(8)

CONTAINMENT LOAD EXPERT MEETING

SEPTEMBER 16, 1983

BROOKHAVEN NATIONAL LABORATORY

D. SQUARER, EPRI

PREPARED COMMENTS AFTER REVIEWING
STANDARD PROBLEM CALCULATION

REQUIRED INFORMATION

- BETTER DEFINITION OF THE QUANTITY OF WATER AND THE LOCATION OF THE WATER. VARIABILITY BETWEEN ~130 TONS (3.2 M DEEP) AND ~20 TONS (0.5 M DEEP) IS TOO LARGE.

- BETTER DEFINITION OF THE TIMING OF QUENCH IN ORDER TO ACCOUNT CORRECTLY FOR DECAY HEAT (81,000 MJ IN 45 MIN.)

- RESOLUTION OF THE DOWNWARD QUENCHING OF A STRATIFIED WATER/MELT LAYERS SEPARATED BY A CRUST, IN ORDER TO DEFINE THE CREDIBILITY OF A LOW CONTAINMENT LOAD ESTIMATE.

- POSSIBILITY OF PERMANENT SEPARATION BETWEEN MELT AND WATER (DETERMINATION OF FRACTION OF MELT THAT MIXES).

CONTINUED - REQUIRED INFORMATION

- CORRECT ACCOUNT FOR PASSIVE HEAT SINKS AND FOR CONDENSATION (SUBDIVISION INTO COMPARTMENTS).
- NONEQUILIBRIUM PROCESSES IN THE CONTAINMENT ATMOSPHERE (CREDIBILITY OF SUPERHEATING) AND EFFECT OF THERMAL STRATIFICATION WITHIN THE CONTAINMENT.
- SCALING OF ANL TESTS (ΔP LESS THAN ADIABATIC IN TESTS).
- CREDIBILITY OF REPEATED STEAM EXPLOSIONS WHEN CORE DRIBBLE DOWN AND WATER REENTERS CAVITY.
- DIRECT HEATING OF CONTAINMENT.

AVAILABLE INFORMATION

ANL TESTS (ΔP LESS THAN ADIABATIC).

SIMULANT MATERIAL CRUST BEHAVIOR (PURDUE, UCLA).

COMPUTER CODES (PASSIVE HEAT SINKS, THERMAL STRATIFICATION).

SUGGESTED SPECIFIC TESTS

MELT/WATER STRATIFICATION WITH A CRUST.

CONTAINMENT SUPERHEAT (ANALYZE FIRST ANL CWTI6).

REPEATED STEAM EXPLOSIONS.

