Regulatory Docket File

Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550

March 23, 1976

Director of Nuclear Reactor Regulation
Att: Mr Robert A. Purple, Chief
Operating Reactor Branch No 1
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-255, LICENSE DPR-20
PALISADES PLANT, ANSWER TO
QUESTION ON LOCA (4.A.7)

By letter dated March 20, 1976, we transmitted answers to questions contained in your letter of March 10, 1976. In answer to Question 4.A.7, we indicated that a response would be provided at a later date. This letter provides that response. Please note that the question responded to is somewhat different from that contained in your March 10, 1976 letter. This response is based on discussion with the regulatory staff which took place prior to receipt of the letter. We believe our response will provide the information required.

SECTION 4.0, ACCIDENT AND TRANSIENT ANALYSES

Question 4.A.7

Provide the following information for the calculated worst break case for Palisades.

1. Reactor coolant temperature versus time at the hot spot.

2. Average fuel temperature at the hot spot.

3. Hot assembly flow rate.

4. Quality at the hot spot.

5. Gap conductance versus time at hot spot.

6. Hot rod internal pressure.

7. Rupture time.

Response

The attached information is for the 1.0 DES/PD case with ENC fuel. For this case, the blowdown maximum temperature node is heat transfer Node 22 from

2959

Figure 3.2 of XN-75-64. Node 22 is also the maximum power node and corresponds to Node 17 of the TOODEE2 calculation. The hot spot during reflood moves up the rod to TOODEE2 Node 19 (hot channel Node 24). All these heat transfer nodes are bounded by fluid Volume 6 of the hot channel model as shown by Figure 3.1 of XN-75-64.

The following information is supplied:

1. The average fluid temperature in Volume 6 of the hot channel model (Figure 1).

2. The volumetric average fuel rod temperature for heat transfer Node 22 of the hot channel model (Figure 2).

3. Hot assembly flows at inlet Junction 10 and outlet Junctions 11 and 12 for the hot channel model (Figures 3, 4 and 5).

4. Average quality of Volume 6 of the hot channel model (Figure 6).

5. Gap conductance for the maximum power node for both blowdown and reflood and gap conductance for the PCT node during refill and reflood (Figures 7 and 8).

6. The hot rod pin pressure during the entire transient (Figure 9).

7. Rupture time for the 1.0 DES/PD was calculated to occur at 49.82 seconds after the break.

The transient gap conductance during blowdown is not an available quantity from the RELAP4-EM runs and was approximated from the fuel rod surface heat flux and the calculated outer fuel surface and inner cladding surface temperatures. This procedure is valid when pseudo steady state conditions exist across the gap and cladding but may be in error when energy storage terms in the cladding are significant compared to the surface heat flux, as at CHF. During refill and reflood, the gap conductance is available directly from TOODEE2 results.

Pressure Distribution

Overall system irrecoverable pressure losses were adjusted equal to the pump head as given by pump performance data. Loss coefficients through the core were based on experimental data from full scale single assembly flow experiments which included modeling of the upper and lower core support structure. Line losses were estimated from standard correlations for expansions and contractions. Because of the conservatively low flow rate assumed, system balancing, particularly across the steam generator, required artifically augmenting the pressure loss. This was accomplished conservatively by reducing the steam generator effective flow area until a balance was achieved.

Flow Distribution

The distribution of flow between the two steam generators and four pump flow paths was taken from plant flow measurements made in April 1975.

