EG&G Idaho, Inc.

FORM EG&G-561 (Rev. 1-77)

MEMO OF CONVERSATION

#6

PERSON CALLING: C. A. Dobbe DATE 8-14-79

REPRESENTING: EG&G (INEL) TIME 0930

PERSON CALLED: Ed Throm PHONE NUMBER

REPRESENTING: NRC-DSS

CITY:

SUBJECT: B & W Audit Calculations

DISTRIBUTION

S. R. Behling	P. E. Litteneker, DOE-ID
W. W. Bixby, DOE-ID	W. Lyon, NRC-RSR
T. R. Charlton	C. F. Obenchain
C. B. Davis	E. Throm, NRC-DSS
J. A. Dearien	P. H. Vander Hyde

I asked Ed what level the steam generator secondary side was maintained at during auxiliary feedwater delivery.

Ed called back with the following information.

(a) The old guidlines (pre-TMI) state that after the reactor coolant pumps were tripped, the level was maintained at 50% of the steady state (operating) level.

If the RC pumps are still running, the level is maintained at 3' above the bottom of the tube sheet.

(b) New guidlines (from Bulletins and Orders), state that the level will be maintained at 95% of initial operating level after RC pumps are tripped.

I told Ed that I would rerun the original calculation (.01 ft^2 cold leg break with no auxiliary feedwater delay) with the 50% level to compare with the original B & W submittal and with the new 95% level to compare with the forthcoming B & W analysis. This will give us a handle on the effect of this new guideline by comparing calculational sensitivity to this level difference.

SIGNATURE Charles Dobbe

(CONTINUE ON REVERSE SIDE)

EG&G Idaho, Inc.

Please send copies to T. Throm, M. Lauben. Rtn original to me. T. Throm, R. Denen

P. O. Box 1625
Idaho Falls, Idaho 83401

November 30, 1979

Mr. R. E. Tiller, Director
Reactor Operations and Programs Division
Idaho Operations Office - DOE
Idaho Falls, ID 83401

TRANSMITTAL OF "BABCOCK AND WILCOX AUDIT CALCULATIONS - SMALL BREAK", EG&G IDAHO, INC. TECHNICAL REPORT EGG-CAAP-5061, NOVEMBER 1979 - JAD-241-79

Ref: Status Summary Report, WRSR, Office of Nuclear Regulatory Research, October 15, 1979

Dear Mr. Tiller:

Enclosed is the subject Preliminary Assessment Report. This transmittal represents formal documentation of information hand delivered to the NRC on October 16, 1979. The enclosed PAR completes the Node on line 6, page 3-15, Task A6047, LOCA Analyses Assessment and Application, of the referenced Buff Book.

Very truly yours,

John A. Dearien

J. A. Dearien, Manager
Code Assessment and
Applications Program

CAD:tn

Enclosure:
As stated

cc: W. C. Lyon, NRC-RSR
R. W. Kiehn, EG&G Idaho w/o enc.

EG&G Idaho, Inc.

FORM EG&G-398
(Rev. 12-78)

INTERIM REPORT

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C. A. Dobbe

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Responsible NRC Individual and NRC Office or Division:

W. C. Lyon, NRC-RSR

EG&G Idaho, Inc.
Idaho Falls, Idaho 83401

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INTERIM REPORT

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BABCOCK & WILCOX AUDIT CALCULATIONS - SMALL BREAK

by

C. A. Dobbe

November 1979

ABSTRACT

Audit calculations were performed for a Babcock & Wilcox pressurized water reactor at the request of the Nuclear Regulatory Commission. The analysis involved breaks of 0.00093 m^2 and 0.0065 m^2 in a cold leg pipe. The transients were evaluated using an experimental version of the RELAP4 computer code.

SUMMARY

Two cold leg break transients were calculated for a Babcock & Wilcox pressurized water reactor. The calculations were performed with an experimental version of the RELAP4 computer code. Break sizes of 0.00093 m^2 and 0.0065 m^2 were analyzed.

Results of the analysis indicate a potential for core uncovery in the 0.00093 m^2 case due to absence of sustained natural circulation. A combination of reduced secondary side mixture level during auxiliary feedwater delivery and a single degraded HPI pump contributed to primary loop flow stagnation. The 0.0065 m^2 analysis showed initiation of accumulator flow reestablishing adequate core cooling.

CONTENTS

FIGURES

I. INTRODUCTION

Two cold-leg small break audit calculations were performed for a Babcock and Wilcox pressurized water reactor as requested by the Nuclear Regulatory Commission. Break sizes of 0.00093 m^2 and 0.0065 m^2 were analyzed using an experimental version of the RELAP4 computer code.[1] The following report contains a brief description of the computer code (Section II), the input model used and assumptions made (Section III), calculational scenario (Section IV), results (Section V), and conclusions (Section VI).

II. COMPUTER CODE DESCRIPION

The computer code used for the analyses described in this report is an experimental version of the RELAP4 computer code (internally designated as RELAP4/MOD7, Version G92). Modifications made to the code for these analyses are:

1. Addition of a mixture level dependent fill model to allow control of steam generator auxiliary feedwater flow as a function of secondary side mixture level.

2. Modification to the heat transfer logic to set local heat slab surface qualities, representing the outside surface of the steam generator tubes below the auxiliary feedwater nozzle, to zero during auxiliary feedwater flow. This approximated the heat transfer coefficient for a falling film of water.

3. Deletion of the time step control due to zero flow crossings at a junction. This change improved the problem running time without adversely affecting calculational stability.

Version G92 of RELAP4/MOD7 is stored at INEL under Code Configuration Control Numbers H007184B and H009982B (steam tables). A listing of the updates used for the analyses is supplied in Appendix A.

III. MODEL DESCRIPTION

The RELAP4 nodalization used for these analyses was that developed for the TMI-2 calculations.[2] A nodalization diagram is shown in Figure 1. Unlike the TMI-2 analyses, however, a single volume pressurizer with associated surge line volume and a three volume core were used. Bubble rise was used in the cold legs between the steam generators and pumps, steam generator secondaries, pressurizer, accumulator, and all vessel volumes except the upper plenum exit annulus. Slip was used in the downcomer, lower plenum, vertical hot leg junctions, between the steam generator inlet annulus and active tubes, and between the pressurizer surge line and hot leg.

The break was assumed to occur in the B loop cold leg and critical flow was calculated with the Henry Fauske - HEM model using a multiplier of 1.0 and transition quality of 0.02.