CONTAIN Steam Spike Calculations for Containment Loads Working Group

K. D. Bergeron
Sandia National Laboratories
Albuquerque, NM

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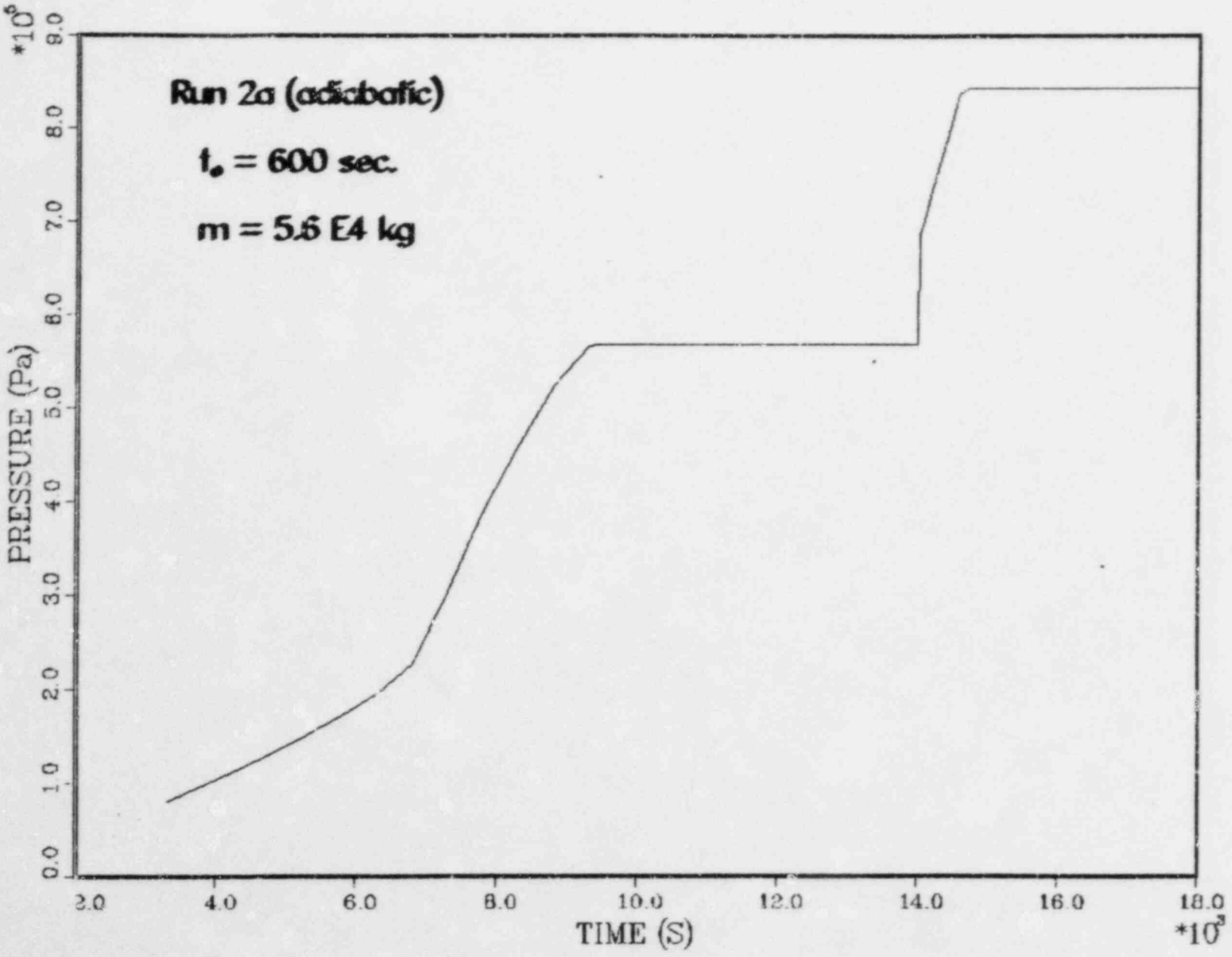
Non-adiabatic Steam Spike Calculations

* Zion geometry and heat sinks
* Precondition heat sinks with realistic steam blowdown (TMLB')
* Blowdown peak pressure = .4 MP_a
* Pressure at vessel failure = .3 MP_a
* Vessel failure source fixed by standard problem
* Fuel quench steam source varied over range of parameters

