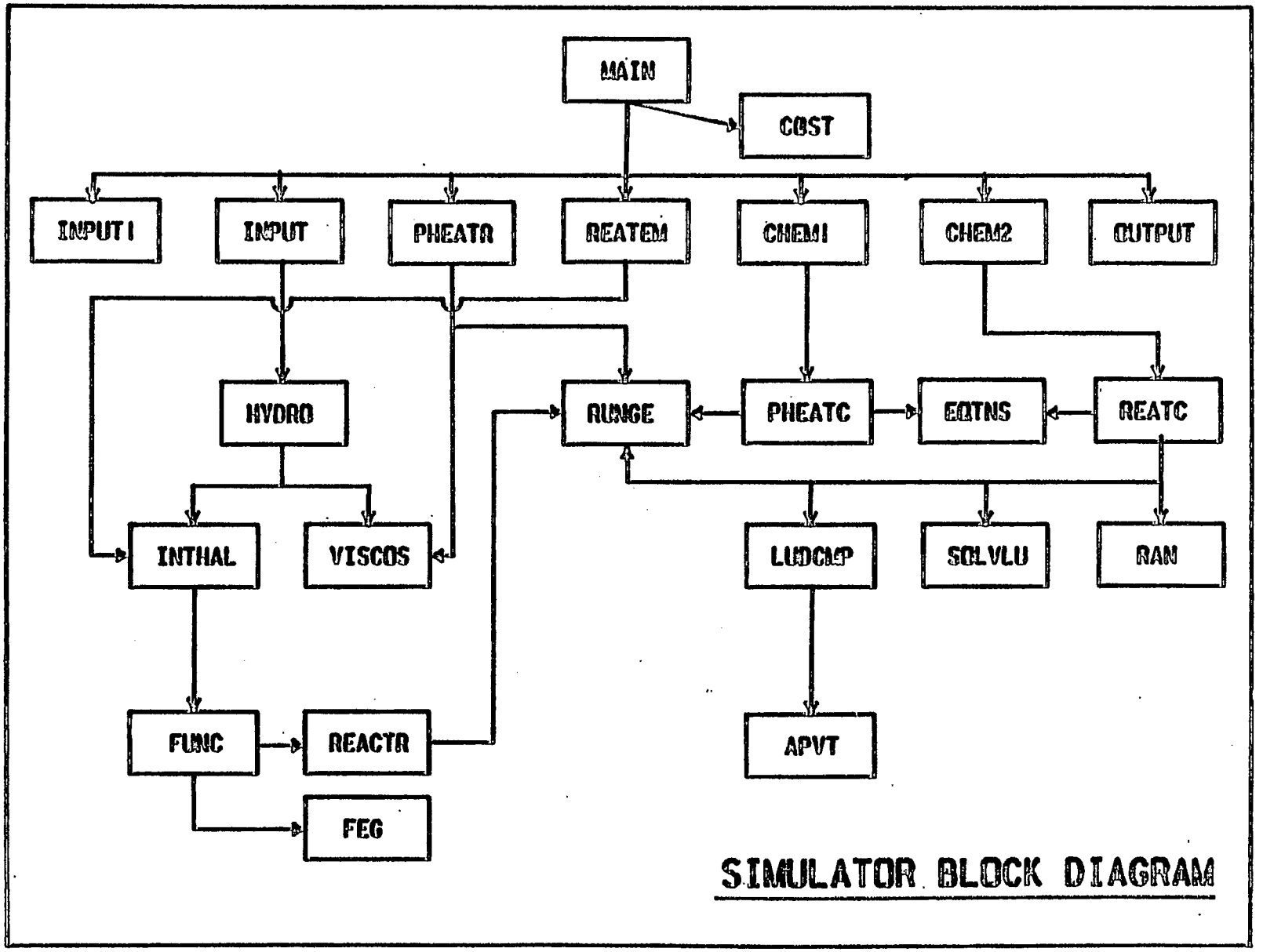
APPENDIX A

This section includes the program source code and a simulator block diagram.


MAIN
COST
INPUT1
INPUT
PHEATR
REATEM
CHEM1
CHEM2
OUTPUT
HYDRO
RUNGE
PHEATC
EQTNS
REATC
INTHAL
VISCOS
LUDCMP
SOLVLU
RAN
FUNC
REACTR
APVT
FEG
SIMULATOR BLOCK DIAGRAM

SUBROUTINE/FUNCTION NAME	PURPOSE
INPUT 1	Reads input data: viz. coal conversion kinetics
INPUT	Reads input data: viz. Physical dimensions of the units, physical and thermal properties and hydrogen consumption kinetics
PHEATR:	Simulates preheater performance: Thermal and hydrogen consumption only
REATEM:	Simulates reactor performance: Thermal balance only
CHEM1:	Initializes simulation of preheater: Chemical species conversion
CHEM2:	Initializes simulation of reactor: Chemical species conversion
OUTPUT:	Prints output
HYDRO:	Calculates hydrodynamic parameters
RUNGE:	Runge-Kutta fourth-order integrator
PHEATC:	Simulates preheater performance: Chemical species conversion
EQTNS:	Calculates chemical species conversion rates
REATC:	Simulates reactor performance: Chemical species conversion
INTHAL:	Interval halving program to solve implicit equations
VISCOS:	Calculates viscosity of coal slurry in preheaters
LUDCMP:	Calculates lower and upper triangular matrices
SOLVLU:	Finds solution of matrix AX=B, after finding its LU equivalent matrices
RAN:	Random numbers generator
FUNC:	Function routine that calls REACTR and FEG
REACTR:	Simulates reactor performance: Hydrogen consumption only.
APVT:	Finds largest element for pivot and performs interchanges
FEG:	Provides equations for calculation of gas holdup