David A. Bixel
Assistant Nuclear Licensing Administrator

CC: JGKeppler, USNRC

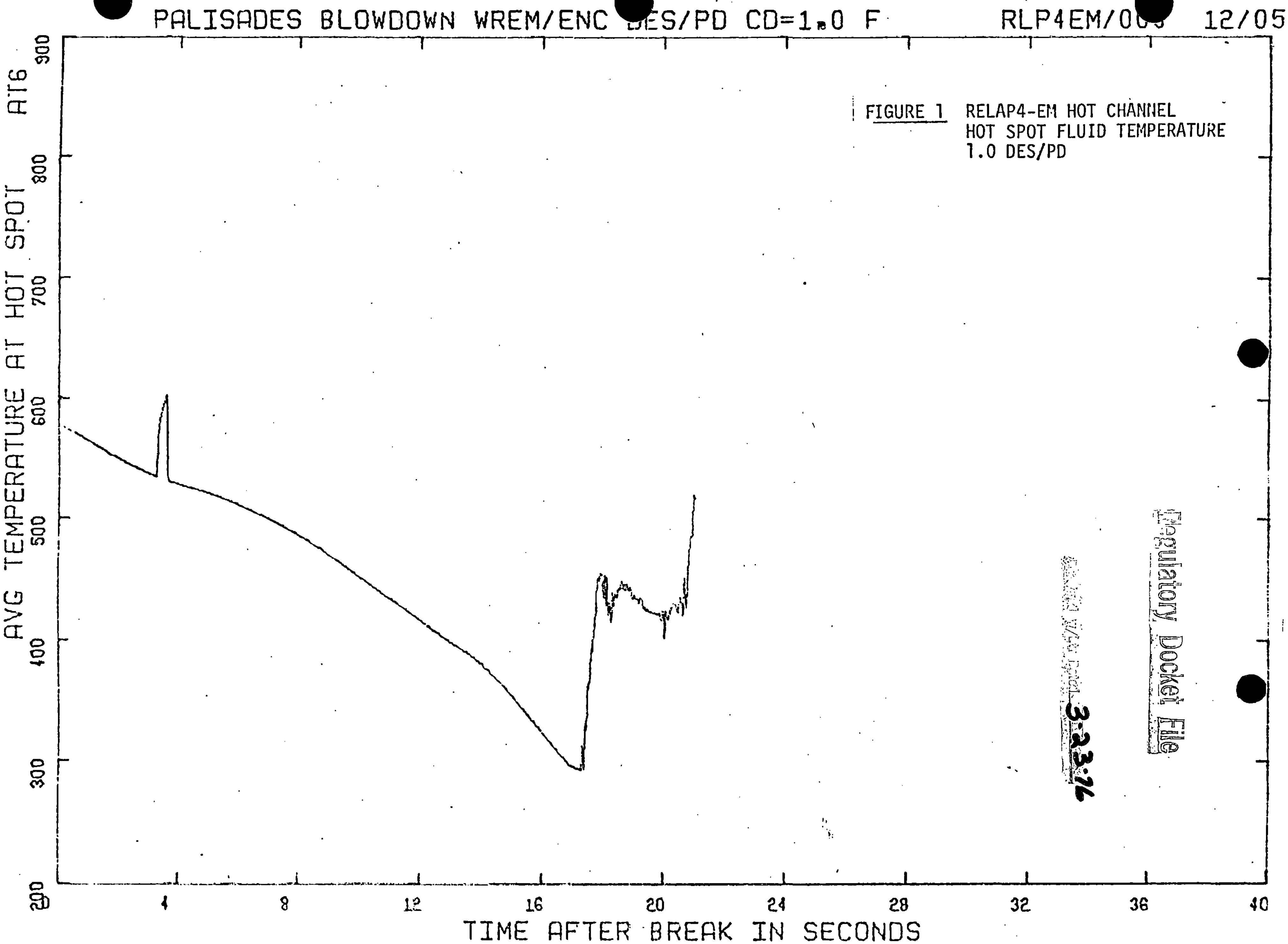
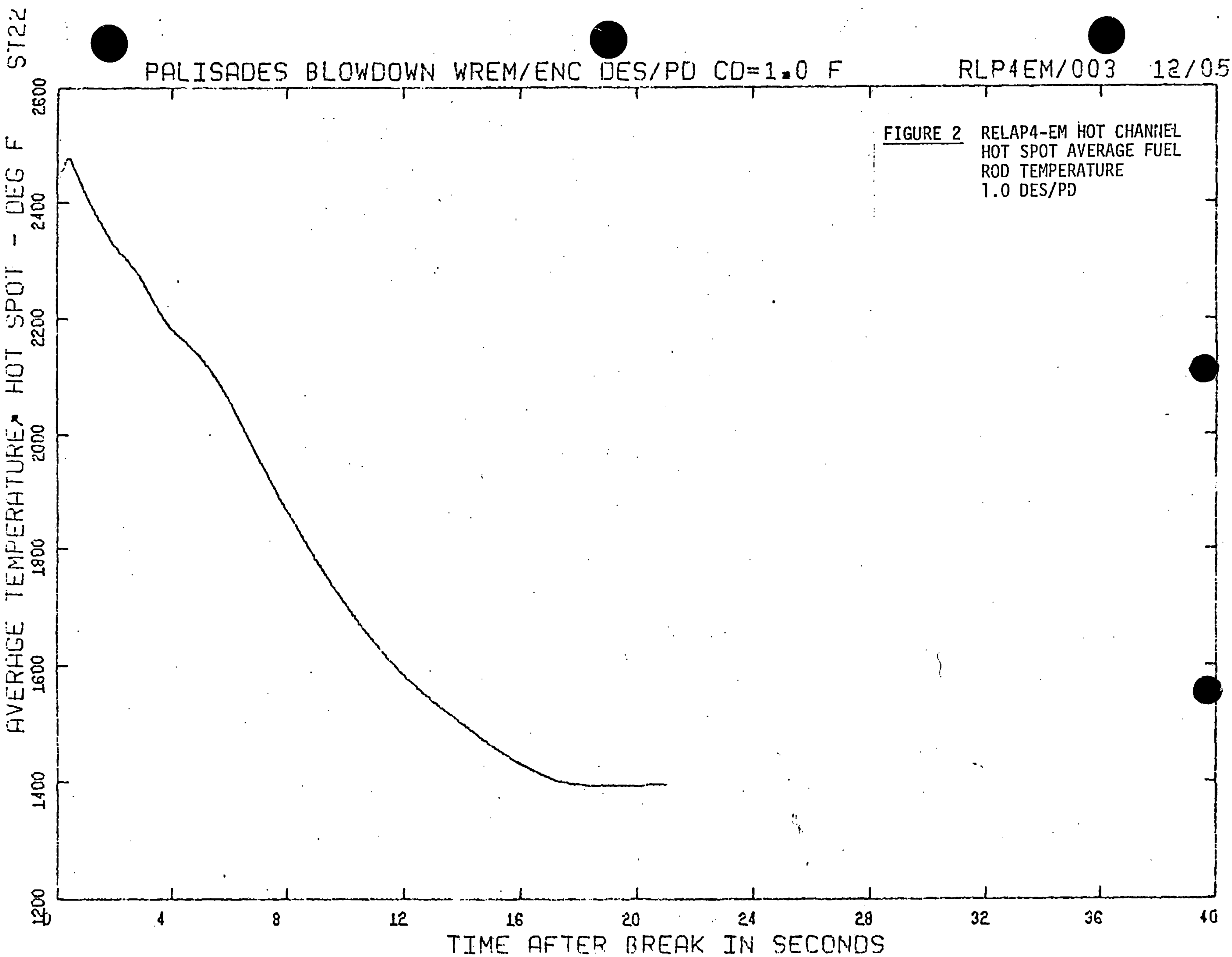


