569  19.569  0  0.85    0.0                                   ISP83220
/*   *****  JUN.27  CORE INLET  *****                                   ISP83230
      25  28     0   0   0   2    4.899    0.00492  -3.626866     0.0   ISP83240
        10.5898 10.5898 0  0.85    0.0                                  ISP83250
/*   *****  JUN.28  CORE OUTLET *****                                   ISP83260
      32  26     0   0   0   2    4.899    0.00492  -1.950466     0.0   ISP83270
        7.2754  7.2754 0  0.85    0.0                                   ISP83280
/*   *****  JUN.29  BREAK PLANE *****                                   ISP83290
      17  27     0   1   0   1    0.0      0.00024   0.2159     978.25  ISP83300
          1.00777 1.13360 0  0.85    0.6                                ISP83310
/*   *****  JUN.30  BREAK PLANE *****                                   ISP83320
      35  27     0   2   0   1    0.0      0.00024   0.0        318.823 ISP83330
          1.38245 1.15464 0  0.85    0.6                                ISP83340
/*   *****  JUN.31  WITHIN CORE REGION  *****                           ISP83350
      28  29     0   0   0   2    4.899    0.00492  -3.347466     0.0   ISP83360
          0.0      0.0  0  0.85    0.0                                  ISP83370
/*   *****  JUN.32  WITHIN CORE REGION  *****                           ISP83380
      29  30     0   0   0   2    4.899    0.00492  -3.068066     0.0   ISP83390
          0.0      0.0  0  0.85    0.0                                  ISP83400
/*   *****  JUN.33  WITHIN CORE REGION  *****                           ISP83410
      30  31     0   0   0   2    4.899    0.00492  -2.788666     0.0   ISP83420
          0.0      0.0  0  0.85    0.0                                  ISP83430
/*   *****  JUN.34  WITHIN CORE REGION  *****                           ISP83440
      31  32     0   0   0   2    4.899    0.00492  -2.509266     0.0   ISP83450
```

```
----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
         0.0       0.0  0  0.85     0.0                                           ISP83460
/*    *****  JUN.35  ACC EXIT   *****                                             ISP83470
      33  34    0    0    0    1     0.0        0.00046    0.0576375     0.0    ISP83480
         71.095    1.E6 0  0.85    -1.0                                           ISP83490
/*    *****  JUN.36  ECC INJECTION POINT   *****                                  ISP83500
      36   9    0    0    2    1     0.0        0.00046    0.0333375     0.0    ISP83510
         71.095    1.E6 0  0.85    -1.0                                           ISP83520
/*    *****  JUN.37  HPIS   *****                                                 ISP83530
       0  36    2    0    2    1     0.0        0.00015    0.0454875     0.0    ISP83540
         0.0       0.0  0  0.85     1.0                                           ISP83550
/*    *****  JUN.38  LPIS   *****                                                 ISP83560
       0  36    3    0    2    1     0.0        0.00028    0.0454875     0.0    ISP83570
         0.0       0.0  0  0.85     1.0                                           ISP83580
/*    *****  JUN.39  COLD LEG BREAK NODE ENTRANCE *****                           ISP83590
      18  35    0    0    0    1     0.0        0.00349    0.0          292.636 ISP83600
         1.0E-10 1.0E-10 0  0.85      1.0                                         ISP83610
/*    *****  JUN.40  WITHIN ACC LINE   **********                                 ISP83620
/*    34  36    0    3    0    1     0.0        0.00046    1.0301175     0.0    ISP83630
/*      142.19     1.E6 0  0.85    -1.0                                           ISP83640
      34  36    0    3    0    1     0.0        0.00046    0.0454875     0.0    ISP83650
        142.19     1.E6 0  0.85    -1.0                                           ISP83660
/*                                                                                ISP83670
/*     CHECK VALVE DATA                                                           ISP83680
/*                                                                                ISP83690
       -6        0.0      0.0      0.0       0.0          /  BREAK VALVE (J29)    ISP83700
       -7        0.0      0.0      0.0       0.0          /  BREAK VALVE (J30)    ISP83710
       -8        0.0      0.0      0.0       0.0          /  ACC LINE    (J40)    ISP83720
                                                                                  ISP83730
/*                                                                                ISP83740
/*                                                                                ISP83750
/*     LEAK DATA                                                                  ISP83760
/*           AT JUNCTION 22  OF SG SECONDARY SIDE                                 ISP83770
/*                                                                                ISP83780
       2     6     1.0338E4     0.6     0.85                                      ISP83790
   0.0 0.4082 8.0 0.4082 12.0 0.2041 24.0 0.0     24.001 0.0 50.0 0.0             ISP83800
/*                                                                                ISP83810
/*     FILL DATA                                                                  ISP83820
/*           AT JUNCTION 23 OF SG SECONDARY SIDE     FEED WATER                   ISP83830
/*                                                                                ISP83840
       3     0    61.1814E4     73.6                                              ISP83850
   0.0  0.4082              1.0  0.0            50.0  0.0                         ISP83860
/*          HPIS     (JUNCTION 37)                                                ISP83870
/*                                                                                ISP83880
       4     0       7.0338E4     27.778                                          ISP83890
     0.0  0.0149    30.0  0.0149    30.001  0.0817    50.0  0.0817                ISP83900
/*                                                                                ISP83910
/*          LPIS     (JUNCTION 38)                                                ISP83920
/*                                                                                ISP83930
       2     0       7.0338E4     27.778                                          ISP83940
     0.0  0.299    50.0  0.299                                                    ISP83950
/*                                                                                ISP83960
/*     KINETICS CONSTANT DATA                                                     ISP83970
/*                                                                                ISP83980
       1     0       0.0       0.0                                                ISP83990
       30                                                                         ISP84000
        0.0     1.0     1.23    1.0     1.64    0.795  2.05    0.597              ISP84010
        2.18    0.579   2.51    0.579   2.59    0.597  2.86    0.795              ISP84020
        3.27    1.0     5.05    1.0     5.45    0.795  6.00    0.597              ISP84030
        6.68    0.398   7.36    0.216   7.64    0.199 11.05    0.199              ISP84040
       11.45    0.138  12.00    0.121  15.27    0.121 15.82    0.086              ISP84040
```

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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
      16.91   0.086 17.45    0.147 18.00    0.156 19.36    0.156        ISP84050
      20.18   0.061 20.72    0.052 26.45    0.022 36.00    0.022        ISP84060
      39.55   0.038 42.00    0.038                                      ISP84070
/*                                                                      ISP84080
/*    HEAT SLAB DATA                                                    ISP84090
/*                                                                      ISP84100
      3   21  1   2.73053 3.39619  6.2100E-3   0.0  0.0     / U-TUBE1   ISP84110
      4   21  1   2.73053 3.39619  6.2100E-3   0.0  0.0     / U-TUBE2   ISP84120
      0   28  2   0.0     0.3763   1.0085E-3   0.0  0.0     / CORE #1   ISP84130
      0   29  2   0.0     0.3763   1.0085E-3   0.0  0.0     / CORE #2   ISP84140
      0   30  2   0.0     0.3763   1.0085E-3   0.0  0.0     / CORE #3   ISP84150
      0   31  2   0.0     0.3763   1.0085E-3   0.0  0.0     / CORE #4   ISP84160
      0   32  2   0.0     0.7526   2.0170E-3   0.0  0.0     / CORE #5   ISP84170
/*                                                                      ISP84180
/*    CORE SECTION DATA                                                 ISP84190
/*                                                                      ISP84200
      3     0.2794     0.0146     0.1323                                ISP84210