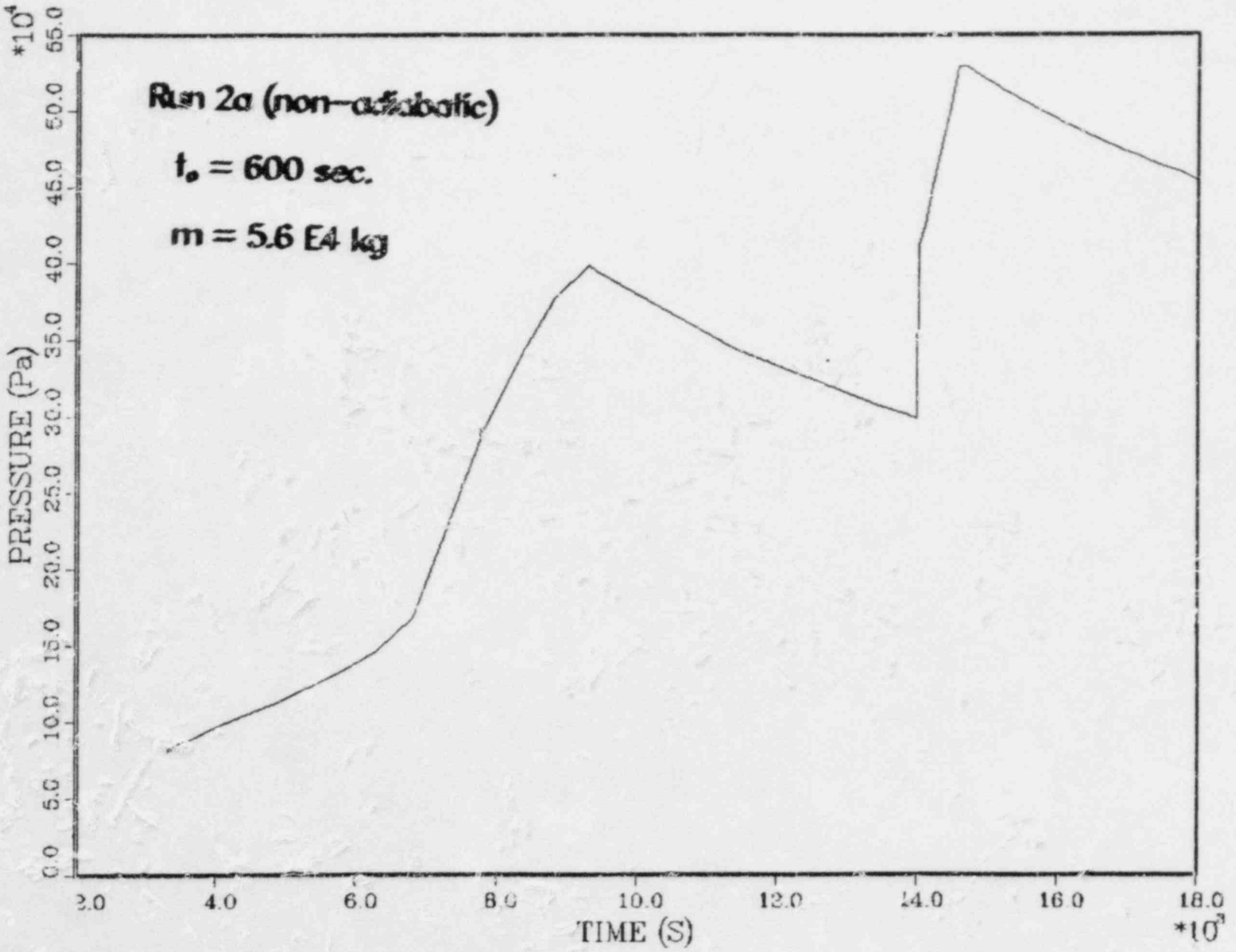
Fuel Quench Steam Source

* Inject M_1 energy into atmosphere at constant rate over time t_o
* Specific enthalpy approximately saturated vapor value at containment pressure
* Choose two values of M_1, three values of t_o
* Both adiabatic and non-adiabatic calculations performed
* Total of twelve calculations