FIGURE 1 RELAP4-EM HOT CHANNEL HOT SPOT FLUID TEMPERATURE 1.0 DES/PD


ST22
PALISADES BLOWDOWN WREM/ENC DES/PD CD=1.0 F
RLP4EM/003 12/05
FIGURE 2 RELAP4-EM HOT CHANNEL
HOT SPOT AVERAGE FUEL
ROD TEMPERATURE
1.0 DES/PD
AVERAGE TEMPERATURE, HOT SPOT - DEG F
2600
2400
2200
2000
1800
1600
1400
1200
0
4
8
12
16
20
24
28
32
36
40
TIME AFTER BREAK IN SECONDS

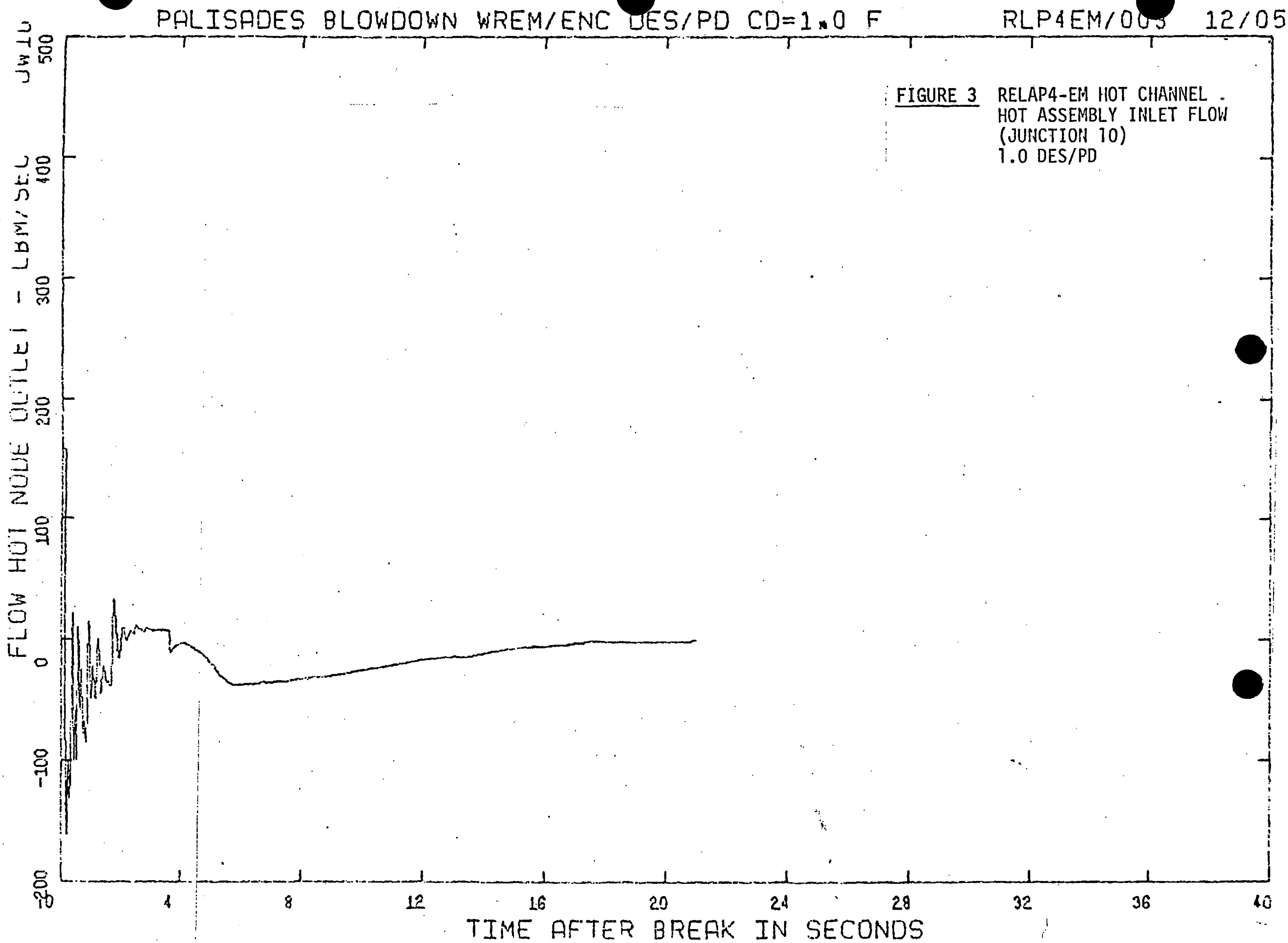


FIGURE 3 RELAP4-EM HOT CHANNEL
HOT ASSEMBLY INLET FLOW
(JUNCTION 10)
1.0 DES/PD