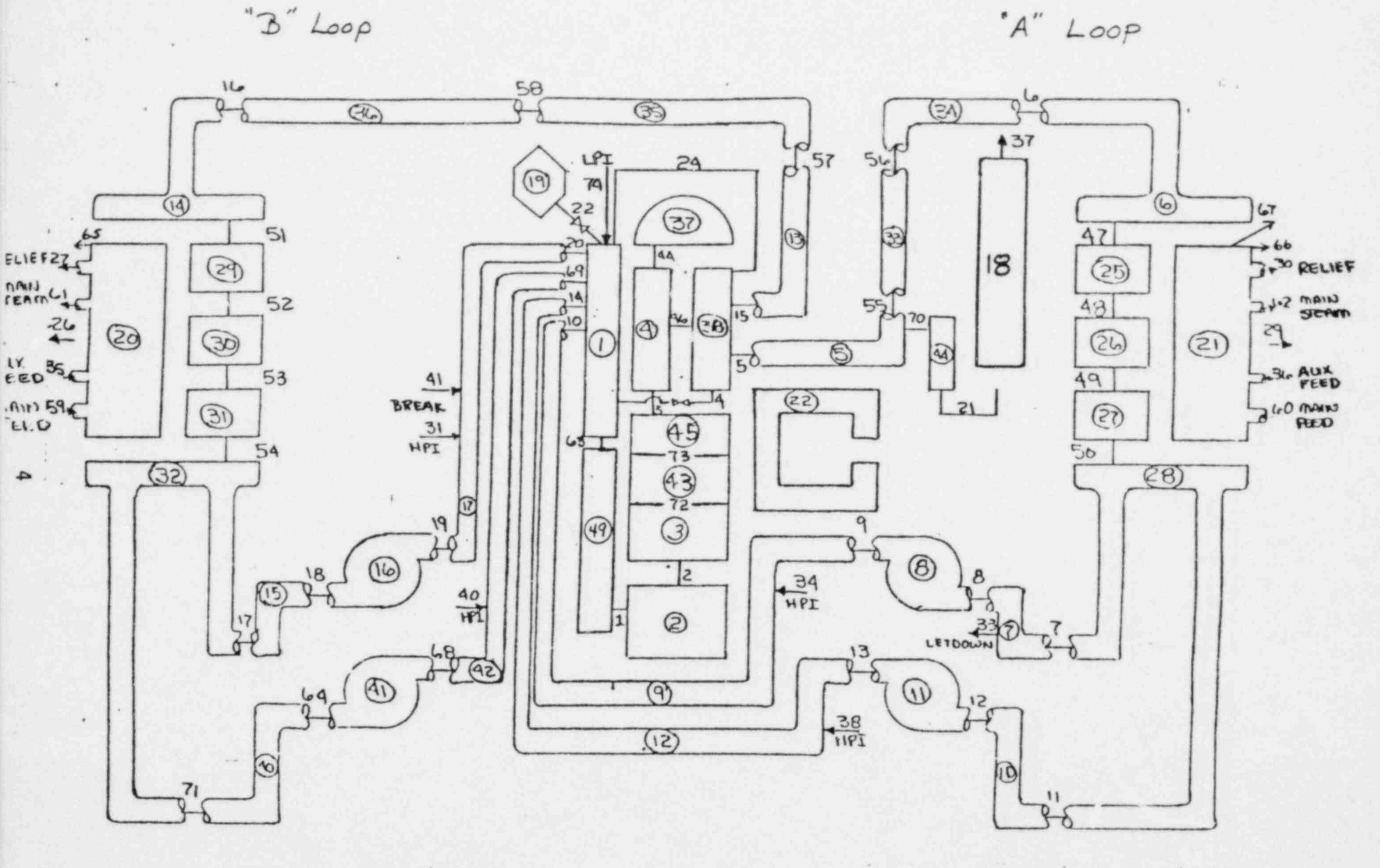

Fig. 1 RELAP4/MOD7 nodalization for B&W analysis.

IV. CALCULATIONAL SPECIFICATIONS

Boundary and initial conditions were as follows:

1. Initial power was 2689.0 Mw
2. Decay heat was ANS + 20%
3. Reactor scrammed on a 13.1 MPa pressure in hot leg plus a 0.5 s delay
4. Turbine trip and primary coolant pumps were tripped concurrent with scram
5. Steam generator auxiliary feedwater flow was initiated at 36 s after scram
6. HPI began when the hot leg pressure reached 9.41 MPa plus a 35 s delay. 50% of the flow was injected in the broken cold leg with the remainder split evenly to the other loops. Flow was based on a single operating HPI pump, as shown in Table 1
7. Auxiliary feedwater flow was controlled to maintain secondary side mixture level at 6.16 m. The flow was maintained at full rated flow (45.51 kg/s) between 0. m and 6.10 m and then ramped to 0.0 kg/s between 6.10 m and 6.16 m
8. Steam generator secondary side relief valves were ramped from closed at 7340 kPa to completely open at 7480 kPa

TABLE 1. HIGH PRESSURE INJECTION FLOW

Pressure (MPa)	Total Flowrate (l/s)
0.10	32.5
4.24	28.4
7.00	25.6
10.45	21.6
13.89	17.4
16.65	13.2
18.62	0.

V. RESULTS

1. 0.00093 m^2 BREAK

The analysis has been carried out to 6100 s transient time and has required 11 hours of CDC 176 cp time. Figure 2 shows the pressure in the upper plenum (AP4) and the steam generator secondaries (AP20 and AP21). At 59.5 s, scram and turbine trip occurred, and the steam generator secondary pressure reached the relief valve setting of 7410 kPa. Auxiliary feedwater was initiated at 96 s and began reducing secondary side pressure at 400 s. Secondary side depressurization continued until 650 s when the secondary side mixture levels reached 6.16 m. Formation of voids below this mixture level maintained the level above the auxiliary feedwater shutoff setpoint and resulted in a repressurization of both primary and secondary systems. At 1000 s, the mixture level dropped below 6.16 m and auxiliary feedwater flow resumed, which depressurized the primary system to 8300 kPa where it essentially remained for the duration of the calculation. The secondary side pressures remained at approximately the relief valve set point pressure when an essentially "equilibrium" condition was established between auxiliary feedwater flow and relief valve flow.

Figure 3 shows the upper plenum mixture level (ML4) and the upper core volume mixture level (ML45). After the upper head voided at 400 s, the mixture level in the upper plenum dropped rapidly until it reached the hot leg elevation and the loop flows dropped (Figure 4). The mixture level dropped gradually over the remainder of the transient due to steam production in the core, no sustained natural circulation, and the fact that the total HPI flow was less than the break flow. The break flow, shown in Figure 5, was observed to be 23 kg/s, with oscillations due to condensation induced quality fluctuations. HPI flow from one pump at 8300 kPa was only 16 kg/s.