      4     0.2794     0.0146     0.2307                                ISP84220
      5     0.2794     0.0146     0.2553                                ISP84230
      6     0.2794     0.0146     0.2086                                ISP84240
      7     0.5588     0.0146     0.1731                                ISP84250
/*                                                                      ISP84260
/*    SLAB  GEOMETRY DATA                                               ISP84270
/*                                                                      ISP84280
/*    *****  GEOMETRY INDEX 1  *****                                    ISP84290
      2    1   0   1    3   12.446E-4    1.0     5.1054E-3  / INCONEL600ISP84300
/*    *****  GEOMETRY INDEX 2  *****                                    ISP84310
      2    4   0   2    2    8.890E-4    0.0     0.0        / B.N.      ISP84320
           0       3    5   21.830E-4    1.0                / CONSTANTANISP84330
           0       2    3   12.960E-4    0.0                / B.N.      ISP84340
           0       4    2    9.910E-4    0.0                / ST        ISP84350
/*                                                                      ISP84360
/*    MATERIAL THERMAL PROPERTY DATA                                    ISP84370
/*                                                                      ISP84380
/*    THERMAL CONDUCTIVITY OF INCONEL-600                               ISP84390
/*                                                                      ISP84400
      5                                                                 ISP84410
      37.8    3.5133E-3    148.9     3.9597E-3      315.6     4.6087E-3 ISP84420
     593.3    5.6420E-3   1000.0     7.1553E-3                          ISP84430
/*                                                                      ISP84440
/*    HEAT CAPACITY OF INCONEL-600                                      ISP84450
/*                                                                      ISP84460
      5                                                                 ISP84470
      37.8  916.024        204.4     979.463        315.6  1021.595     ISP84480
     426.7 1063.888       1000.0    1282.129                            ISP84490
/*                                                                      ISP84500
/*    GAP CONDUCTANCE DATA                                              ISP84510
/*                                                                      ISP84520
      2                                                                 ISP84530
      0.0   0.0     1000.0   0.0                                        ISP84540
/*                                                                      ISP84550
/*    THERMAL CONDUCTIVITY OF BORON-NITRIDE                             ISP84560
/*                                                                      ISP84570
      22                                                                ISP84580
      50.0    0.5995E-2    100.0     0.5966E-2      150.0     0.5936E-2 ISP84590
     200.0    0.5907E-2    250.0     0.5877E-2      300.0     0.5848E-2 ISP84600
     350.0    0.5819E-2    400.0     0.5789E-2      450.0     0.5760E-2 ISP84610
     500.0    0.5731E-2    550.0     0.5701E-2      600.0     0.5672E-2 ISP84620
     650.0    0.5643E-2    700.0     0.5613E-2      750.0     0.5584E-2 ISP84630
```

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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
     800.0   0.5555E-2      850.0   0.5525E-2      900.0   0.5496E-2    ISP84640
     950.0   0.5467E-2     1000.0   0.5437E-2     1050.0   0.5408E-2    ISP84650
    1100.0   0.5379E-2                                                  ISP84660
/*                                                                      ISP84670
/*    HEAT CAPACITY OF BORON-NITRIDE                                    ISP84680
/*                                                                      ISP84690
      22                                                                ISP84700
      50.0   0.4625E3       100.0   0.5279E3       150.0   0.5874E3     ISP84710
     200.0   0.6413E3       250.0   0.6899E3       300.0   0.7335E3     ISP84720
     350.0   0.7726E3       400.0   0.8074E3       450.0   0.8382E3     ISP84730
     500.0   0.8654E3       550.0   0.8895E3       600.0   0.9105E3     ISP84740
     650.0   0.9289E3       700.0   0.9451E3       750.0   0.9593E3     ISP84750
     800.0   0.9718E3       850.0   0.9831E3       900.0   0.9935E3     ISP84760
     950.0   0.1003E4      1000.0   0.1013E4      1050.0   0.1022E4     ISP84770
    1100.0   0.1032E4                                                   ISP84780
/*                                                                      ISP84790
/*    GAP CONDUCTANCE                                                   ISP84800
      2                                                                 ISP84810
       0.0   0.0           1000.0   0.0                                 ISP84820
/*                                                                      ISP84830
/*    THERMAL CONDUCTIVITY OF CONSTANTAN                                ISP84840
/*                                                                      ISP84850
      22                                                                ISP84860
      50.0   0.6138E-2      100.0   0.6336E-2      150.0   0.6535E-2    ISP84870
     200.0   0.6733E-2      250.0   0.6931E-2      300.0   0.7129E-2    ISP84880
     350.0   0.7328E-2      400.0   0.7526E-2      450.0   0.7724E-2    ISP84890
     500.0   0.7923E-2      550.0   0.8121E-2      600.0   0.8319E-2    ISP84900
     650.0   0.8517E-2      700.0   0.8716E-2      750.0   0.8914E-2    ISP84910
     800.0   0.9112E-2      850.0   0.9311E-2      900.0   0.9509E-2    ISP84920
     950.0   0.9707E-2     1000.0   0.9905E-2     1050.0   0.1010E-1    ISP84930
    1100.0   0.1030E-1                                                  ISP84940
/*                                                                      ISP84950
/*    HEAT CAPACITY OF CONSTANTAN                                       ISP84960
      22                                                                ISP84970
      50.0   0.8771E3       100.0   0.8945E3       150.0   0.9120E3     ISP84980
     200.0   0.9294E3       250.0   0.9469E3       300.0   0.9643E3     ISP84990
     350.0   0.9818E3       400.0   0.9992E3       450.0   0.1017E4     ISP85000
     500.0   0.1034E4       550.0   0.1052E4       600.0   0.1069E4     ISP85010
     650.0   0.1086E4       700.0   0.1104E4       750.0   0.1121E4     ISP85020
     800.0   0.1139E4       850.0   0.1156E4       900.0   0.1174E4     ISP85030
     950.0   0.1191E4      1000.0   0.1209E4      1050.0   0.1226E4     ISP85040
    1100.0   0.1244E4                                                   ISP85050
/*                                                                      ISP85060
/*    GAP CONDUCTANCE DATA                                              ISP85070
      2                                                                 ISP85080
       0.0   0.0           1000.0   0.0                                 ISP85090
/*                                                                      ISP85100
/*    THERMAL CONDUCTIVITY OF STAINLESS STEEL                           ISP85110
/*                                                                      ISP85120
      22                                                                ISP85130
      50.0   0.3287E-2      100.0   0.3446E-2      150.0   0.3604E-2    ISP85140
     200.0   0.3763E-2      250.0   0.3921E-2      300.0   0.4079E-2    ISP85150
     350.0   0.4238E-2      400.0   0.4396E-2      450.0   0.4555E-2    ISP85160
     500.0   0.4713E-2      550.0   0.4872E-2      600.0   0.5030E-2    ISP85170
     650.0   0.5189E-2      700.0   0.5347E-2      750.0   0.5505E-2    ISP85180
     800.0   0.5664E-2      850.0   0.5822E-2      900.0   0.5981E-2    ISP85190
     950.0   0.6139E-2     1000.0   0.6298E-2     1050.0   0.6456E-2    ISP85200
    1100.0   0.6614E-2                                                  ISP85210
                                                                        ISP85220
/*
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
/*    HEAT CAPACITY OF STAINLESS STEEL                                  ISP85230
/*                                                                      ISP85240
      22                                                                ISP85250
      50.0    0.9204E3     100.0    0.9350E3       150.0     0.9495E3   ISP85260
     200.0    0.9640E3     250.0    0.9783E3       300.0     0.9926E3   ISP85270
     350.0    0.1007E4     400.0    0.1021E4       450.0     0.1035E4   ISP85280
     500.0    0.1049E4     550.0    0.1062E4       600.0     0.1076E4   ISP85290