PALISADES BLOWDOWN WREM/ENC DES/PD CD=1.0 F RLP4EM/003 12/05/

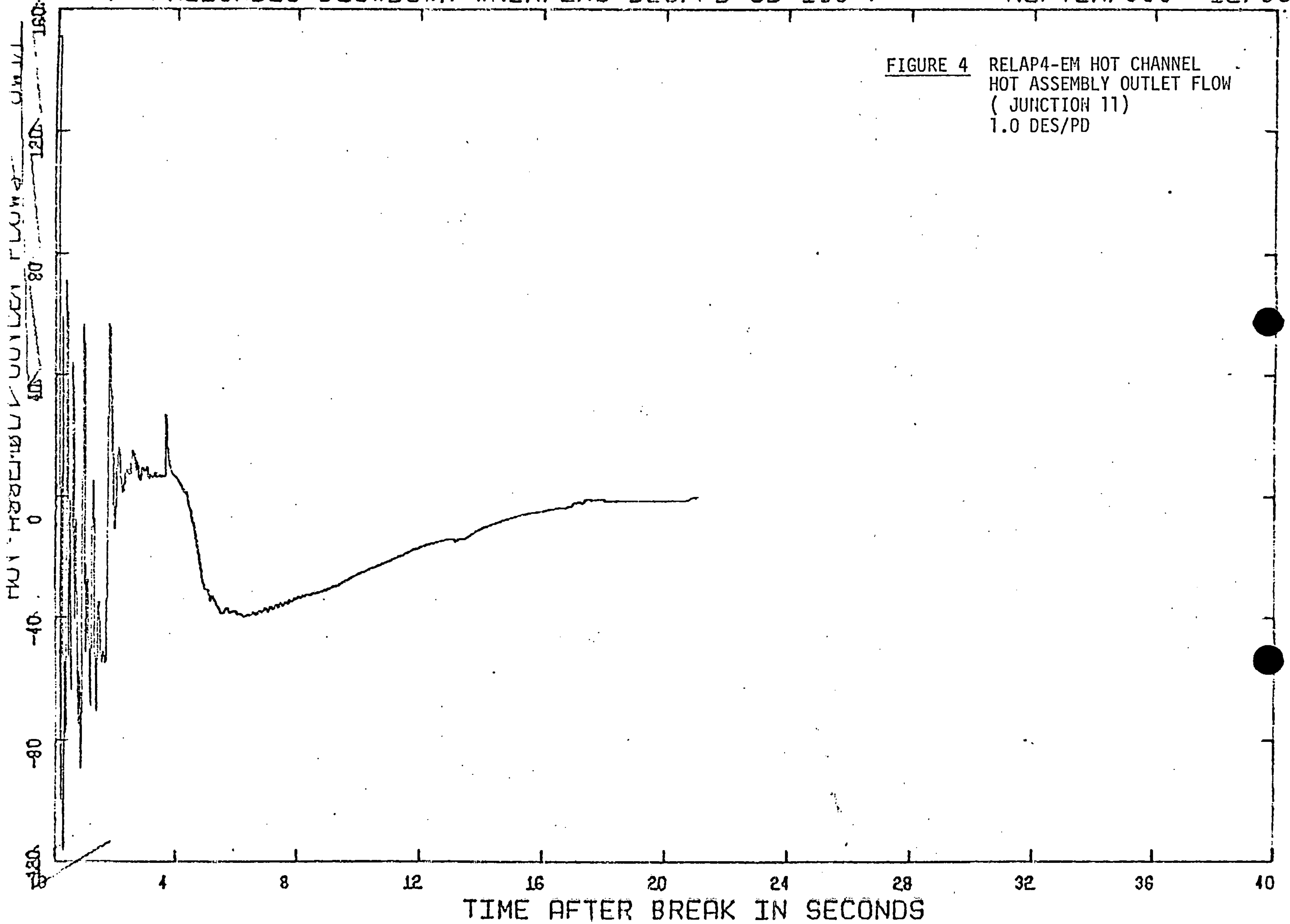


FIGURE 4 RELAP4-EM HOT CHANNEL
HOT ASSEMBLY OUTLET FLOW
(JUNCTION 11)
1.0 DES/PD

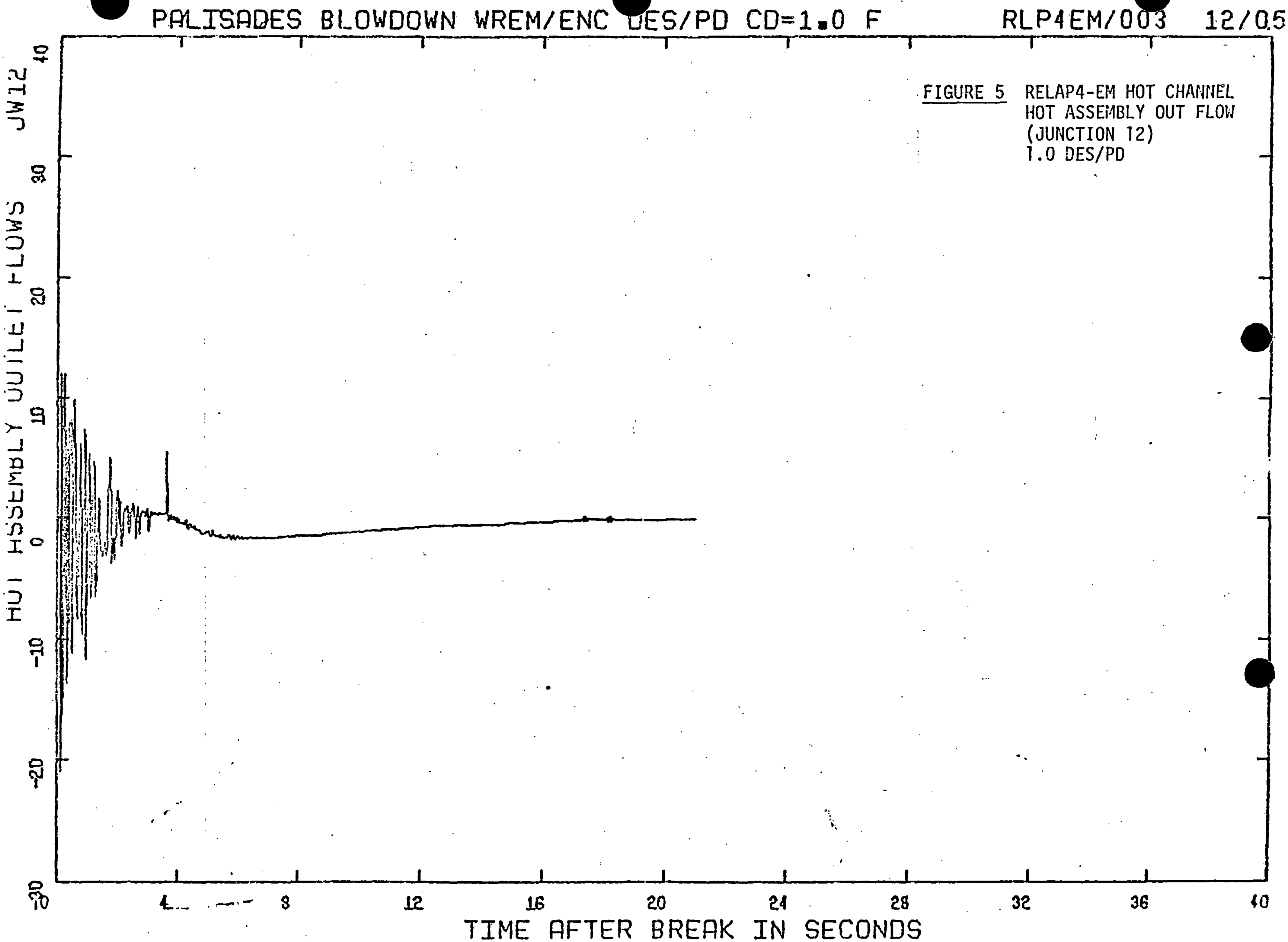
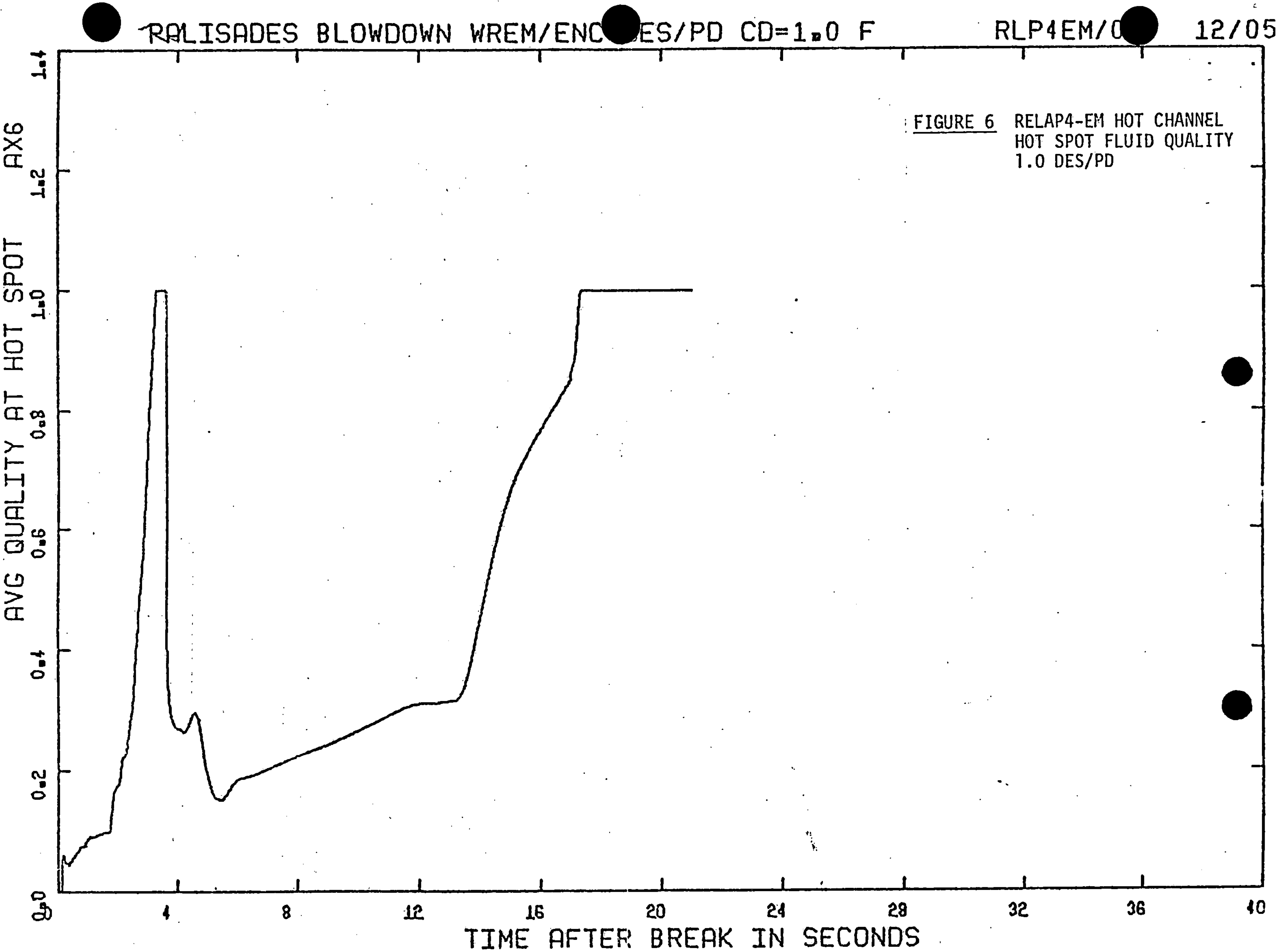