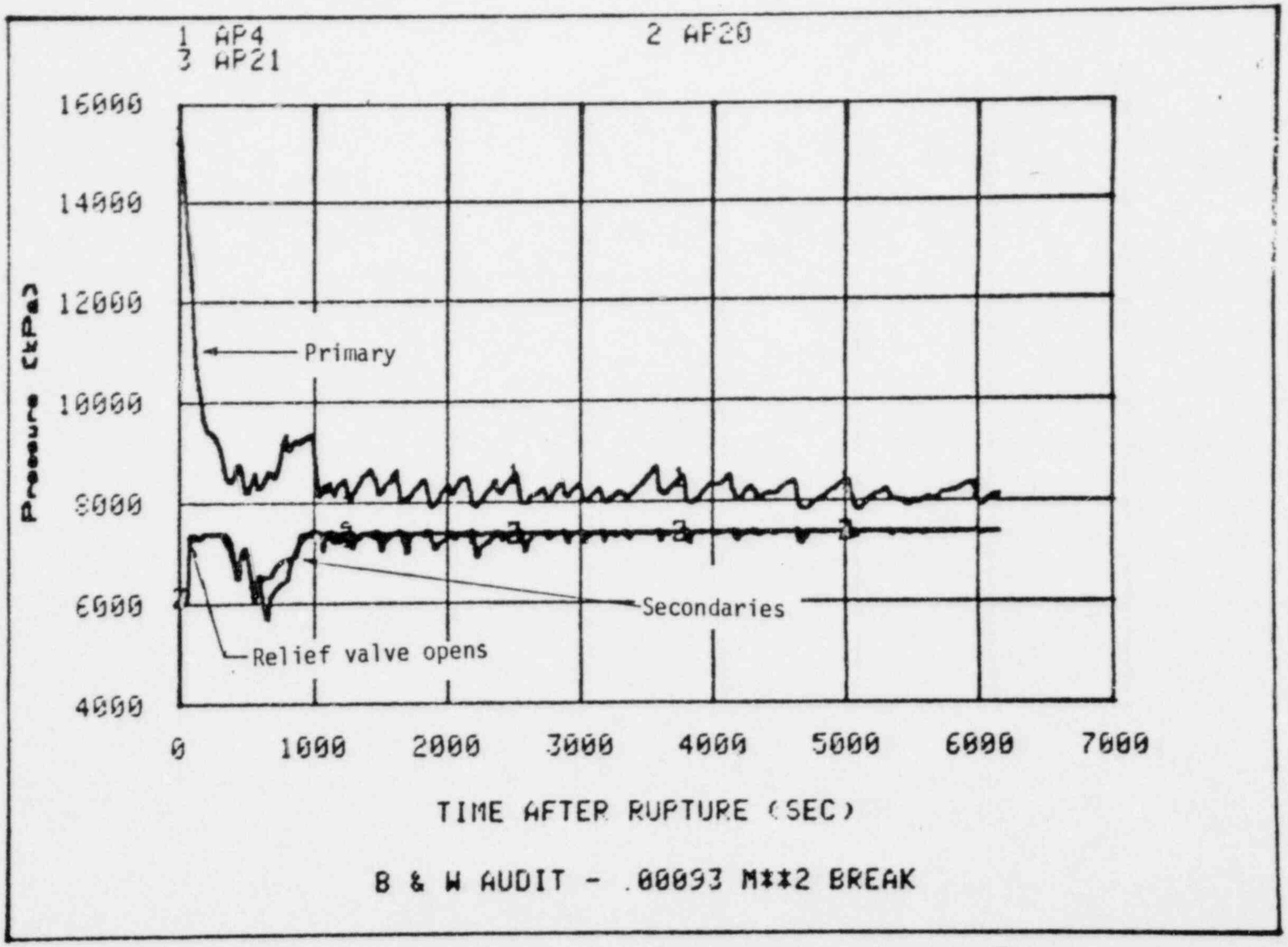

Fig. 2 Primary and secondary system pressure response

5

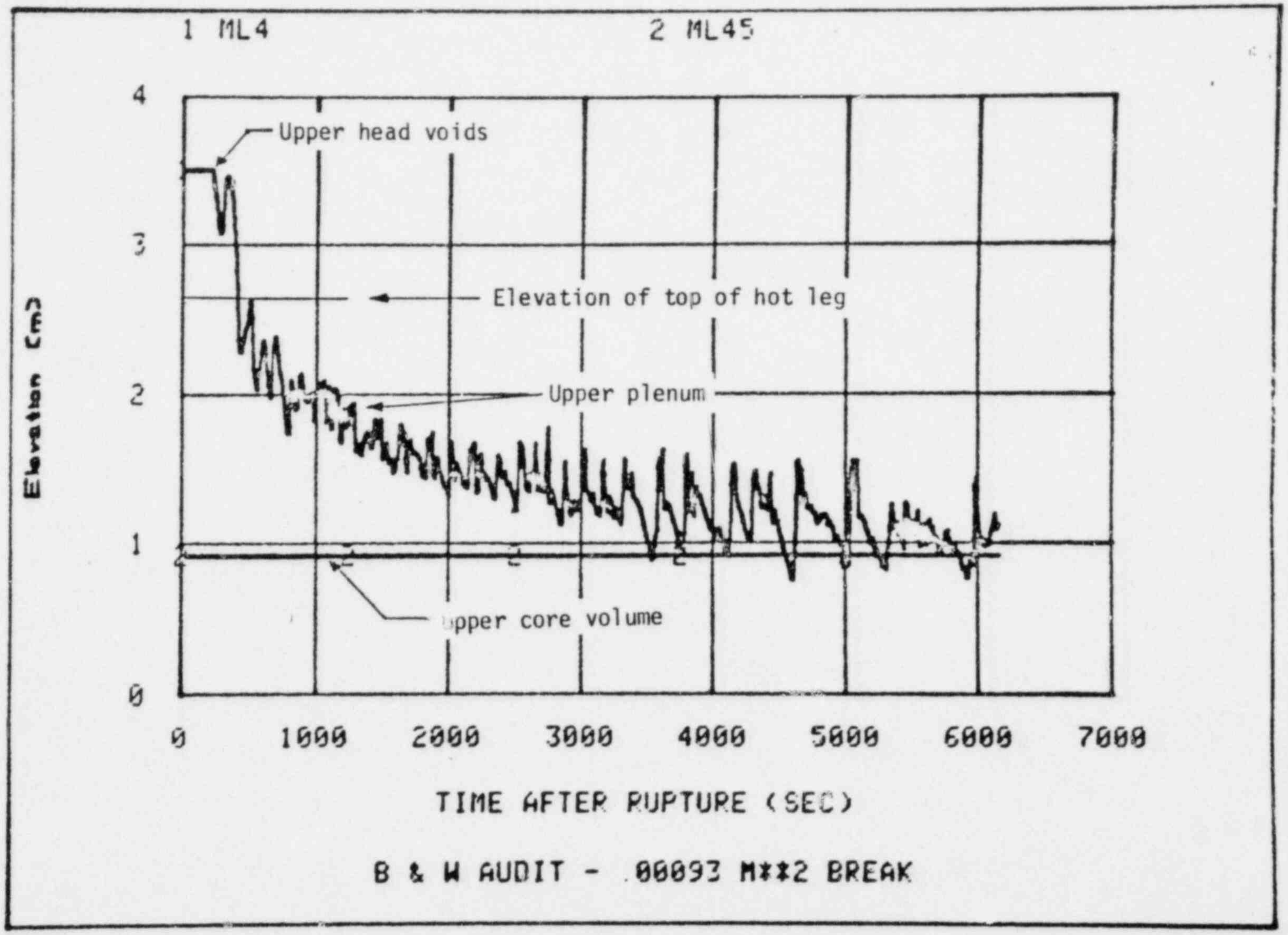

Fig. 3 Upper plenum and upper core mixture levels

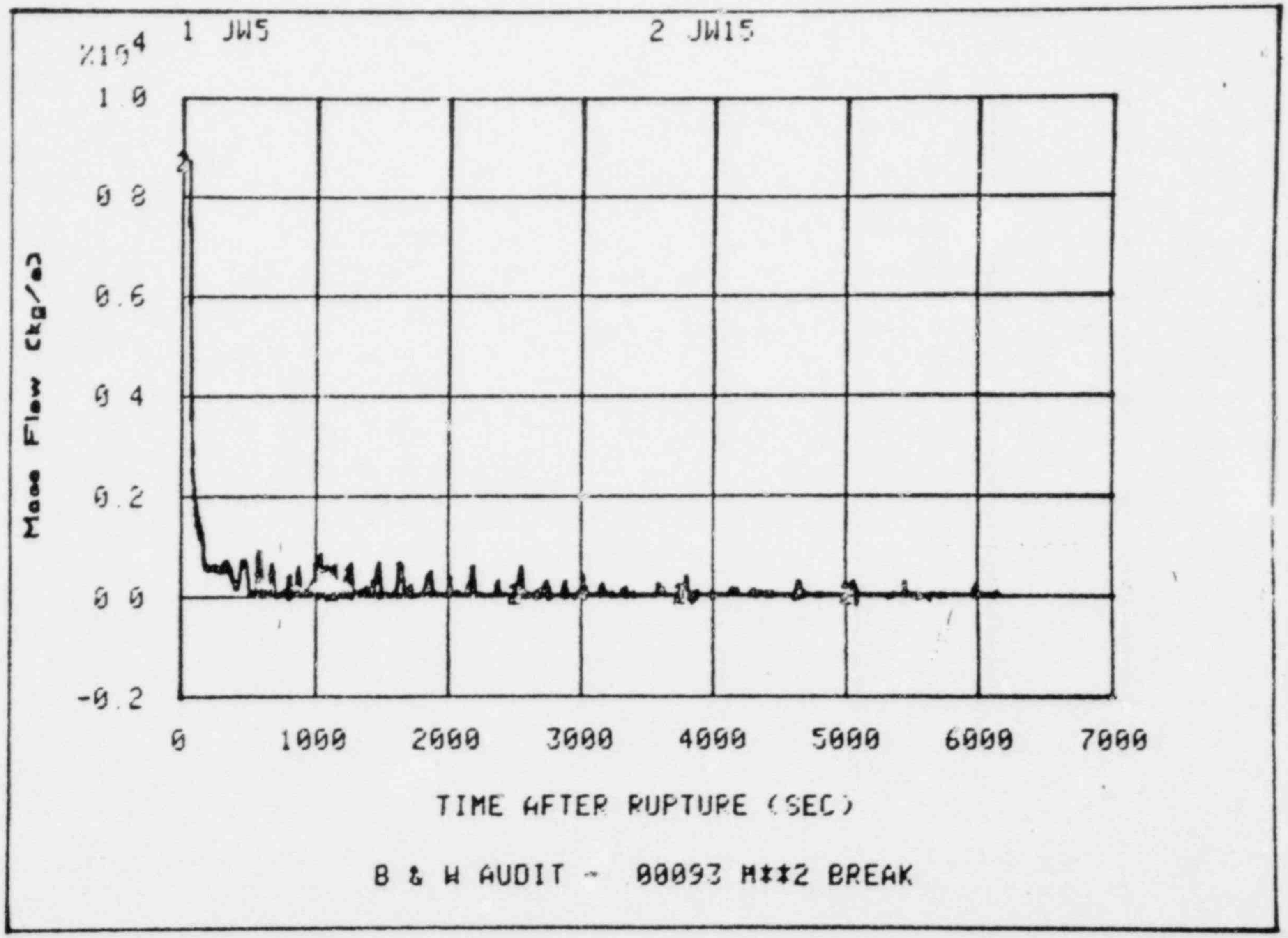

Fig. 4 Hot leg flows

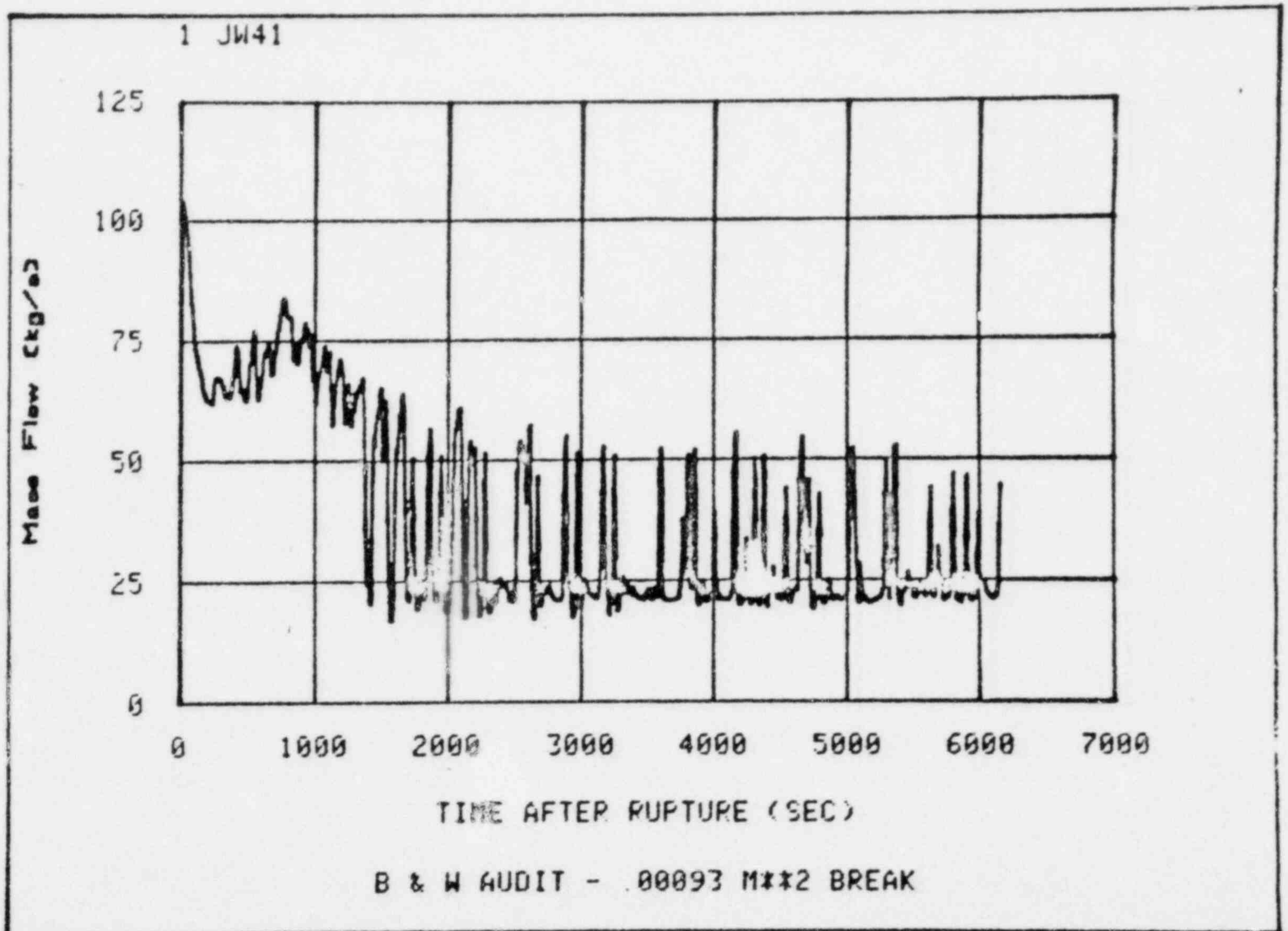

Fig. 5 Break flow

The calculation exhibits the potential for core uncovery due to the lack of sustained natural circulation, the time of the beginning of core uncovery estimated to be 18,000 - 20,000 s. Further analysis is required to ascertain if uncovery does indeed occur and what the consequences would be.

2. 0.0065 m^2 BREAK

The calculation has been carried out to 1886 s and has required 11 hours of CDC 176 cp time. Figure 6 shows the system pressure response in the upper plenum (AP4) and the steam generator secondaries (AP20 and AP21). After scram and turbine trip at 9.6 s, the secondary side pressure reached the relief valve setpoint very rapidly and remained there until auxiliary feedwater flow began refilling the secondaries. The primary side pressure dropped rapidly until it approaches secondary side pressure at 100s. The system continued depressurizing steadily until 600-700 sec, at which time both steam generator secondaries fill to 6.16 m and auxiliary feedwater flow was terminated. The primary and secondary sides equilibrated at 950 s and remained approximately equal for the remainder of the transient. Primary removal of core decay power was through the break.

The upper plenum and upper core volume mixture levels are shown in Figure 7 (ML7 and ML45, respectively). The upper plenum mixture level was observed to drop rapidly until the level reached the top of the hot legs (Figure 7). The level dropped slowly until the steam generator heat transfer became negligible at which time core boiloff rapidly emptied the upper plenum and began uncovering the upper core volume at 1500 s. The loop flows (Figure 8) were essentially zero from 250 s on. Accumulator injection was initiated at 1730 s (Figure 9) and injected intermittently. The upper core volume began refilling at this time and the fuel rod surface temperature (Figure 10) did not exhibit any significant heatup over saturation temperature at the 3.4 m elevation.