     650.0    0.1090E4     700.0    0.1103E4       750.0     0.1117E4   ISP85300
     800.0    0.1130E4     850.0    0.1143E4       900.0     0.1156E4   ISP85310
     950.0    0.1170E4    1000.0    0.1182E4      1050.0     0.1195E4   ISP85320
    1100.0    0.1208E4                                                  ISP85330
/*                                                                      ISP85340
/*    GAP CONDUCTANCE DATA                                              ISP85350
/*                                                                      ISP85360
      2                                                                 ISP85370
       0.0    0.0           1000.0    0.0                               ISP85380
/*                                                                      ISP85390
/*    END  OF DATA                                                      ISP85400
/*                                                                      ISP85410
/******************************************************************     ISP85420
/*    INDIVIDUAL PARAMETERS CORRESPONDING TO MEASUREMENT DATA     *     ISP85430
/*     PRESSURE                                                   *     ISP85440
/*            PU-PRIZE          ----------     AP 10              *     ISP85450
/*            PB-42             ----------     AP 17              *     ISP85460
/*            PB-23             ----------     AP 35              *     ISP85470
/*            PV-UP+10          ----------     AP 26              *     ISP85480
/*            PU-ACC            ----------     AP 33              *     ISP85490
/*            PU-SGSD           ----------     AP 21              *     ISP85500
/*     DIFFERENTIAL PRESSURE                                      *     ISP85510
/*            DPU-10-12         ----------  AP 6 - AP 8           *     ISP85520
/*            DPB-32-36L        ----------  AP 12- AP 15          *     ISP85530
/*            DPB-38-40         ----------  AP 15- AP 17          *     ISP85540
/*            DPV-LP-UP         ----------  AP 24- AP 26          *     ISP85550
/*     FLOW RATE                                                  *     ISP85560
/*            FTV-COREIN (V)    ----------  JW 27                 *     ISP85570
/*            FTU-15     (V)    ----------  JW 10                 *     ISP85580
/*            FTU-PRIZE  (V)    ----------  JW 12                 *     ISP85590
/*            FTU-LPIS   (V)    ----------  JW 38                 *     ISP85600
/*            FTU-HPIS   (V)    ----------  JW 37                 *     ISP85610
/*            FTU-ACC    (V)    ----------  JW 35                 *     ISP85620
/*            FTU-10,GU-10      ----------  JW 7                  *     ISP85630
/*            FDB-42,GB-42R     ----------  JW 29                 *     ISP85640
/*            FDR-23,GB-23R     ----------  JW 30                 *     ISP85650
/*     FLUID DENSITY                                              *     ISP85660
/*            GB-42VR           ----------  AR 17                 *     ISP85670
/*            GB-23VR           ----------  AR 35                 *     ISP85680
/*            GU-15C            ----------  AR 9                  *     ISP85690
/*            GU-10             ----------  AR 6                  *     ISP85700
/*            GVCOR-150HZ       ----------  AR 25                 *     ISP85710
/*            GV161/192D        ----------  AR 24                 *     ISP85720
/*     FLUID TEMPERATURE                                          *     ISP85730
/*            TFU-PRIZE         ----------  AT 11                 *     ISP85740
/*            TFB-23            ----------  AT 35                 *     ISP85750
/*            TFV-UP+10         ----------  AT 26                 *     ISP85760
/*     HT COEFF. AND AVERAGE QUALITY OF AVERAGE CORE REGION       *     ISP85770
/*          HC 28 , AX 28  ---------- AT ELEVATION 8"ABOVE BOTTOM *     ISP85780
/*          HC 29 , AX 29  ---------- AT ELEVATION 14"ABOVE BOTTOM*     ISP85790
/*          HC 30 , AX 30  ---------- AT ELEVATION 28"ABOVE BOTTOM*     ISP85800
/*          HC 31 , AX 31  ---------- AT ELEVATION 39"ABOVE BOTTOM*     ISP85810
```

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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
/*     INTEGRATED MASS INVENTORY                                      *     ISP85820
/*                                                                    *     ISP85830
/*********************************************************************     ISP85840
/*                                                                          ISP85850
```

Appendix 2   List of Input-data (RUN 3)

```
/*                                                                      ISP80010
/*      AN ANALYSIS OF SEMISCALE S-06-3 TEST BY ALARM-P1 CODE           ISP80020
/*                                                                      ISP80030
      ALARM-P1 PREDICTION OF CSNI STANDARD PROBLEM NO.8                 ISP80040
/*                                                                      ISP80050
/*    PROBLEM DIMENSION                                                 ISP80060
/*                                                                      ISP80070
/*  LDMP NEDI NTC  NTRP  NVOL NBUB NJUN NPMP NPMPC NCKV NLK NFLL        ISP80080
/*   NSLB NOCOR NGOM  NMAT NHTX     POWRO                               ISP80090
     -3   18   10    10   36   2    40    1     1     3   1   3         ISP80100
      7     5     2    4     0      1.0058                              ISP80110
/*                                                                      ISP80120
/*    EDIT VARIABLE                                                     ISP80130
/*                                                                      ISP80140
JW  J29 JW  J30 AP  N10 AP  N17 AP  N35 AP  N21 AP  N26 ST  N28 ST  N29 ISP80150
ST  N30 ST  N31 JW  J7  AT  N11 AT  N18 AT  N26 WM  N27 TM  N27 HC  N28 ISP80160
/*                                                                      ISP80170
/*    TIME STEP SIZE                                                    ISP80180
/*                                                                      ISP80190
     100     20   1   2000      0.000005       0.01                     ISP80200
     100     10   1   1000      0.00001        0.05                     ISP80210
     100     40   1    400      0.000025       0.3                      ISP80220
     100     20   1    200      0.00005        0.5                      ISP80230
     100     20   1    100      0.0001         5.0                      ISP80240
     100     20   1     40      0.00025       10.0                      ISP80250
     100     10   1     20      0.0005        14.0                      ISP80260
     100     20   1     40      0.00025       20.0                      ISP80270
     100     50   1    100      0.0001        25.0                      ISP80280
     100     20   1    200      0.00005       50.0                      ISP80290
/*                                                                      ISP80300
/*    TRIP CONTROL                                                      ISP80310
/*                                                                      ISP80320
       1      1   0      0     40.0            0.0    / END OF PROBLEM  ISP80330
      21      1   0      0      0.0            0.0    / STEAM OUTLET J22ISP80340
       3      1   0      0      0.0            0.0    /  POWER          ISP80350
       4      1   0      0    100.0            0.0    / PUMP TRIP       ISP80360
      51      1   0      0      0.0            0.0    / FEED WATER   J23ISP80370
      52     -4  36      0    127.5778E4       0.0    / HPIS  J37       ISP80380
      53     -4  36      0     18.6126E4       0.0    / LPIS  J38       ISP80390
       6      1   0      0      0.00001        0.0    / BREAK           ISP80400
       7      1   0      0      0.00001        0.0    / BREAK           ISP80410
       8      1   0      0     18.2            0.0    / ACC VALVE    J40ISP80420
/*    VOLUME DATA                                                       ISP80430
/*                                                                      ISP80440
/*   IBUB NPUMP     P             TEMP    HORX       V         ZVOL     ISP80450
/*        ZM             FLOWA     DIAMV        ELEV       FLOWL        ISP80460
/*  **********  VOL.1 INTACT LOOP HOT LEG  **********                   ISP80470
        0   0   161.7740E4       326.444  -1.0    0.01082   0.3086735   ISP80480
        0.3086735       0.00349    0.0667     0.1825625     3.17        ISP80490
/*                                                                      ISP80500
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
/* **********  VOL.2  SG INLET PLENUM  **********                       ISP80510