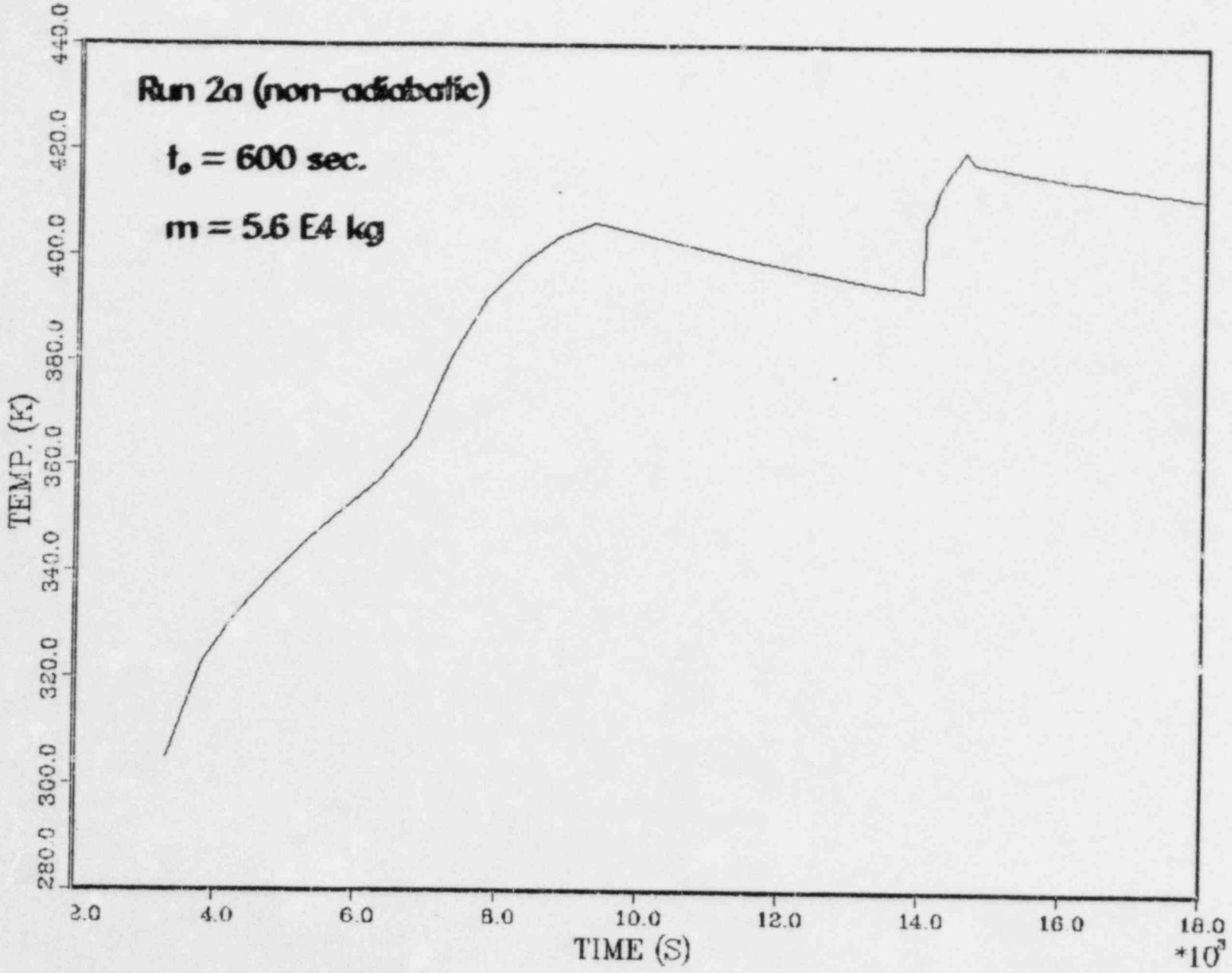
CELL PRESSURES



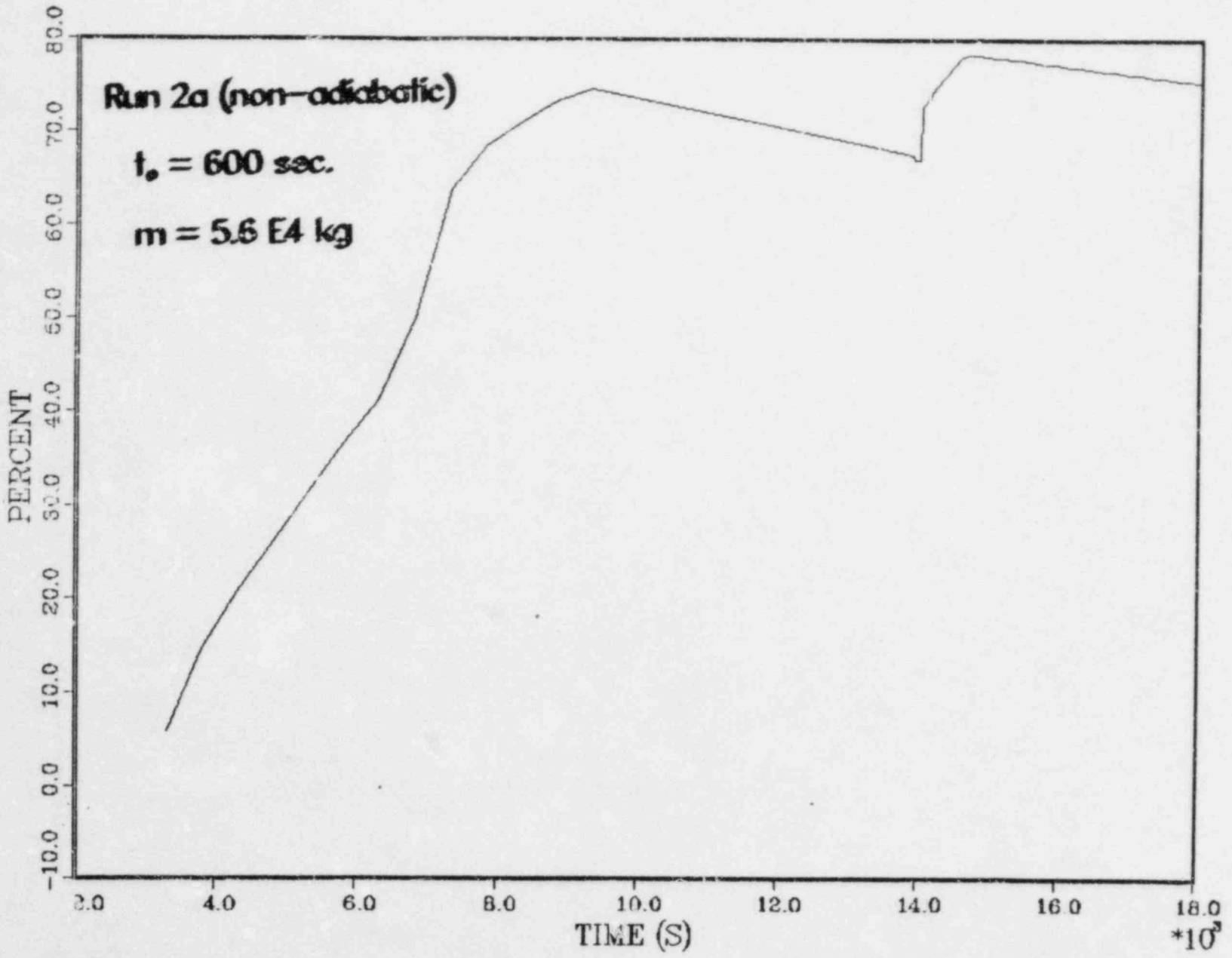
CELL PRESSURES



CELL GAS TEMPERATURES



PERCENT H2O VAPOR



PERCENT H2

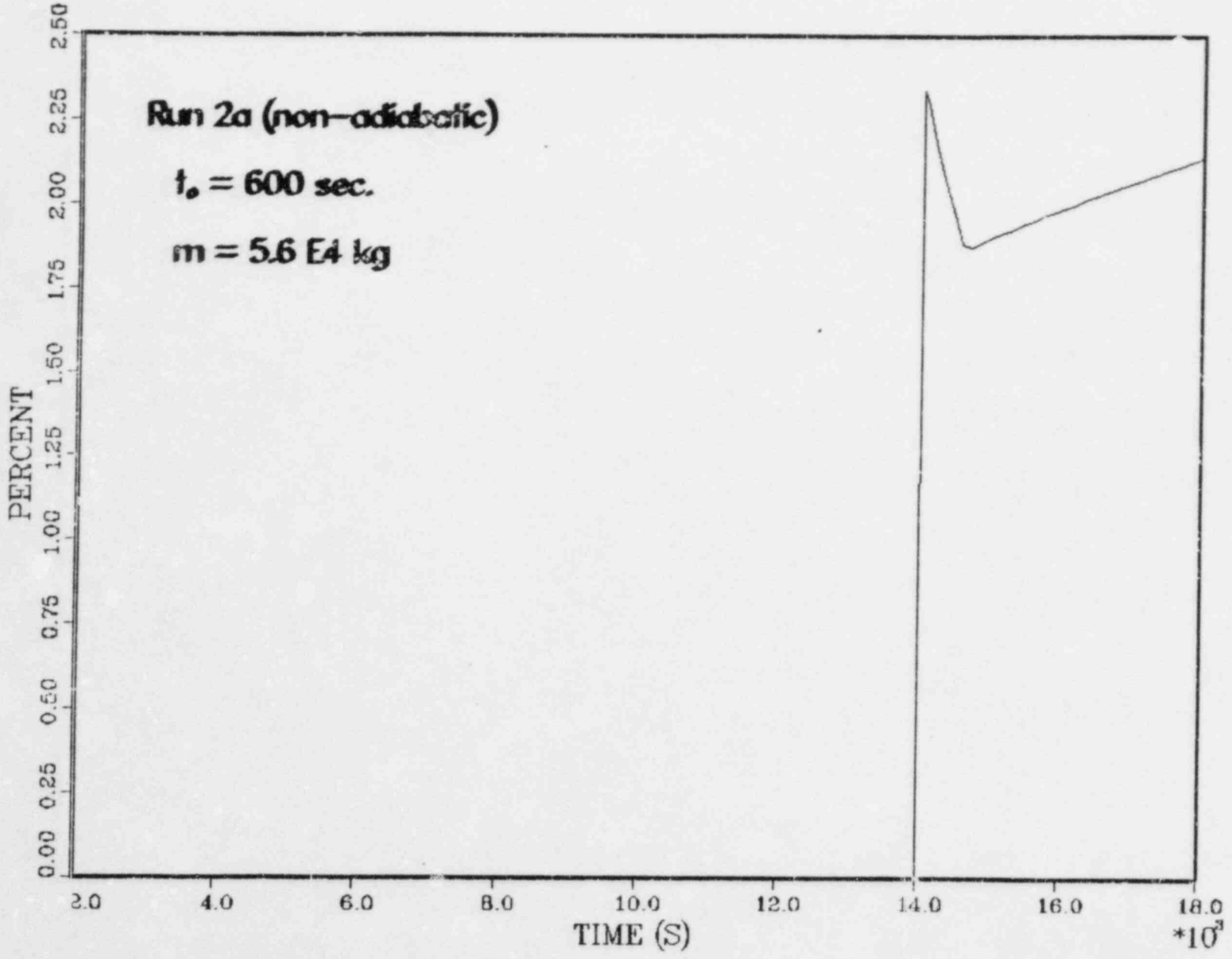
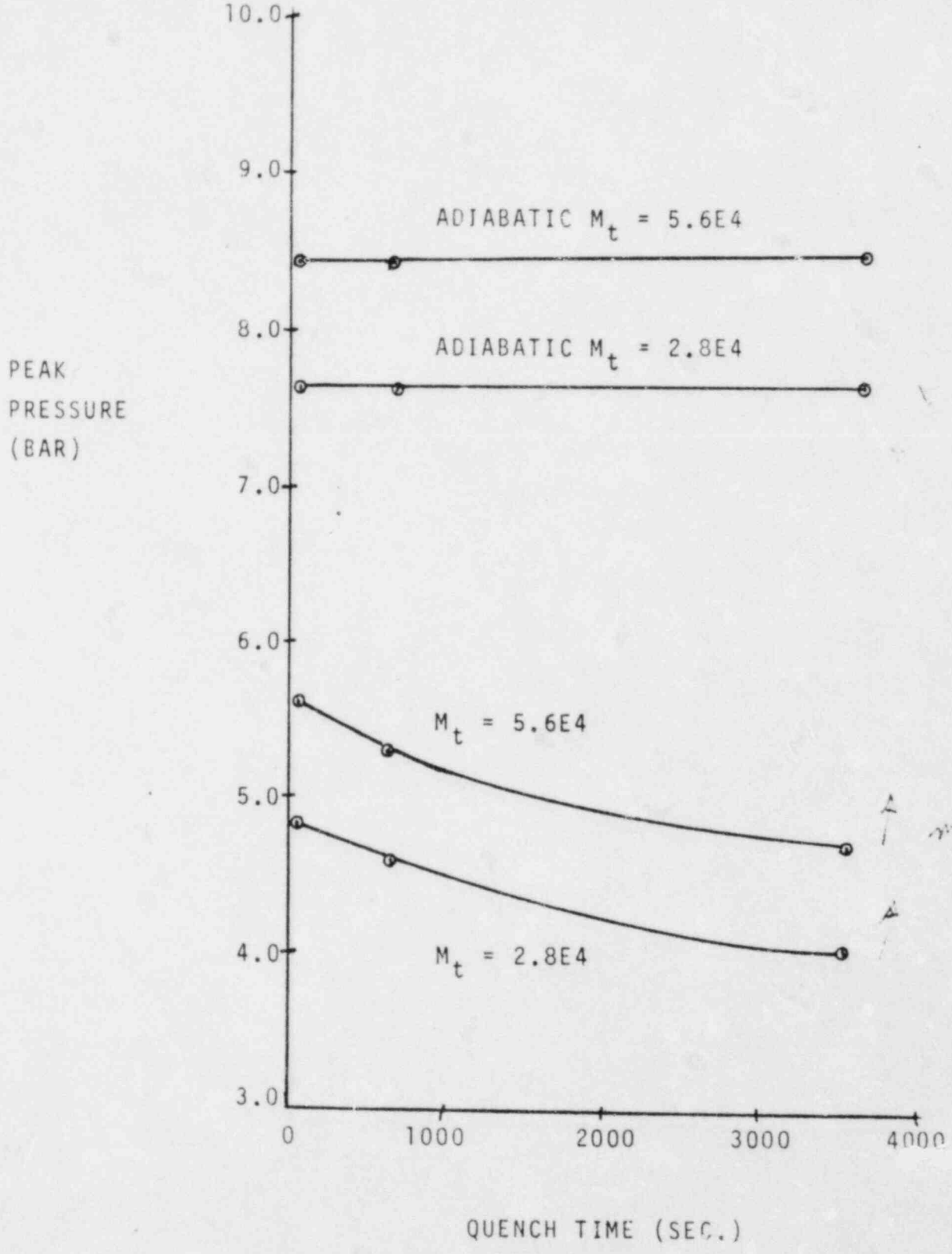

Run 2a (non-adiabatic)
t_o = 600 sec.
m = 5.6 E4 kg
PERCENT
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
2.25
2.50
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
TIME (S)
*10³

Table I. Results of CONTAIN Steam Spike Parameter Study

Case	mass steam boiled in quench M_s	time (sec) t_s	Adiabatic Pressure Rise (Pa)	Non-Adiabatic Pressure Rise	Percent Change
1	5.6E4	60	2.811E5	2.624E5	7.1
2	5.6E4	600	2.786E5	2.344E5	18.9
3	5.6E4	3600	2.799E5	1.716E5	63.1
4	2.8E4	60	1.982E5	1.834E5	8.1
5	2.8E4	600	1.964E5	1.613E5	21.8
6	2.8E4	3600	1.967E5	1.061E5	85.4


10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
ADIABATIC M_t = 5.6E4
ADIABATIC M_t = 2.8E4
M_t = 5.6E4
M_t = 2.8E4
PEAK PRESSURE (BAR)
0
1000
2000
3000
4000
QUENCH TIME (SEC.)