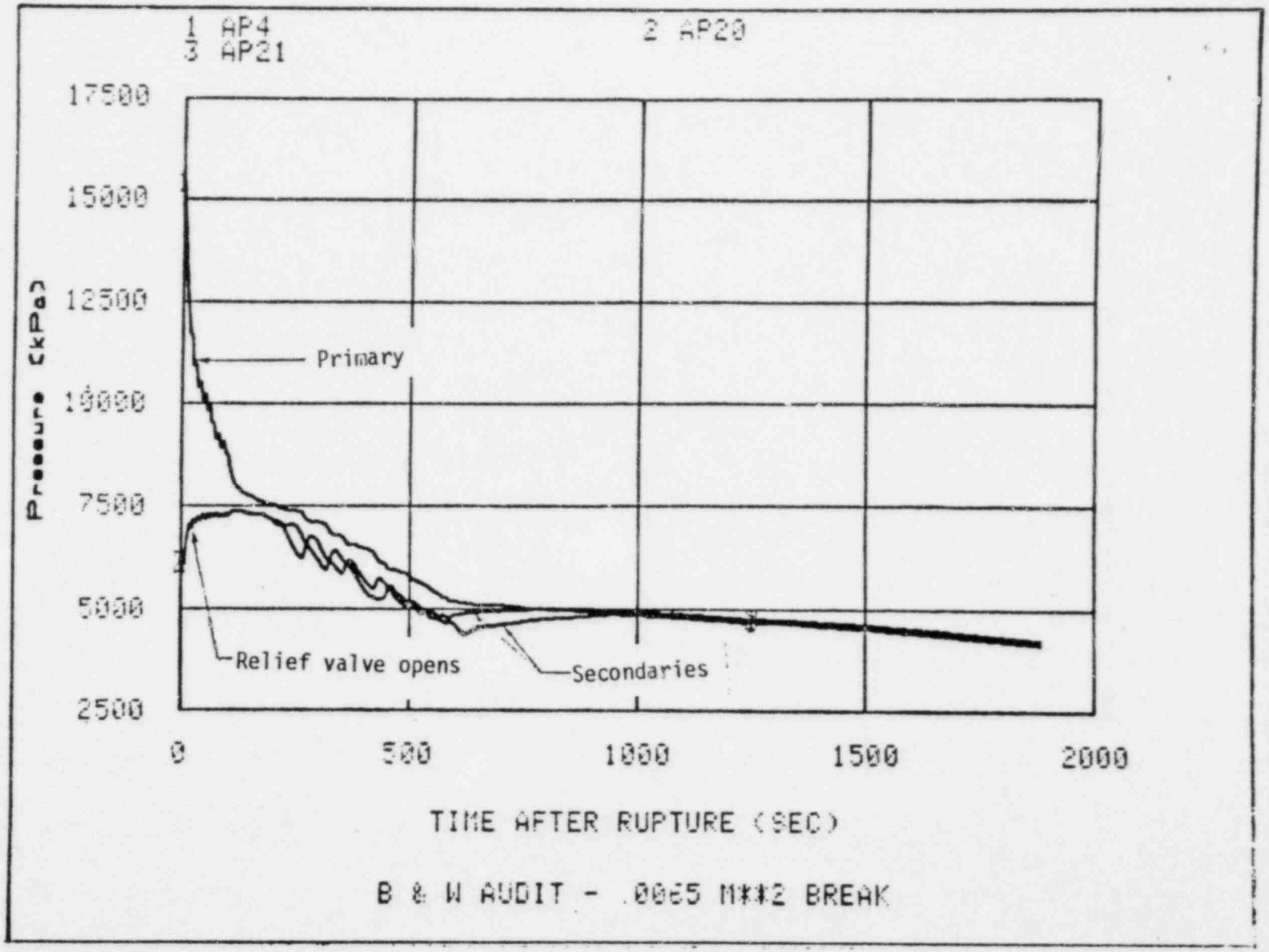

Fig. 6 Primary and secondary system pressure response

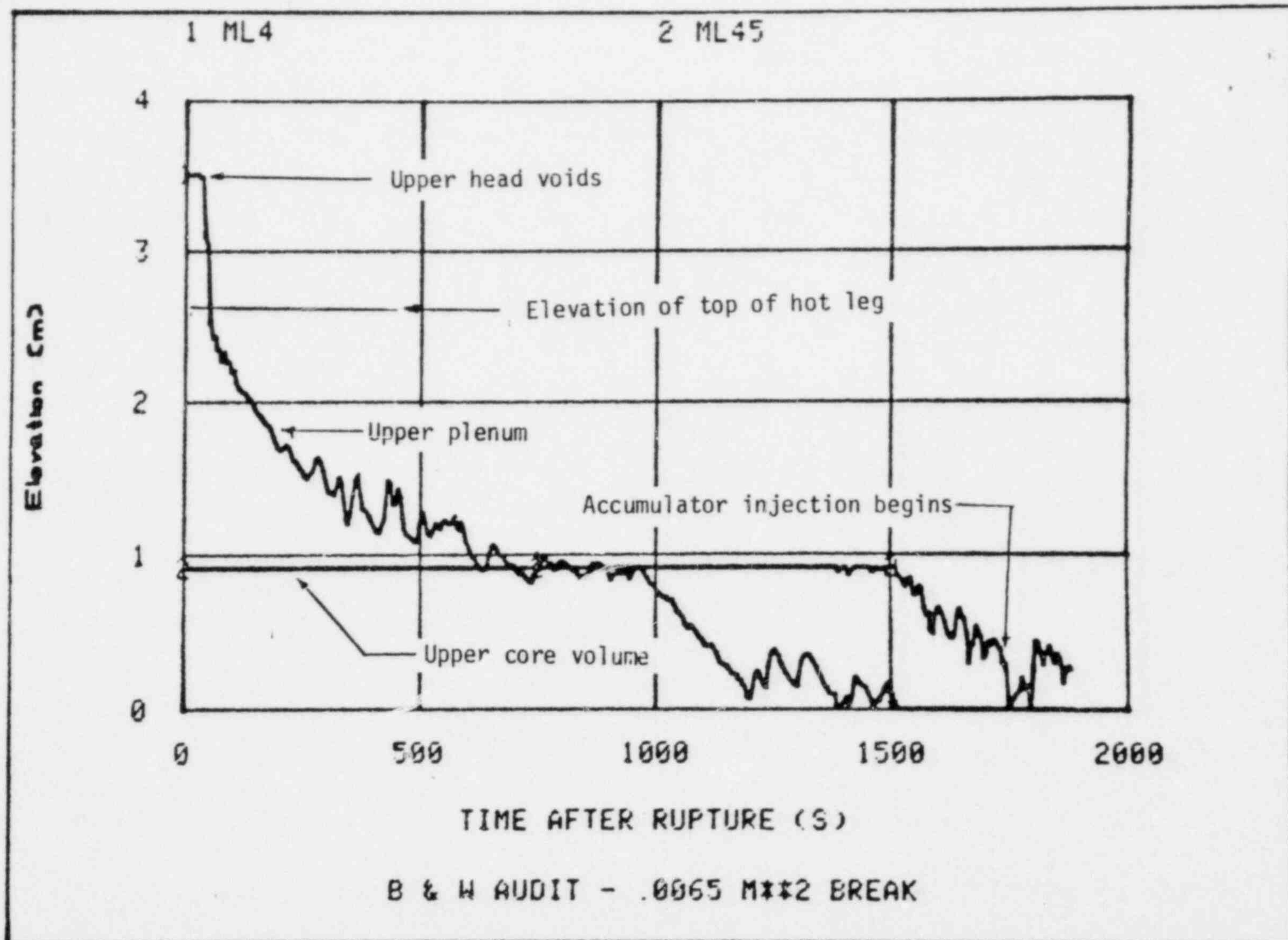

Fig. 7 Upper plenum and upper core mixture levels

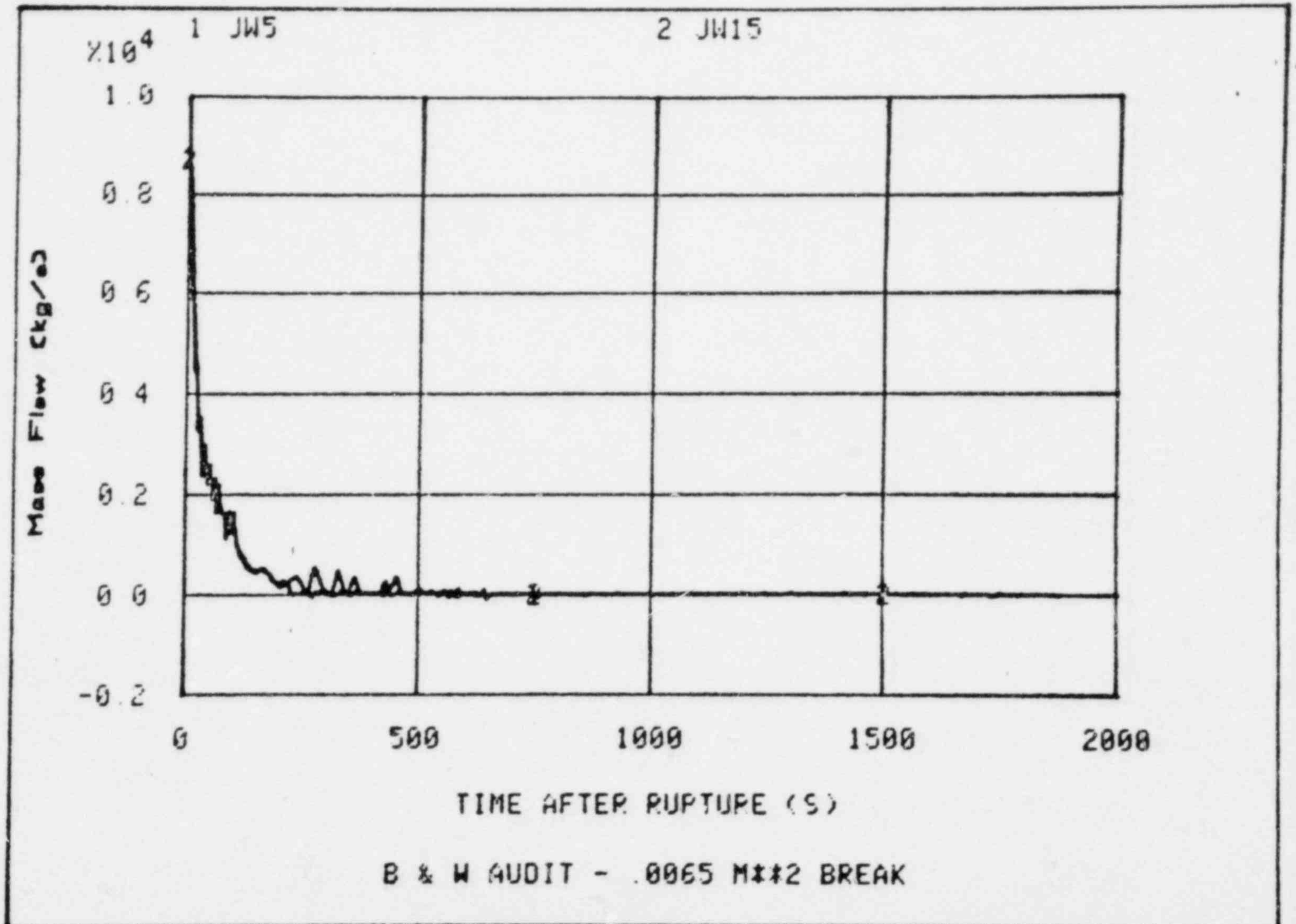

Fig. 8 Hot leg flows

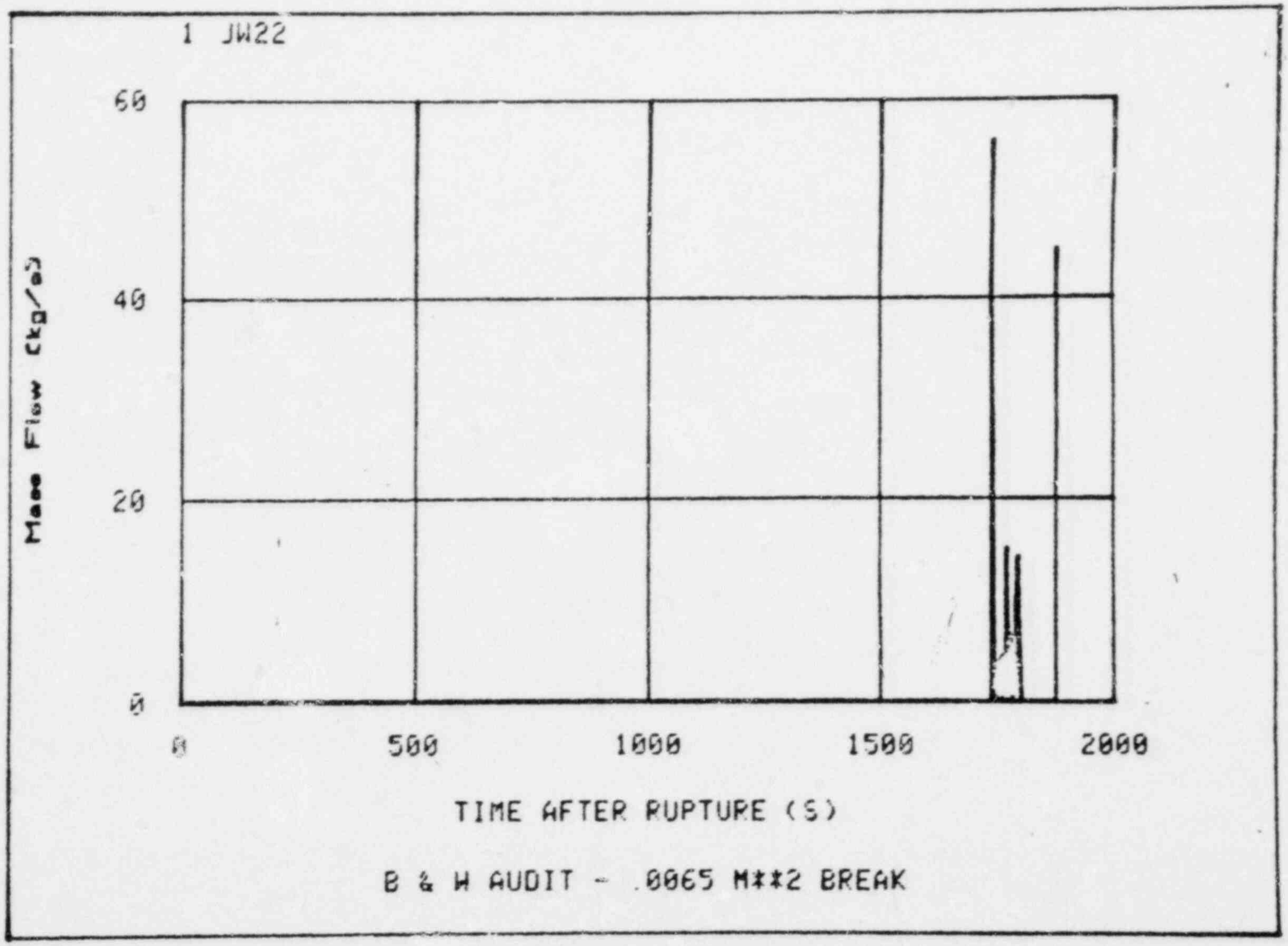

Fig. 9 Accumulator flow

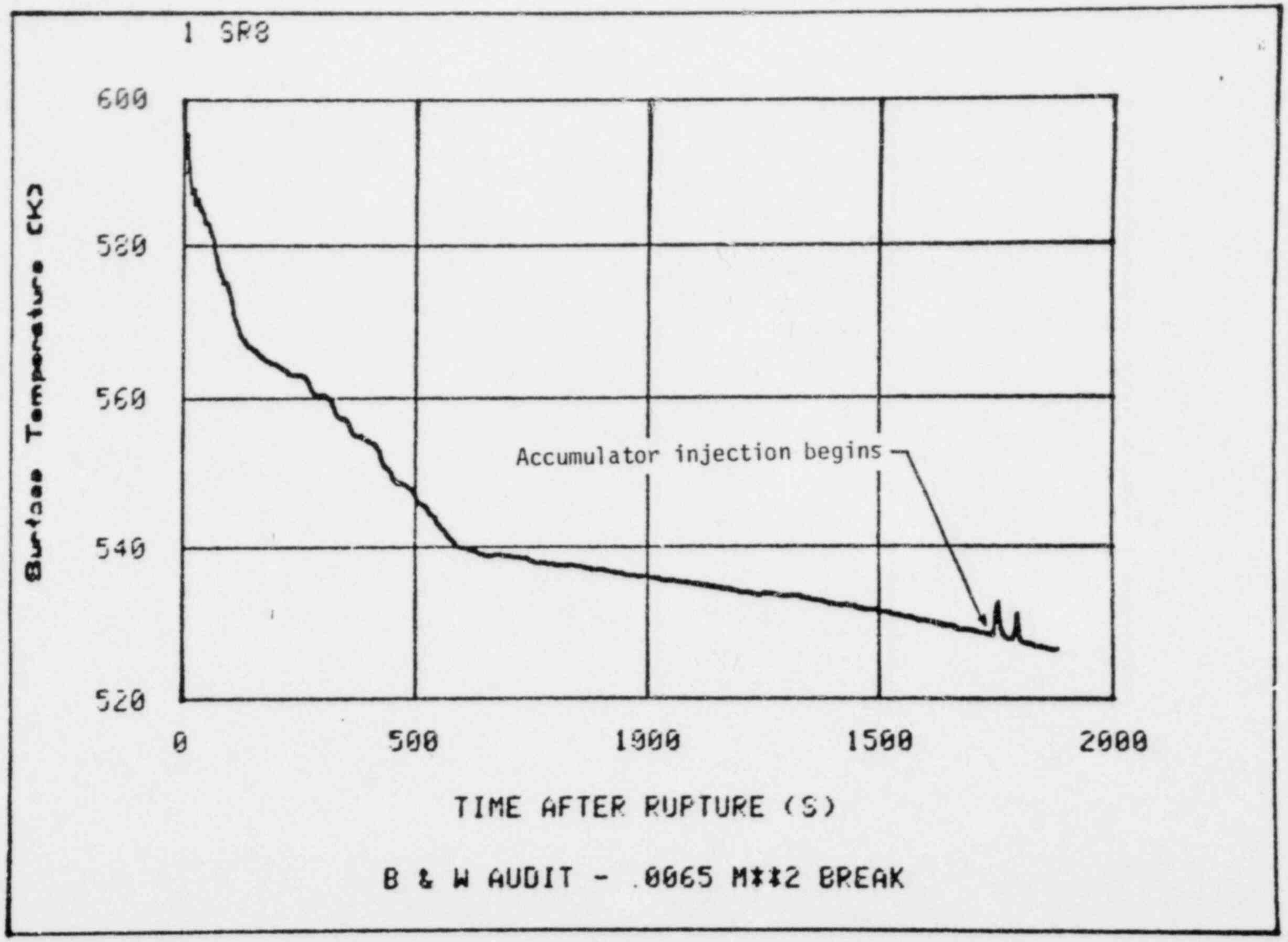

Fig. 10 Cladding surface temperature - 3.4 m elevation

VI. CONCLUSIONS

1. *The 0.00093 m^2 break size exhibits the potential for core uncovery.*

The analysis shows that a potential for core uncovery existed for a 0.00093 m^2 break in the cold leg of a Babcock and Wilcox pressurized reactor. It should be noted, however, that the analysis was based on (1) mixture level in the steam generator secondaries maintained at 50% of operating level during auxiliary feedwater delivery and (2) single degraded HPI pump delivery with 50% of the flow injected at the break for the entire transient. Present administrative controls require maintenance of the secondary side level at 95% of initial operating level. This additional heat sink may be sufficient to initiate and sustain natural circulation. Secondly, the use of undegraded HPI with both HPI pumps operating and/or injecting more HPI liquid into the intact loops and less to the broken loop may also initiate and maintain stable cooling.

2. *The 0.0065 m^2 break size results in adequate core cooling.*

The analysis of the 0.0065 m^2 break shows that a partial core uncovery does occur. However, initiation of accumulator flow refilled the core prior to any significant cladding surface temperature increase over primary system saturation temperature.

VII. REFERENCES

1. G. W. Johnsen et al, RELAP4/MOD7 (Version 2) User's Manual, INEL, CDAP-TR-78-036 (August 1978).

2. C. E. Hendrix and S. R. Behling, An Analysis of the Accident at Three Mile Island Using RELAP4/MOD7, attachment to letter "Three Mile Island Transient Analysis Completion," from P. North to R. E. Tiller, PN-143-79, August 30, 1979.