       0   0    161.6642E4       326.444  -1.0    0.00963   0.48514     ISP80520
         0.48514          0.01984     0.1590      0.491236       0.0    ISP80530
/*                                                                      ISP80540
/* **********  VOL.3  SG U-TUBE  **********                             ISP80550
       0   0    161.5263E4      -343.52   -1.0    0.01140   2.629916    ISP80560
        2.629916        0.00442    0.0102      0.976376      0.0        ISP80570
/*                                                                      ISP80580
/* **********  VOL.4  SG U-TUBE  **********                             ISP80590
       0   0    161.4936E4      -320.14   -1.0    0.01140   2.629916    ISP80600
        2.629916        0.00442    0.0102      0.976376      0.0        ISP80610
/*                                                                      ISP80620
/* **********  VOL.5  SG OUTLET PLENUM  **********                      ISP80630
       0   0    161.5913E4       290.889  -1.0    0.00963   0.48514     ISP80640
        0.48514         0.01984    0.1590      0.491236      0.0        ISP80650
/*                                                                      ISP80660
/* **********  VOL.6  PUMP SUCTION LEG  **********                      ISP80670
       0   0    161.4422E4       290.889  -1.0    0.01018   1.543812    ISP80680
        1.543812        0.00349    0.0667     -1.052576      0.0        ISP80690
/*                                                                      ISP80700
/* **********  VOL.7  ACTIVE PUMP  **********                           ISP80710
       0   1    161.7334E4       290.889  -1.0    0.00408   0.2809875   ISP80720
        0.2809875       0.00349    0.0667     -0.24765       0.0        ISP80730
             169.53                                                     ISP80740
/*                                                                      ISP80750
/* **********  VOL.8  INTACT LOOP COLD LEG NEAR PUMP  **********        ISP80760
       0   0   162.0807E4        290.889  -1.0    0.00425   0.066675    ISP80770
        0.066675        0.00349    0.0667     -0.0333375     1.25       ISP80780
/*                                                                      ISP80790
/* **********  VOL.9  INTACT LOOP COLD LEG  **********                  ISP80800
       0   0    162.0714E4       290.889  -1.0    0.00425   0.066675    ISP80810
        0.066675        0.00349    0.0667     -0.0333375     1.25       ISP80820
/*                                                                      ISP80830
/* **********  VOL.10 PRESSURIZER  **********                           ISP80840
       2   0   161.6584E4        -1.0      0.0    0.02741   1.143       ISP80850
        0.62547         0.02466    0.0         1.86055       0.0        ISP80860
/*                                                                      ISP80870
/* **********  VOL.11 PRESSURIZER SURGE LINE  **********                ISP80880
       0   0   161.7364E4        242.850  -1.0    0.00037   1.8077125   ISP80890
        1.8077125       4.3E-5     0.0         0.2492375     3.9000     ISP80900
/*                                                                      ISP80910
/* **********  VOL.12  BROKEN LOOP HOT LEG  **********                  ISP80920
       0   0    161.8662E4       322.960  -1.0    0.00315   0.2190115   ISP80930
        0.2190115       0.00349    0.0667      0.1825625     1.00646    ISP80940
/*                                                                      ISP80950
/* **********  VOL.13  SG SIMULATOR  **********                         ISP80960
       0   0    161.7808E4       -349.762 -1.0    0.00852   2.6099135   ISP80970
        2.6099135       0.00374    0.0690      0.401574      2.57658    ISP80980
/*                                                                      ISP80990
/* **********  VOL.14  SG SIMULATOR  **********                         ISP81000
       0   0    161.7808E4       -346.519 -1.0    0.00852   2.6099135   ISP81010
        2.6099135       0.00374    0.0690      0.401574      2.57658    ISP81020
/*                                                                      ISP81030
/* **********  VOL.15  PUMP SUCTION LEG  **********                     ISP81040
       0   0    161.8278E4       317.800  -1.0    0.00252   1.417574    ISP81050
        1.417574        0.00158    0.0449     -1.016         1.40081    ISP81060
/*                                                                      ISP81070
/* **********  VOL.16  PUMP SIMULATOR  **********                       ISP81080
       0   0    161.8882E4       317.000  -1.0    0.00147   0.2301875   ISP81090
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
        0.2301875       0.00198    0.0016    -1.2461875    23.3         ISP81100
/*                                                                      ISP81110
/* **********  VOL.17  HOT LEG BREAK NODE  **********                   ISP81120
       0   0    161.8407E4       316.970  -1.0    0.00227   1.4954250   ISP81130
        1.4954250       0.00145    0.0429    -1.2461875     1.50799     ISP81140
/*                                                                      ISP81150
/* **********  VOL.18  BROKEN LOOP COLD LEG  **********                 ISP81160
       0   0    162.0795E4       290.720  -1.0    0.00461   0.066675    ISP81170
        0.066675        0.00349    0.0667    -0.0333375  100.           ISP81180
/*                                                                      ISP81190
/* **********  VOL.19  HOT LEG SIDE REFLOOD BYPASS LINE  **********     ISP81200
       0   0    161.8471E4       315.850  -1.0    0.00538   0.552323    ISP81210
        0.552323        0.00349    0.0667     0.1825625     0.0         ISP81220
/*                                                                      ISP81230
/* **********  VOL.20  COLD LEG SIDE REFLOOD BYPASS LINE **********     ISP81240
       0   0    162.0507E4       288.850  -1.0    0.00640   0.768223    ISP81250
        0.768223        0.00349    0.0667    -0.0333375     0.0         ISP81260
/*                                                                      ISP81270
/* **********  VOL.21  SG SECONDARY SYSTEM  **********                  ISP81280
       1   0     67.9253E4         0.0    0.03208 0.19820   4.6580      ISP81290
        2.90            0.04255    0.0        0.976376      0.0         ISP81300
/*                                                                      ISP81310
/* **********  VOL.22  PRESSURE VESSEL INLET PLENUM  **********         ISP81320
       0   0    162.0396E4       290.889  -1.0    0.00504   0.45847     ISP81330
        0.45847         0.00548    0.0412    -0.2667        0.0         ISP81340
/*                                                                      ISP81350
/* **********  VOL.23  DOWNCOMER ANNULUS  **********                    ISP81360
       0   0    162.1922E4       290.889  -1.0    0.02183   3.880612    ISP81370
        3.880612        0.00534    0.0214    -4.147312      3.9         ISP81380
/*                                                                      ISP81390
/* **********  VOL.24  LOWER PLENUM  **********                         ISP81400
       0   0    162.3555E4       290.889  -1.0    0.02161   0.731774    ISP81410
        0.731774        0.00623    0.0       -4.879086      1.0         ISP81420
/*                                                                      ISP81430
/* **********  VOL.25  MIXER HOUSING  **********                        ISP81440
       0   0    162.2452E4       290.889  -1.0    0.00371   0.520446    ISP81450
        0.520446        0.00713    0.0       -4.147312      0.0         ISP81460
/*                                                                      ISP81470
/* **********  VOL.26  UPPER PLENUM  **********                         ISP81480
       0   0    161.8628E4       326.444  -1.0    0.02620   2.972816    ISP81490
        2.972816        0.00713    0.0       -1.950466      2.5         ISP81500
/*                                                                      ISP81510
/* **********  VOL.27  PRESSURE SUPPRESSION SYSTEM  **********          ISP81520
       1   0      3.5150E4        16.35    0.0  100.        4.5225462   ISP81530
        1.21            0.70205    0.9454    -2.5654        0.0         ISP81540
/*                                                                      ISP81550
/* **********  VOL.28  CORE REGION #1  **********                       ISP81560
       0   0    162.1384E4      -311.09   -1.0    0.00137   0.2794      ISP81570
        0.2794          0.00492    0.0113    -3.626866      0.0         ISP81580
/*                                                                      ISP81590
/* **********  VOL.29  CORE REGION #2  **********                       ISP81600