FIGURE 5 RELAP4-EM HOT CHANNEL HOT ASSEMBLY OUT FLOW (JUNCTION 12) 1.0 DES/PD


PALISADES BLOWDOWN WREM/ENC DES/PD CD=1.0 F
RLP4EM/0
12/05
FIGURE 6 RELAP4-EM HOT CHANNEL
HOT SPOT FLUID QUALITY
1.0 DES/PD
AVG QUALITY AT HOT SPOT AX6
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
4
8
12
16
20
24
28
32
36
40
TIME AFTER BREAK IN SECONDS

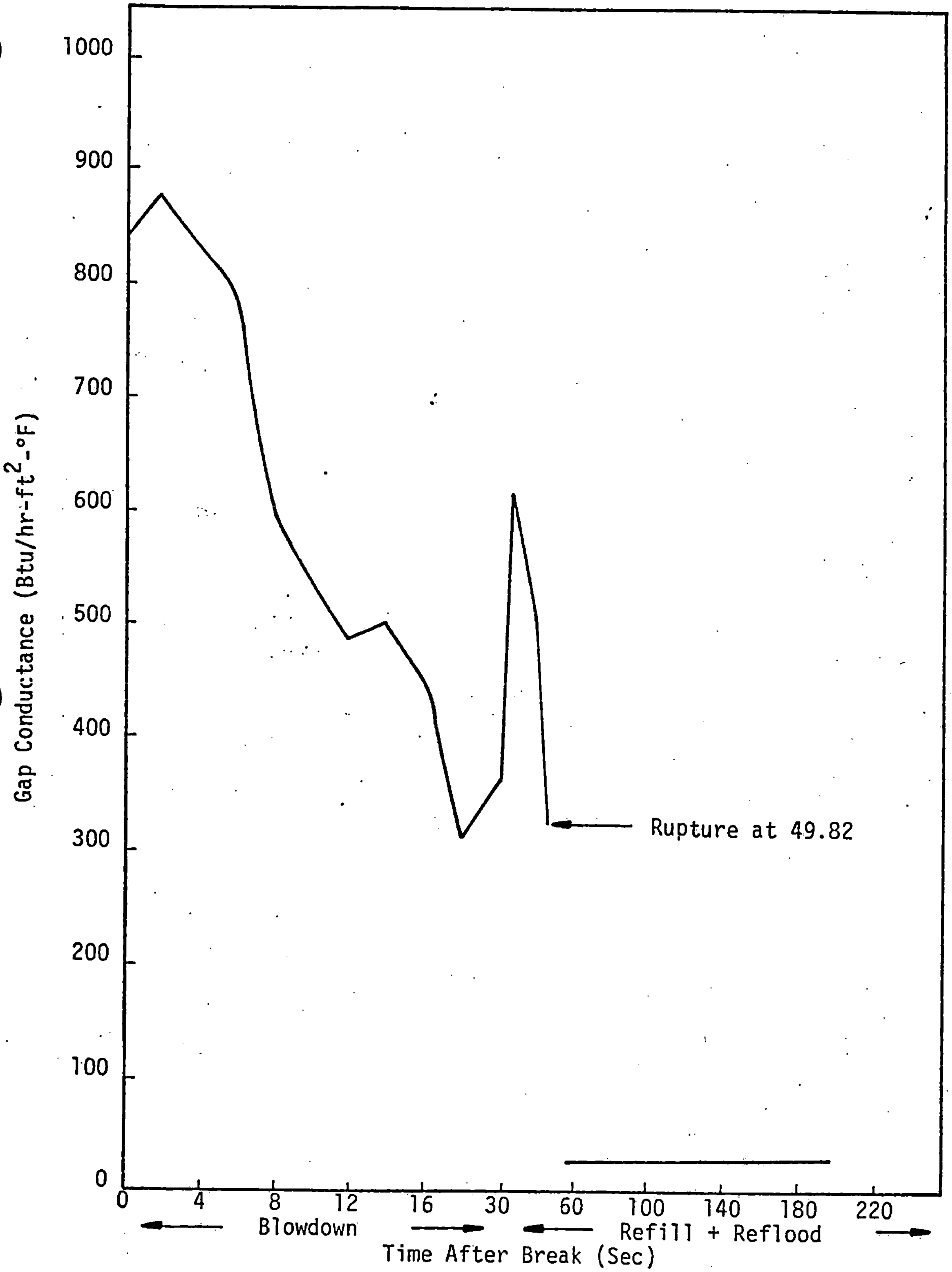


FIGURE 7 PEAK POWER NODE GAP CONDUCTANCE
VS TIME 1.0 DES/PD
ENC FUEL

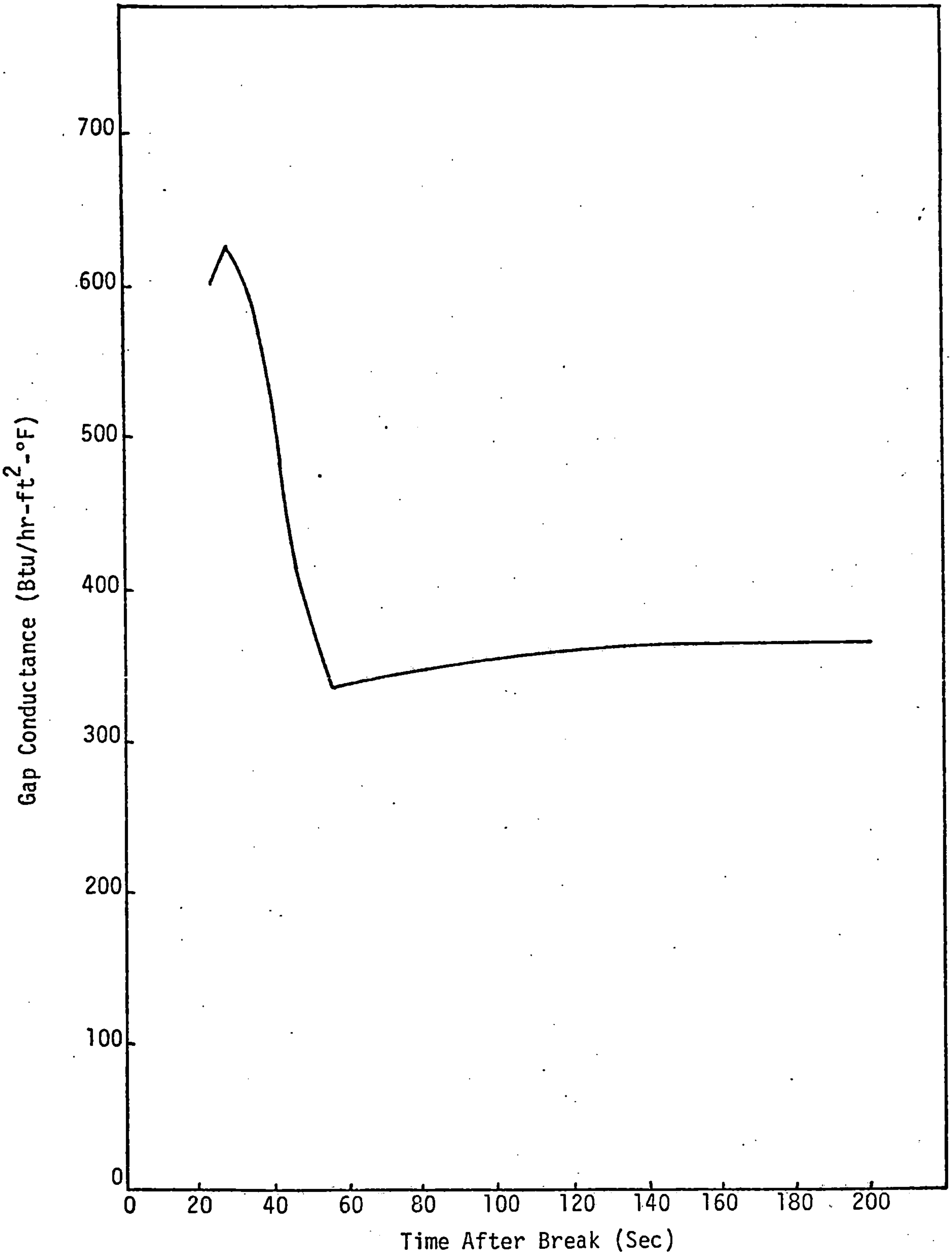


FIGURE 8 HOT SPOT GAP CONDUCTANCE
VS TIME 1.0 DES/PD
ENC FUEL

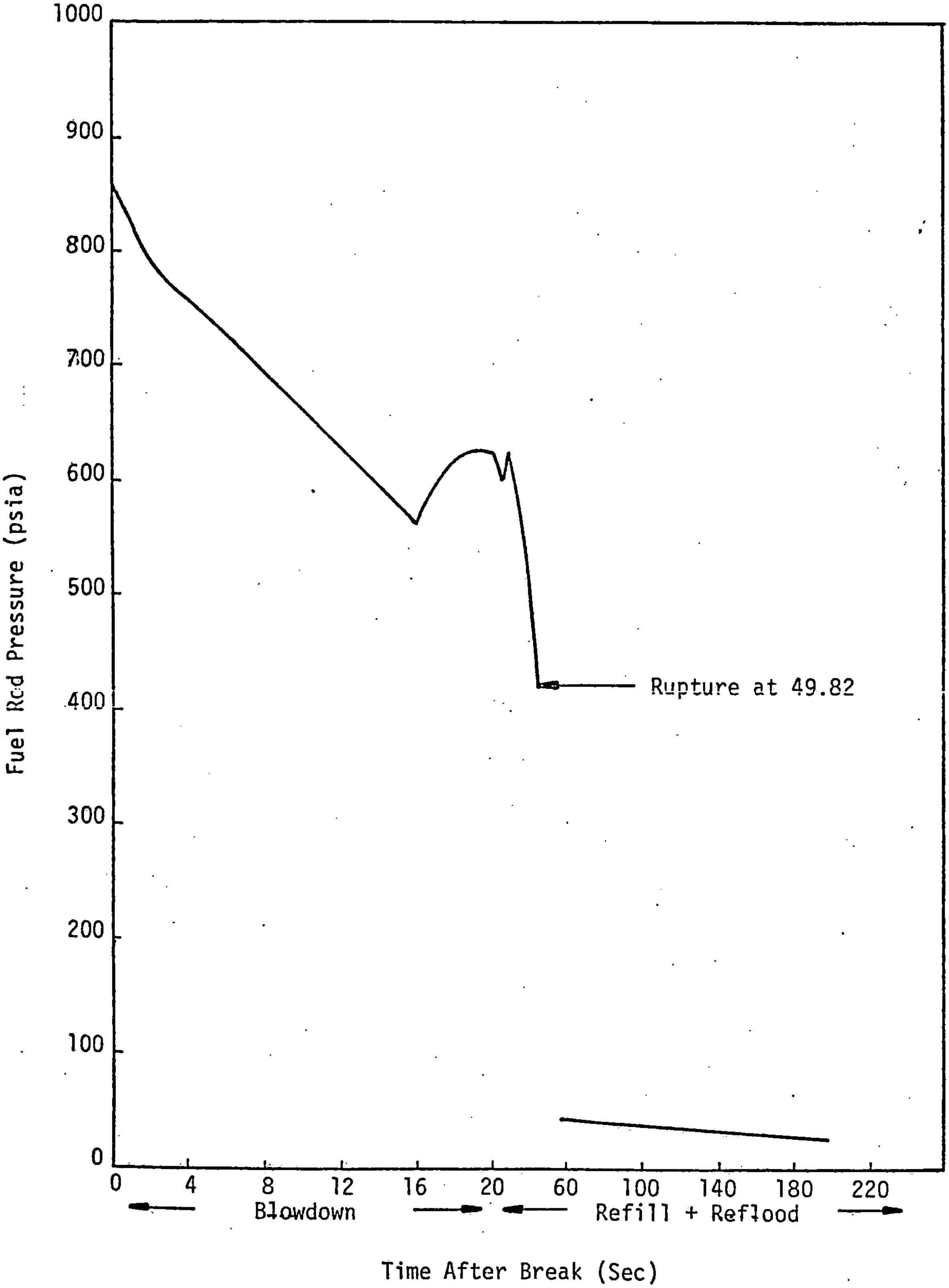


FIGURE 9 MAX. POWER FUEL ROD PRESSURE
VS TIME 1.0 DES/PD
ENC FUEL