APPENDIX A

UPDATES USED WITH RELAP4/MOD7 VERSION G92

```
CICXD,T20000,EC400,P3,PEI.
ACCT(DCBEE       INELCXDTNT*115A5822240443314000)
ATTACH,OLDPL,RELAP4MOD92058,ID=CIDLC,MR=1.
UPDATE.
RETURN,OLDPL.
RFL,160000.
FTN,I,A,OPT=2,L=0,B=NEWOBJ,STATIC.
REDUCE.
RETURN,COMPILE.
ATTACH,OLDOBJ,RELAP4MOD920OB,ID=CIDLC,MR=1.
ATTACH,PRELOADGX,ID=CIGLS,MR=1,CY=290.
ATTACH,TAPE17,OVERLAYG,ID=CIGLS,MR=1,CY=290.
ATTACH,ENVRL,RELAP4ENVRL,ID=CICLS,MR=1.
ATTACH,TAPE15,STH2XT,ID=CICLS,MR=1.
VSN,PRTAPE=A50932/A50933/A50934.
REQUEST,PRTAPE,NT,NORING.
LABEL,PRTAPE,R,L=DCBBE.
COPY,PRTAPE,TAPE3.
UNLOAD,PRTAPE.
REWIND,TAPE3.
FILE,TAPE3,SBF=NO.
FILE,TAPE4,SBF=NO.
COPYBR,INPUT,TAPE5.
REWIND,TAPE5,TAPE17.
PRELOAD.
RETURN,TAPE5,PRELOAD,TAPE17.
EDITLIB,T=TAPE19,L=LIBLST.
RETURN,LIBLST,TAPE19,OLDOBJ.
RFL,CM=70000,EC=200.
LDSET,ERR=NONE,PRESETA=NGINDEF,LIB=NEWLIB/ENVRL.
SEGLOAD,I=TAPE18,B=RELAP4.
NOGO.
RETURN,NEWLIB,TAPE18,OLDOBJ,ENVRL.
RFL,CM=210000,EC=400.
REWIND,OUTPUT.
RELAP4,TAPE21.
EXIT,U.
REDUCE.
RETURN,RELAP4,TAPE21,TAPE15.
REWIND,TAPE4.
REQUEST,PRTAPE,NT,PE,N,RING,VSN=SCRINL.
LABEL,PRTAPE,W,L=DCBBE.
TAPELBL,PRTAPE,DSN=DCBBE,DESC=B&W RESTART TAPE,ID=INL.
COPY,TAPE4,PRTAPE.
UNLOAD,PRTAPE.
REWIND,TAPE4.
COPY,TAPE4,RELAP.
RETURN,TAPE4.
REWIND,RELAP.
FILE,RELAP,SBF=NO.
REQUEST,CGMI,*PF.
ATTACH,PGMLIB,ID=CIHRB,MR=1.
LIBRARY,PGMLIB.
ZCCM.
CATALOG,CGMI,BWPI,ID=CICXD,RP=050,MR=1,AC=443314000.
*ID HNCV---KN
*D HNCV.77
      CALL FAILED (9990)
*D HNCV.86
      CALL FAILED (9990)
*D HNCV.111
      CALL FAILED (9990)
*D HNCV.119
      CALL FAILED (9990)
*D HNCVG64TD.2
      PRCP(2)=PRES*SIPR
      CALL STH2X2(LFA(I4),PROP,R4F)
```

```
*D HNCVGE4TD.3
  611 FORMAT(1X,"FAILURE IN CALL TO STH2X2 FROM HNCV WITH PRES =",E12.6)
*D HNCVGE4TD.7
      PROP(2)=PRES*SIPR
      CALL STH2X2(LFA(IX),PROP,ERR)
*ID TWCW---KN
*I TWOW.245
      IF(XLFRAC.LT.0.) XLFRAC=0.
      IF(XLFRAC.GT.1.) XLFRAC=1.
*ID SLIPTMICH
*I SLIP.549
        BOTTOM = RVAP + RHOL
        WTOT = GNET*AJUNT(J)
        WLIQ = (RHOL/BOTTOM)*(WTOT + VSL*RVAP*AJUNT(J))
        IF(WLIQ .GT. 0.0 .AND. VSL .GT. 0.0 .AND. XTOP .EQ. 1.0) RHOL=0.0
        IF(WLIQ .LT. 0.0 .AND. VSL .LT. 0.0 .AND. XTOP .EQ. 1.0) RHOL=0.0
*ID SVEL---CH
*D SVEL.112
      IF((B**2.0 - 4.0*A*C) .LT. 0.0) GO TO 35
*I SVEL.113
      IF (VSLIP4 .LT. 0.0) VSLIP4 = 0.0
      GO TO 36
   35 VSLIP4 = 0.0
*D SVEL.114
   36 IF (MAP .EQ. 6) GO TO 30
*D SVEL.116,SVEL.119
*ID REST---SB
*D RESTG67JT.5
        IN2=0
*IDENT  INFIGXXMH
*D  INFI.486
      IWW=ITI+NPTS
*D  INFI.487
      IW2=IWW+ILEN
*D  INFI.489
      IW=IWW
*D  INFI.506
      IWW=IWW+1
*D  INFI.526
      IWW=ITI+NPTS
*D  INFI.527
      IW2=IWW+ILEN
*D  INFI.528
      IHI=IWW+NPTS
*D  INFI.530
      IW=IWW
*D  INFI.540
      IWW=IWW+1
*D   INFI.254
  50  IF(ITYPE.GT.0 .AND. ITYPE.LT. 6)  GO  TO  60
*D  INFI.397
 400  IF(ITYPE.GT. 4 )  GO  TO  450
      IDX=IDXSCR
*I  INFI.427
      GO  TO  600
C
C     ITYPE= 5 = FLOW AND ENTHALPY ARE FUNCTIONS OF MIXTURE LEVEL
C                DATA IN TRIPLETS  LEVEL(I),FLOW(I),H(I)
450   IDX=IDXSCR
      ILEN=ILEN+NPTS
      IF (NPTS.LE.33)  GO  TO  1410
      IL=KADDR+9
      CALL  FTBSFT(FILLID,IL,3,FILIDX)
      TEMPID=NEXTID(0)
      CALL  RESERV(TEMPID,ILEN,1,IDX)
      LEN=LCONTG(1)
      CALL  FTBSFT(FILLID,LEN,3,FILIDX)
```

```
1410  L3B(1)=L3(1)+1
      L3B(2)=-L3(1)-99
      L3B(3)=ILEN
      IF  (LENFIL(NFLL).NE. C)  L3B(3)=0
      L3B(4)=ILEN
      L3E(6)=1
      CALL  INP2(DATA,FA(IDX),L3B,IA)
      IF(L3B(6).LT. 0)  GC  TC  30
C     STORE MIXTURE LEVEL      , FLOW RATE AND ENTHALPY
      JADDR=IADDR+9