       0   0    162.1147E4      -319.99   -1.0    0.00137   0.2794      ISP81610
        0.2794          0.00492    0.0113    -3.347466      0.0         ISP81620
/*                                                                      ISP81630
/* **********  VOL.30  CORE REGION #3  **********                       ISP81640
       0   0    162.0912E4      -331.90   -1.0    0.00137   0.2794      ISP81650
        0.2794          0.00492    0.0113    -3.068066      0.0         ISP81660
/*                                                                      ISP81670
/* **********  VOL.31  CORE REGION #4  **********                       ISP81680
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
       0   0    162.0682E4      -343.28   -1.0   0.00137    0.2794      ISP81690
        0.2794          0.00492    0.0113    -2.788666     0.0         ISP81700
/*                                                                      ISP81710
/* **********  VOL.32  CORE REGION #5  **********                       ISP81720
       0   0    162.0348E4      -352.64   -1.0    0.00274   0.5588      ISP81730
        0.5588          0.00492    0.0113    -2.509266     0.0         ISP81740
/*                                                                      ISP81750
/* **********  VOL.33  ACCUMULATOR TANK  **********                     ISP81760
       2   0     46.0400E4        27.778   0.0    0.1145    3.0036      ISP81770
        2.096           0.03812    0.2203     0.0576375    0.0         ISP81780
/*                                                                      ISP81790
/* **********  VOL.34  ACCUMULATOR LINE  **********                     ISP81800
       0   0     46.0680E4        27.778  -1.0    0.00244   0.0243      ISP81810
        0.02430         0.00046    0.0243     0.0333375    5.31        ISP81820
/*                                                                      ISP81830
/* **********  VOL.35  COLD LEG BREAK NODE  **********                  ISP81840
       0   0    162.0795E4       288.800  -1.0    0.00161   0.066675    ISP81850
        0.066675        0.00349    0.0667    -0.0333375    0.601748    ISP81860
/*                                                                      ISP81870
/* **********  VOL.36  ACCUMULATOR LINE  **********                     ISP81880
       0   0    162.0689E4       238.850  -1.0    0.00244   0.0243      ISP81890
        0.0243          0.00046    0.0243     0.0333375    5.31        ISP81900
/*                                                                      ISP81910
/*    BUBBLE RISE PARAMETER                                             ISP81920
/*                                                                      ISP81930
      0.0    0.9144                                                     ISP81940
      0.8    0.9144                                                     ISP81950
/*                                                                      ISP81960
/*    PUMP  DESCRIPTION DATA AND CURVE DATA                             ISP81970
/*                                                                      ISP81980
      6  5   9   10   13   12   13   11   2                             ISP81990
          0.0    1.0E-5    997.856     58.522    0.0114    372.8       ISP82000
          4.8111        1.6139       0.3                                ISP82010
/*                                                                      ISP82020
/*    HEAD                                                              ISP82030
/*                                                                      ISP82040
      -1.0    1.5       -0.8    1.275  -0.6    1.375    -0.4      1.375 ISP82050
       0.0    1.2        1.0    1.0                                     ISP82060
/*                                                                      ISP82070
      -1.0    0.175     -0.5    0.65    0.0    0.975     0.5      1.35  ISP82080
       1.0    1.95                                                      ISP82090
/*                                                                      ISP82100
      -1.0    0.175     -0.75  -0.15    -0.55  -0.3      -0.275   -0.4  ISP82110
       0.0   -0.35       0.30  -0.20    0.50   0.0       0.80     0.545 ISP82120
       1.0    1.0                                                       ISP82130
/*                                                                      ISP82140
      -1.0    1.50      -0.80   1.15   -0.60   0.95     -0.40     0.83  ISP82150
      -0.2    0.775      0.0    0.725   0.20   0.725     0.40     0.80  ISP82160
       0.6    1.025      1.0    1.95                                    ISP82170
/*                                                                      ISP82180
/*    TORQUE                                                            ISP82190
/*                                                                      ISP82200
      -1.0    0.62      -0.80   0.68   -0.60   0.53     -0.40     0.46  ISP82210
      -0.20   0.49       0.0    0.54    0.20   0.59      0.40     0.65  ISP82220
       0.60   0.77       0.80   0.95    0.90   0.98      0.95     0.96  ISP82230
       1.0    0.87                                                      ISP82240
/*                                                                      ISP82250
      -1.0   -1.44      -0.80  -1.25   -0.60  -1.08     -0.40    -0.92  ISP82260
      -0.20  -0.77       0.0   -0.63    0.20  -0.51      0.40    -0.39  ISP82270
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
       0.60  -0.29      0.80  -0.20     0.90  -0.16      1.0     -0.13  ISP82280
/*                                                                      ISP82290
      -1.0   -1.44     -0.80  -1.12    -0.60  -0.79     -0.40    -0.52  ISP82300
      -0.20  -0.31      0.0   -0.15     0.20   0.02      0.40     0.22  ISP82310
       0.60   0.46      0.80   0.71     0.90   0.81      0.95     0.85  ISP82320
       1.0    0.87                                                      ISP82330
/*                                                                      ISP82340
      -1.0    0.62     -0.80   0.53    -0.60   0.46     -0.40     0.42  ISP82350
      -0.2    0.39      0.0    0.36     0.20   0.32      0.40     0.27  ISP82360
       0.6    0.18      0.80   0.05     1.0   -0.13                     ISP82370
/*                                                                      ISP82380
       0.0    0.0       1.0E8  0.0                                      ISP82390
/*                                                                      ISP82400
/*    JUNCTION DATA                                                     ISP82410
/*                                                                      ISP82420
/*    IW1 IW2  IP  IV  IA  JEN JCH WP       AJUN      ZJUN       INERTA ISP82430
/*    FRIFF    FRIFR  ANG ZACOEF CONTCZ CONTCM                          ISP82440
/*   *****  JUN.1   UPPER PLENUM TO HOT LEG  *****                      ISP82450
      26   1    0   0   2   1 0   4.899    0.00183   0.2159       0.0   ISP82460
       0.0      0.0    0 0.4     0.6   1.0                              ISP82470
/*   *****  JUN.2   SG INLET  *****                                     ISP82480
       1   2    0   0   0   1 0   4.899    0.00349   0.491236     0.0   ISP82490
        6.198   6.198  0 0.4     0.6   1.0                              ISP82500
/*   *****  JUN.3   INLET PLENUM TO U-TUBE   *****                      ISP82510
       2   3    0   0   0   1 0   4.899    0.00442   0.976376     0.0   ISP82520
          0.0     0.0  0 0.4     0.6   1.0                              ISP82530
/*   *****  JUN.4   TOP OF U-TUBE  *****                                ISP82540
       3   4    0   0   0   1 0   4.899    0.00442   3.531108     0.0   ISP82550
          0.0     0.0  0 0.4     0.6   1.0                              ISP82560
/*   *****  JUN.5   U-TUBE TO OUTLET PLENUM  *****                      ISP82570
       4   5    0   0   0   1 0   4.899    0.00442   0.976376     0.0   ISP82580
          0.0     0.0  0 0.4     0.6   1.0                              ISP82590
/*   *****  JUN.6   SG OUTLET  *****                                    ISP82600
       5   6    0   0   0   1 0   4.899    0.00349   0.491236     0.0   ISP82610
        15.4395 15.4395 0  0.4     0.6   1.0                            ISP82620
/*   *****  JUN.7   PUMP INLET  *****                                   ISP82630
       6     7 -1   0   0   1 0   4.899    0.00349  -0.24765      0.0   ISP82640
          5.30    4.86 0  0.4     0.6   1.0                             ISP82650
/*   *****  JUN.8   PUMP OUTLET  *****                                  ISP82660
       7   8    1   0   0   1 0   4.899    0.00349   0.0          0.0   ISP82670
          1.65    1.65 0  0.4     0.6   -1.0                            ISP82680
/*   *****  JUN.9   WITHIN COLD LEG  *****                              ISP82690