      NU=IDX+ILEN-1
      KADDR=KADDR+ILEN+9
      IF (KADDR .GT. LEN)  GO  TO  700
      IF(LENFIL(NFLL) .NE. C)  GO  TO 1425
      DO  1420  J=IDX,NU,3
      FA(JADDR)=FA(J)
      FA(JADDR+NPTS)=FA(J+1)
      FA(JADDR+2*NPTS)=FA(J+2)
      JADDR=JADDR+1
1420  CONTINUE
1425  IF(TEMPIC .GT.  0.0)  CALL  DELETE(TEMPIC)
*C  INF1.514
625   IF(ITYPE.GT.4)  GC  TO  1625
      ILEN=(NPTS+1)/2
*I  INF1.545
      GO  TO  645
1625  ILEN=(NPTS+1)/2
      II=0
      DO  1626  IJK=IJB,IJE,IJSKP
      II=II+1
      IF( IF.EQ.IPUMP(1,IJK).AND.IW1(1,IJK).EQ. 0)  GO  TO  1627
1626  CONTINUE
1627  KKK=KKK+1
      IFLJKT(KKK)=II
      WRITE(6,12006)  ITYPE,ITRIP,ARFRAC,ISATFL
12006 FORMAT("0",10X,"FILL TYPE  TRIP ID      AIR"/ 33X,"FRACTION" //
     1 14X,I3,7X,I3,4X,E12.5//10X,"NON EQUILIBRIUM FILL FLAG = ",I3)
      WRITE(6,12003)
      WRITE(6,12007)
12007 FORMAT(1H0,2(2X,"N",7X,"M.L.",10X,"FLOW RATE",7X,"ENTHALPY",10X)/
     * 1X,2(10X,"       ",8X,"(LB/SEC-FT2)",5X,"(BTU/LB)",10X)/)
      IF (LENFIL(IFA) .NE. C)  GO  TC  645
      IT1=IADDR+9
      IT2=IT1+ILEN
      IWW=IT1+NPTS
      IW2=IWW+ILEN
      IH1=IWW+NPTS
      IH2=IH1+ILEN
      IW=IWW
      J=ILEN+1
      DO  1640  N=1,ILEN
      IF  (N.EQ. 2)  GO  TC  82000
      GC  TO  83000
82000 ZMCRIT(KKK)=FA(IT1)
      WPMAXF(KKK)=FA(IWW)
83000 CONTINUE
      IF (IT2 .LT. IW)  GO  TC  1630
      WRITE(6,12008) N,FA(IT1),FA(IWW),FA(IH1)
      GO  TO  1635
1630  WRITE(6,12008)N,FA(IT1),FA(IWW),FA(IH1),J,FA(IT2),FA(IW2),FA(IH2)
1635  IT1=IT1+1
      IT2=IT2+1
      IWW=IWW+1
      IW2=IW2+1
      IH1=IH1+1
      IH2=IH2+1
      J=J+1
1640  CONTINUE
```

```
*I   INFI.47?
12003 FORMAT(1H0,52X,"** FILL TABLE  **")
*I   INFI.567
12CO3 FORMAT(1X,2(I3,1P3E16.6,7X))
*I   INFI.113
C        INTEGER  IZ(1,1)
L        INTEGER IZ(2,1)
      EQUIVALENCE(IZ(1),FA(1))
*CALL   DSHE
*CALL   IPMP
*CALL   IWIX
*CALL   VCLP
*I   INFI.436
         KKK=0
*D INFI.497
         WRITE(6,2005) N,FA(IT1),FA(IW)
*D INFI.499
  605  WRITE(6,2005) N,FA(IT1),FA(IW),J,FA(IT2),FA(IW2)
*D INFI.5C1
  610  WRITE(6,2005) N,FA(IT1),FA(IW),J,FA(IT2),FA(IW2),
*D INFI.534
       WRITE(6,2008) N,FA(IT1),FA(IW),FA(IP1)
*D INFI.536
  630  WRITE(6,2008) N,FA(IT1),FA(IW),FA(IP1),J,FA(IT2),FA(IW2),
*IDENT   FILLGXXMH
*D   FILL.2
      FUNCTION  FILL(IFILL,J,AJUNT,PRES,HP,ARFRAC,SMXLV)
*D   FILL.124
25       GO  TO (30,40,50,30,65),    ITYPE
*I   FILL.131
65       X=SMXLV
         GO   TO   60
*D   FILL.174
      IF (ITYPE.EQ. 5)    WRITE(6,28CC)
*I   FILL.193
2800  FORMAT(1H0,2(4HM.L.,16X,5HFLCW RATE,11X,8HENTHALPY,12X)/
     1 1H ,2(5H       ,15X,12H(LB/SEC-FT2),8X,8H(BTU/LB),12X)/1H )
*IDENT   ENTHGXXMH
*C   ENTH.471
      WP(J)=FILL(IPUMP(1,J),J,AJUNT(J),P(K),HP(J),ARFRAC,ZM(K))
      DO 81000  IIS=1,4
      IF(JJ.EQ. IFLJKT(IIS)) GC TO 180
81000 CONTINUE
      GO   TO   190
180   IF(ZM(K).GT.ZMCRIT(IIS).AND.WP(J).NE.0.) GO TO 195
      GO   TO   190
195   WP(J)=WP(J)+WNETF(IIS)
      WLIMIT=WPMAXF(IIS)*AJUNT(J)
      IF (WP(J).GT. WLIMIT      )  WP(J)=WLIMIT
190   CONTINUE
*D   ENTH.518
      WP(J)=FILL(IPUMP(1,J),J,AJUNT(J),P(K), DUM4,DUM5,ZM(K))
*IDENT   BALOGXXMH
*I     BALC.500
       DO   99995   IG=1,4
       IJINDX=IFLJKT(IG)
       IF (IJINDX.EQ. 0)   GO   TO   99995
       INLETV=IW2(1,IJEM+IJINDX*IJSKP)
       WNET=0.
       II=C
       DO   99996     IS=IJB,IJE,IJSKP
       II=II+1
       IF (IW2(1,IS) .EQ. INLETV.AND.II.NE.IJINDX)  WNET=WNET+WP(IS)
       IF(IW1(1,IS).EQ.INLETV) WNET=WNET-WP(IS)
99996  CONTINUE
       IF (WNET.GE. 0) WNET=0.
       WNET=-WNET
       WNETF(IG)=WNET
```