       8   9    0   0   0   1 0   4.899    0.00349   0.0          0.0   ISP82700
        0.467   7.32   0  0.4     0.6   -1.0                            ISP82710
/*   *****  JUN.10  VESSEL INLET *****                                  ISP82720
       9  22    0   0   2   1 0   4.899    0.00183   0.0          0.0   ISP82730
        0.658   1.466  0  0.4     0.6   -1.0                            ISP82740
/*   *****  JUN.11  PRESSURIZER OUTLET  *****                           ISP82750
      10  11    0   0   0   1 0   0.0     4.3E-5     2.05695  0.0       ISP82760
       10.0    10.0    0. 0.4     0.6   0.6                             ISP82770
/*   *****  JUN.12  SURGE LINE OUTLET  *****                            ISP82780
      11   1    0   0   2   1 0   0.0      4.3E-5    0.2492375 0.0      ISP82790
          0.0    0.0    0. 0.4      0.6   0.6                           ISP82800
/*   *****  JUN.13  VESSEL TO HOT LEG  *****                            ISP82810
      26  12    0   0   2   1 0   0.0      0.00183   0.2159     747.499 ISP82820
       0.677051 1.2144 0  0.4     0.6   1.0                             ISP82830
/*   *****  JUN.14  SG SIMULATOR INLET  *****                           ISP82840
      12  13    0   0   0   1 0   0.0      0.00024   0.401574   1012.61 ISP82850
          1.41181 1.41146 0  0.4     0.6   1.0                          ISP82860
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
/*    *****  JUN.15  TOP OF SG SIMULATOR  *****                                  ISP82870
       13  14    0    0    0    1 0    0.0        0.00349   2.9448125 1030.44  ISP82880
         285.435 285.435 0  0.4      0.6   1.0                                   ISP82890
/*    *****  JUN.16  SG SIMULATOR OUTLET  *****                                  ISP82900
       14  15    0    0    0    1 0    0.0        0.00024   0.401574  1387.54  ISP82910
           1.40405 1.41583 0  0.4      0.6   1.0                                 ISP82920
/*    *****  JUN.17  PUMP SIMULATOR INLET  *****                                 ISP82930
       15  16    0    0    0    1 0    0.0        0.00024  -1.016       827.54  ISP82940
           0.844137 1.54353 0  0.4      0.6   1.0                                ISP82950
/*    *****  JUN.18  PUMP SIMULATOR OUTLET  *****                                ISP82960
       16  17    0    0    0    1 0    0.0        0.00024  -1.21285    2018.77  ISP82970
          12.8823 12.438 0  0.4      0.6   1.0                                   ISP82980
/*    *****  JUN.19  VESSEL EXIT  *****                                          ISP82990
       22  18    0    0    2    1 0    0.0        0.00183   0.0          574.74  ISP83000
        0.677051 1.21442 0  0.4      0.6   -1.0                                  ISP83010
/*    *****  JUN.20  REFLOOD BYPASS EXIT (HOT LEG)  *****                        ISP83020
       19  12    0    0    0    1 0    0.0        0.00349   0.2492375     0.0   ISP83030
           0.0       0.0  0  0.4      0.6   1.0                                  ISP83040
/*    *****  JUN.21  REFLOOD BYPASS EXIT (COLD LEG) *****                        ISP83050
       20  18    0    0    0    1 0    0.0        0.00349   0.0333375     0.0   ISP83060
           0.0       0.0  0  0.4      0.6   1.0                                  ISP83070
/*    *****  JUN.22  STEAM OUTLET  *****                                         ISP83080
       21   0    1    0    2    1 0    0.4082     0.00203   5.345176      0.0   ISP83090
           0.0       0.0  0  0.4      0.6   0.6                                  ISP83100
/*    *****  JUN.23  FEED WATER INLET  *****                                     ISP83110
        0  21    1    0    2    1 0    0.4082     0.00113   3.9307262     0.0   ISP83120
           0.0       0.0  0  0.4      0.6   0.6                                  ISP83130
/*    *****  JUN.24  DOWNCOMER ANNULUS INLET  *****                              ISP83140
       22  23    0    0    2    1 0    4.899      0.00534  -0.2667        0.0   ISP83150
        3.9706E-2 2.2542E-3 0  0.4      0.6   -1.0                               ISP83160
/*    *****  JUN.25  DOWNCOMER TO LOWER PLENUM  ******                           ISP83170
       23  24    0    0    2    1 0    4.899      0.00534  -4.147312      0.0   ISP83180
        4.6518E-2 0.1465 0  0.4      0.6   1.0                                   ISP83190
/*    *****  JUN.26  LOWER PLENUM TO MIXER BOX  ******                           ISP83200
       24  25    0    0    2    1 0    4.899      0.00713  -4.147312      0.0   ISP83210
        19.569  19.569  0  0.4      0.6   1.0                                    ISP83220
/*    *****  JUN.27  CORE INLET  *****                                           ISP83230
       25  28    0    0    0    2 0    4.899      0.00492  -3.626866      0.0   ISP83240
          10.5898 10.5898 0  0.4      0.6   1.0                                  ISP83250
/*    *****  JUN.28  CORE OUTLET *****                                           ISP83260
       32  26    0    0    0    2 0    4.899      0.00492  -1.950466      0.0   ISP83270
          7.2704  7.2704 0  0.4      0.6   1.0                                   ISP83280
/*    *****  JUN.29  BREAK PLANE *****                                           ISP83290
       17  27    0    1    0    1 0    0.0        0.00024   0.2159       978.25  ISP83300
           1.00777 1.13360 0  0.4      0.6   0.6                                 ISP83310
/*    *****  JUN.30  BREAK PLANE *****                                           ISP83320
       35  27    0    2    0    1 0    0.0        0.00024   0.0         318.823 ISP83330
           1.38245 1.15464 0  0.4      0.6   0.6                                 ISP83340
/*    *****  JUN.31  WITHIN CORE REGION  *****                                   ISP83350
       28  29    0    0    0    2 0    4.899      0.00492  -3.347466      0.0   ISP83360
           0.0       0.0  0  0.4      0.6   1.0                                  ISP83370
/*    *****  JUN.32  WITHIN CORE REGION  *****                                   ISP83380
       29  30    0    0    0    2 0    4.899      0.00492  -3.068066      0.0   ISP83390
           0.0       0.0  0  0.4      0.6   1.0                                  ISP83400
/*    *****  JUN.33  WITHIN CORE REGION  *****                                   ISP83410
       30  31    0    0    0    2 0    4.899      0.00492  -2.788666      0.0   ISP83420
           0.0       0.0  0  0.4      0.6   1.0                                  ISP83430
/*    *****  JUN.34  WITHIN CORE REGION  *****                                   ISP83440
       31  32    0    0    0    2 0    4.899      0.00492  -2.509266      0.0   ISP83450
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
          0.0     0.0  0  0.4     0.6   1.0                             ISP83460
/*   *****  JUN.35  ACC EXIT  *****                                     ISP83470
      33  34    0   0   0   1 0   0.0      0.00046    0.0576375    0.0  ISP83480
         92.4     1.E6 0  0.4     0.6   -1.0                            ISP83490
/*   *****  JUN.36  ECC INJECTION POINT  *****                          ISP83500
      36   9    0   0   2   1 0   0.0      0.00046    0.0333375    0.0  ISP83510
         92.4     1.E6 0  0.4     0.6   -1.0                            ISP83520
/*   *****  JUN.37  HPIS  *****                                         ISP83530
       0  36    2   0   2   1 0   0.0      0.00015    0.0454875    0.0  ISP83540
          0.0     0.0  0  0.4     0.6   1.0                             ISP83550
/*   *****  JUN.38  LPIS  *****                                         ISP83560
       0  36    3   0   2   1 0   0.0      0.00028    0.0454875    0.0  ISP83570
          0.0     0.0  0  0.4     0.6   1.0                             ISP83580
/*   *****  JUN.39  COLD LEG BREAK NODE ENTRANCE *****                  ISP83590
      18  35    0   0   0   1 0   0.0      0.00349    0.0        292.636 ISP83600
          1.0E-10 1.0E-10 0  0.4     0.6   1.0                          ISP83610
/*   *****  JUN.40  WITHIN ACC LINE  **********                         ISP83620
      34  36    0   3   0   1 0   0.0      0.00046    0.0454875    0.0  ISP83630
        184.8     1.E6 0  0.4     0.6   -1.0                            ISP83640
/*                                                                      ISP83650
/*    CHECK VALVE DATA                                                  ISP83660
/*                                                                      ISP83670
      -6      0.0    0.0    0.0     0.0          /  BREAK VALVE (J29)   ISP83680
      -7      0.0    0.0    0.0     0.0          /  BREAK VALVE (J30)   ISP83690
      -8      0.0    0.0    0.0     0.0          /  ACC LINE    (J40)   ISP83700
/*                                                                      ISP83710
/*                                                                      ISP83720
/*    LEAK DATA                                                         ISP83730
/*         AT JUNCTION 22  OF SG SECONDARY SIDE                         ISP83740
/*                                                                      ISP83750
      2    6 0  2.0668E4    0.6   0.6   0.4                             ISP83760
   0.0 0.4082 8.0 0.4082 12.0 0.2041 24.0 0.0     24.001 0.0 50.0 0.0   ISP83770
/*                                                                      ISP83780
/*    FILL DATA                                                         ISP83790
/*         AT JUNCTION 23 OF SG SECONDARY SIDE     FEED WATER           ISP83800
/*                                                                      ISP83810
      3    0   62.2144E4    73.6                                        ISP83820
   0.0  0.4082           1.0  0.0          50.0  0.0                    ISP83830
/*        HPIS     (JUNCTION 37)                                        ISP83840
/*                                                                      ISP83850
      4    0     8.0668E4     27.778                                    ISP83860
        0.0  0.0149   30.0  0.0149   30.001   0.0817   50.0  0.0817     ISP83870
/*                                                                      ISP83880
/*        LPIS     (JUNCTION 38)                                        ISP83890
/*                                                                      ISP83900
      2    0     8.0668E4     27.778                                    ISP83910
        0.0  0.299    50.0  0.299                                       ISP83920
/*                                                                      ISP83930
/*    KINETICS CONSTANT DATA                                            ISP83940
/*                                                                      ISP83950
      1    0      0.0     0.0                                           ISP83960
      30                                                                ISP83970
        0.0    1.0    1.23   1.0    1.64   0.795  2.05   0.597          ISP83980
        2.18   0.579  2.51   0.579  2.59   0.597  2.86   0.795          ISP83990
        3.27   1.0    5.05   1.0    5.45   0.795  5.70   0.605          ISP84000
        6.40   0.400  7.36   0.216  7.64   0.199 11.05   0.199          ISP84010
       11.45   0.138 12.00   0.124 15.00   0.124 15.82   0.086          ISP84020
       16.91   0.086 17.45   0.147 18.20   0.160 19.36   0.156          ISP84030
       20.30   0.055 26.20   0.055 27.30   0.023 34.00   0.023          ISP84040
```

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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
      39.55   0.038 40.20   0.043                                       ISP84050
                                                                        ISP84060
/*                                                                      ISP84070
/*    HEAT SLAB DATA                                                    ISP84080
/*                                                                      ISP84080
      3   21  1   2.73053 3.39619  6.2100E-3   0.0  0.0     / U-TUBE1   ISP84090
      4   21  1   2.73053 3.39619  6.2100E-3   0.0  0.0     / U-TUBE2   ISP84100
      0   28  2   0.0     0.3384   9.0699E-4   0.0  0.0     / CORE #1   ISP84110
      0   29  2   0.0     0.3384   9.0699E-4   0.0  0.0     / CORE #2   ISP84120
      0   30  2   0.0     0.3384   9.0699E-4   0.0  0.0     / CORE #3   ISP84130
      0   31  2   0.0     0.3384   9.0699E-4   0.0  0.0     / CORE #4   ISP84140
      0   32  2   0.0     0.6768   1.8140E-3   0.0  0.0     / CORE #5   ISP84150
                                                                        ISP84160
/*                                                                      ISP84170
/*    CORE SECTION DATA                                                 ISP84180
/*                                                                      ISP84190
      3     0.2794     0.0146     0.1323                                ISP84200
      4     0.2794     0.0146     0.2307                                ISP84210
      5     0.2794     0.0146     0.2553                                ISP84220
      6     0.2794     0.0146     0.2086                                ISP84230
      7     0.5588     0.0146     0.1731                                ISP84240
/*                                                                      ISP84250
/*    SLAB  GEOMETRY DATA                                               ISP84260
/*                                                                      ISP84270
/*    *****  GEOMETRY INDEX 1  *****                                    ISP84270
      2    1   0   1    3   12.446E-4    1.0     5.1054E-3  / INCONEL600ISP84280
                                                                        ISP84290
/*    *****  GEOMETRY INDEX 2  *****                                    ISP84300
      2    4   0   2    2    8.890E-4    0.0     0.0        / B.N.      ISP84300
           0       3    5   21.830E-4    1.0                / CONSTANTANISP84310
           0       2    3   12.960E-4    0.0                / B.N.      ISP84320
           0       4    2    9.910E-4    0.0                / ST        ISP84330
                                                                        ISP84340
/*                                                                      ISP84350
/*    MATERIAL THERMAL PROPERTY DATA                                    ISP84360
/*                                                                      ISP84370
/*    THERMAL CONDUCTIVITY OF INCONEL-600                               ISP84380
/*                                                                      ISP84390
      5                                                                 ISP84390
      37.8    3.5133E-3    148.9    3.9597E-3      315.6     4.6087E-3  ISP84400
     593.3    5.6420E-3   1000.0    7.1553E-3                           ISP84410
                                                                        ISP84420
/*                                                                      ISP84430
/*    HEAT CAPACITY OF INCONEL-600                                      ISP84440
/*                                                                      ISP84450
      5                                                                 ISP84450
      37.8  916.024        204.4    979.463        315.6  1021.595      ISP84460
     426.7 1063.888       1000.0   1282.129                             ISP84470
                                                                        ISP84480
/*                                                                      ISP84490
/*    GAP CONDUCTANCE DATA                                              ISP84500
/*                                                                      ISP84510
      2                                                                 ISP84520
      0.0   0.0    1000.0    0.0                                        ISP84530
/*                                                                      ISP84540
/*    THERMAL CONDUCTIVITY OF BORON-NITRIDE                             ISP84550
/*                                                                      ISP84560
      22                                                                ISP84560
      50.0    0.5995E-2    100.0    0.5966E-2      150.0     0.5936E-2  ISP84570
     200.0    0.5907E-2    250.0    0.5877E-2      300.0     0.5848E-2  ISP84580
     350.0    0.5819E-2    400.0    0.5789E-2      450.0     0.5760E-2  ISP84590
     500.0    0.5731E-2    550.0    0.5701E-2      600.0     0.5672E-2  ISP84600
     650.0    0.5643E-2    700.0    0.5613E-2      750.0     0.5584E-2  ISP84610
     800.0    0.5555E-2    850.0    0.5525E-2      900.0     0.5496E-2  ISP84620
     950.0    0.5467E-2   1000.0    0.5437E-2     1050.0     0.5408E-2  ISP84630
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
    1100.0    0.5379E-2                                                 ISP84640
/*                                                                      ISP84650
/*    HEAT CAPACITY OF BORON-NITRIDE                                    ISP84660
/*                                                                      ISP84670
      22                                                                ISP84680
      50.0    0.4625E3     100.0    0.5279E3       150.0     0.5874E3   ISP84690
     200.0    0.6413E3     250.0    0.6899E3       300.0     0.7335E3   ISP84700
     350.0    0.7726E3     400.0    0.8074E3       450.0     0.8382E3   ISP84710
     500.0    0.8654E3     550.0    0.8895E3       600.0     0.9105E3   ISP84720
     650.0    0.9289E3     700.0    0.9451E3       750.0     0.9593E3   ISP84730
     800.0    0.9718E3     850.0    0.9831E3       900.0     0.9935E3   ISP84740
     950.0    0.1003E4    1000.0    0.1013E4      1050.0     0.1022E4   ISP84750
    1100.0    0.1032E4                                                  ISP84760
/*                                                                      ISP84770
/*    GAP CONDUCTANCE                                                   ISP84780
      2                                                                 ISP84790
       0.0    0.0         1000.0    0.0                                 ISP84800
/*                                                                      ISP84810
/*    THERMAL CONDUCTIVITY OF CONSTANTAN                                ISP84820
/*                                                                      ISP84830
      22                                                                ISP84840
      50.0    0.6138E-2    100.0    0.6336E-2      150.0     0.6535E-2  ISP84850
     200.0    0.6733E-2    250.0    0.6931E-2      300.0     0.7129E-2  ISP84860
     350.0    0.7328E-2    400.0    0.7526E-2      450.0     0.7724E-2  ISP84870
     500.0    0.7923E-2    550.0    0.8121E-2      600.0     0.8319E-2  ISP84880
     650.0    0.8517E-2    700.0    0.8716E-2      750.0     0.8914E-2  ISP84890
     800.0    0.9112E-2    850.0    0.9311E-2      900.0     0.9509E-2  ISP84900
     950.0    0.9707E-2   1000.0    0.9905E-2     1050.0     0.1010E-1  ISP84910
    1100.0    0.1030E-1                                                 ISP84920
/*                                                                      ISP84930
/*    HEAT CAPACITY OF CONSTANTAN                                       ISP84940
      22                                                                ISP84950
      50.0    0.8771E3     100.0    0.8945E3       150.0     0.9120E3   ISP84960
     200.0    0.9294E3     250.0    0.9469E3       300.0     0.9643E3   ISP84970
     350.0    0.9818E3     400.0    0.9992E3       450.0     0.1017E4   ISP84980
     500.0    0.1034E4     550.0    0.1052E4       600.0     0.1069E4   ISP84990
     650.0    0.1086E4     700.0    0.1104E4       750.0     0.1121E4   ISP85000
     800.0    0.1139E4     850.0    0.1156E4       900.0     0.1174E4   ISP85010
     950.0    0.1191E4    1000.0    0.1209E4      1050.0     0.1226E4   ISP85020
    1100.0    0.1244E4                                                  ISP85030
/*                                                                      ISP85040
/*    GAP CONDUCTANCE DATA                                              ISP85050
      2                                                                 ISP85060
       0.0    0.0         1000.0    0.0                                 ISP85070
/*                                                                      ISP85080
/*    THERMAL CONDUCTIVITY OF STAINLESS STEEL                           ISP85090
/*                                                                      ISP85100
      22                                                                ISP85110
      50.0    0.3287E-2    100.0    0.3446E-2      150.0     0.3604E-2  ISP85120
     200.0    0.3763E-2    250.0    0.3921E-2      300.0     0.4079E-2  ISP85130
     350.0    0.4238E-2    400.0    0.4396E-2      450.0     0.4555E-2  ISP85140
     500.0    0.4713E-2    550.0    0.4872E-2      600.0     0.5030E-2  ISP85150
     650.0    0.5189E-2    700.0    0.5347E-2      750.0     0.5505E-2  ISP85160
     800.0    0.5664E-2    850.0    0.5822E-2      900.0     0.5981E-2  ISP85170
     950.0    0.6139E-2   1000.0    0.6298E-2     1050.0     0.6456E-2  ISP85180
    1100.0    0.6614E-2                                                 ISP85190
/*                                                                      ISP85200
/*    HEAT CAPACITY OF STAINLESS STEEL                                  ISP85210
/*                                                                      ISP85220
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----*----1----*----2----*----3----*----4----*----5----*----6----*----7-R--*----8
  22                                                                    ISP85230
   50.0     0.9204E3      100.0     0.9350E3       150.0     0.9495E3   ISP85240
  200.0     0.9640E3      250.0     0.9783E3       300.0     0.9926E3   ISP85250
  350.0     0.1007E4      400.0     0.1021E4       450.0     0.1035E4   ISP85260
  500.0     0.1049E4      550.0     0.1062E4       600.0     0.1076E4   ISP85270
  650.0     0.1090E4      700.0     0.1103E4       750.0     0.1117E4   ISP85280
  800.0     0.1130E4      850.0     0.1143E4       900.0     0.1156E4   ISP85290
  950.0     0.1170E4     1000.0     0.1182E4      1050.0     0.1195E4   ISP85300
 1100.0     0.1208E4                                                    ISP85310
/*                                                                      ISP85320
/*    GAP CONDUCTANCE DATA                                              ISP85330
/*                                                                      ISP85340
      2                                                                 ISP85350
       0.0      0.0          1000.0     0.0                             ISP85360
/*                                                                      ISP85370
/*    END  OF DATA                                                      ISP85380
/*                                                                      ISP85390
/*************************************************************          ISP85400
/*    INDIVIDUAL PARAMETERS CORRESPONDING TO MEASUREMENT DATA      *    ISP85410
/*     PRESSURE                                                    *    ISP85420
/*            PU-PRIZE          ----------     AP 10               *    ISP85430
/*            PB-42             ----------     AP 17               *    ISP85440
/*            PB-23             ----------     AP 35               *    ISP85450
/*            PV-UP+10          ----------     AP 26               *    ISP85460
/*            PU-ACC            ----------     AP 33               *    ISP85470
/*            PU-SGSD           ----------     AP 21               *    ISP85480
/*     DIFFERENTIAL PRESSURE                                       *    ISP85490
/*            DPU-10-12         ----------  AP 6 - AP 8            *    ISP85500
/*            DPB-32-36L        ----------  AP 12- AP 15           *    ISP85510
/*            DPB-38-40         ----------  AP 15- AP 17           *    ISP85520
/*            DPV-LP-UP         ----------  AP 24- AP 26           *    ISP85530
/*     FLOW RATE                                                   *    ISP85540
/*            FTV-COREIN (V)    ----------  JW 27                  *    ISP85550
/*            FTU-15     (V)    ----------  JW 10                  *    ISP85560
/*            FTU-PRIZE  (V)    ----------  JW 12                  *    ISP85570
/*            FTU-LPIS   (V)    ----------  JW 38                  *    ISP85580
/*            FTU-HPIS   (V)    ----------  JW 37                  *    ISP85590
/*            FTU-ACC    (V)    ----------  JW 35                  *    ISP85600
/*            FTU-10,GU-10      ----------  JW 7                   *    ISP85610
/*            FDB-42,GB-42R     ----------  JW 29                  *    ISP85620
/*            FDR-23,GB-23R     ----------  JW 30                  *    ISP85630
/*     FLUID DENSITY                                               *    ISP85640
/*            GB-42VR           ----------  AR 17                  *    ISP85650
/*            GB-23VR           ----------  AR 35                  *    ISP85660
/*            GU-15C            ----------  AR 9                   *    ISP85670
/*            GU-10             ----------  AR 6                   *    ISP85680
/*            GVCOR-150HZ       ----------  AR 25                  *    ISP85690
/*            GV161/192D        ----------  AR 24                  *    ISP85700
/*     FLUID TEMPERATURE                                           *    ISP85710
/*            TFU-PRIZE         ----------  AT 11                  *    ISP85720
/*            TFB-23            ----------  AT 35                  *    ISP85730
/*            TFV-UP+10         ----------  AT 26                  *    ISP85740
/*     HT COEFF. AND AVERAGE QUALITY OF AVERAGE CORE REGION        *    ISP85750
/*          HC 28 , AX 28  ---------- AT ELEVATION 8"ABOVE BOTTOM  *    ISP85760
/*          HC 29 , AX 29  ---------- AT ELEVATION 14"ABOVE BOTTOM*     ISP85770
/*          HC 30 , AX 30  ---------- AT ELEVATION 28"ABOVE BOTTOM*     ISP85780
/*          HC 31 , AX 31  ---------- AT ELEVATION 39"ABOVE BOTTOM*     ISP85790
/*     INTEGRATED MASS INVENTORY                                   *    ISP85800
/*                                                                 *    ISP85810
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