PROGRAMS TO GENERATE GRAPHICAL OUTPUT

PLOT.FTN

(SOURCE PROGRAM)

```
0195            ORIGIN(1)=I0-JIFIX(0.267*8000.0)
0196            ORIGIN(2)=I1+JIFIX(3.6*8000.0)
0197            CALL TNDFPI(GGROUP,ANGL,LEVEL,TNP,TSP,TS,ORIGIN,RTNCD,
          1     YLABEL(4),NOATT)
0198            WRITE(10,236) RTNCD
0199            ORIGIN(1)=I0-JIFIX(0.267*8000.0)
0200            ORIGIN(2)=I1+JIFIX(4.8*8000.0)
0201            CALL TNDFPI(GGROUP,ANGL,LEVEL,TNP,TSP,TS,ORIGIN,RTNCD,
          1     YLABEL(5),NOATT)
0202            WRITE(10,236) RTNCD
0203            ORIGIN(1)=I0-JIFIX(0.267*8000.0)
0204            ORIGIN(2)=I1+JIFIX(6.0*8000.0)
0205            CALL TNDFPI(GGROUP,ANGL,LEVEL,TNP,TSP,TS,ORIGIN,RTNCD,
          1     YLABEL(6),NOATT)
0206            WRITE(10,236) RTNCD
0207            TNP(4)=3
0208            TSP(6)=3
0209            ORIGIN(1)=I0-JIFIX(1.03*8000.0)
0210            ORIGIN(2)=I1+JIFIX(5.752*8000.0)
0211            CALL TNDFPI(GGROUP,ANGL,LEVEL,TNP,TSP,TS,ORIGIN,RTNCD,
          *     ONY,NOATT)
0212            WRITE(10,237) RTNCD
0213     237    FORMAT('        RET FORM TNDFPI 2',I)
0214            TNP(4)=2
0215            TSP(6)=2
0216            ORIGIN(1)=I0-JIFIX(1.2373*8000.0)
0217            ORIGIN(2)=I1+JIFIX(5.13*8000.0)
0218            CALL TNDFPI(GGROUP,ANGL,LEVEL,TNP,TSP,TS,ORIGIN,
          1     RTNCL,RR1,NOATT)
0219            WRITE(10,238) RTNCD
0220     238    FORMAT('        RET CODE FROM TNDFPI 3'=I)
0221            NN=2*M
0222            WRITE(10,245) M,NN
0223     245    FORMAT('  M=NN',II)
0224            J=0
0225            DO 25 I=1,NN,2
0226            J=J+1
0227            WRITE(10,234) J,X(J),Y(J)
0228     234    FORMAT('   J,X(J),Y(J)',I,2E)
0229            OR(I)=I0+JIFIX(5.0*X(J)*8000.0)
0230            OR(I+1)=I1+JIFIX((Y(J)/10.0*HY-YTICK(1))/(YTICK(6)-YTICK(1))
          1     *6.0*8000.0)
0231            WRITE(10,*) I,OR(I),OR(I+1),J,X(J),Y(J)
0232     25     CONTINUE
               C
0233            CALL LSDFPI(GGROUP,LEVEL,SPEC3,OR,N,RTNCD,NOATT)
0234            WRITE(10,235) RTNCD
0235     235    FORMAT('        RET FROM LSDFPI',I)
0236            CLOSE (UNIT=10)
0237            CALL DEDFPI(1)
0238            TSKCI(1)=IBUFF(1)
0239            TSKCI(2)=IBUFF(2)
0240            CALL VSENDM(TSKCI,OBUFF,,1,IDS)
0241            CALL RESUME(TSKCI,IDS)
0242            END
```

```
0144            DO 55 I=1,6
0145            WRITE(9,501) YTICK(I)
0146      501   FORMAT(F4.1)
0147      55    CONTINUE
0148            IF(R1.NE.0) WRITE(9,503) R1
0149      503   FORMAT(I2)
0150            CLOSE (UNIT=9)
0151            OPEN (UNIT=9,FILE='DS1:[50,15]FLOT.DAT',STATUS='OLD')
0152            READ(9,300) CNY
0153            WRITE(10,300) CNY
0154      300   FORMAT(A3)
0155            DO 56 I=1,6
0156            READ(9,301) YLABEL(I)
0157            WRITE(10,301) YLABEL(I)
0158      301   FORMAT(A4)
0159      56    CONTINUE
0160            IF(R1.NE.0) READ(9,303) RR1
0161      303   FORMAT(A2)
0162            IF(R1.NE.0) WRITE(10,303) RR1
0163            CLOSE (UNIT=9)
0164            ANGL=90
0165            TNF(1)=0
0166            TNF(2)=800.0
0167            TNF(4)=4
0168            TNF(5)=6
0169            TSF(1)=800.0
0170            TSF(3)=800.0
0171            TSF(3)=10
0172            TSF(6)=4
0173            TS(1)=0
0174            TS(2)=0
0175            TS(3)=0
0176            TS(4)=1
0177            TS(5)=0
0178            TS(6)=0
0179            TS(7)=2
0180            ORIGIN(1)=I0-JIFIX(0.267*8000.0)
0181            ORIGIN(2)=I1+JIFIX(0.03*8000.0)
        C
0182            WRITE(10,568) I0,I1,ORIGIN(1),ORIGIN(2)
0183      568   FORMAT('       I0,I1,ORIGIN(1),ORIGIN(2)',4I)
0184            CALL TNDFPI(GGROUP,ANGL,LEVEL,TNF,TSF,TS,ORIGIN,RTNCD,
           *  YLABEL(1),NOATT)
0185            WRITE(10,236) RTNCD
0186      236   FORMAT('       RET FROM TNDFPI 1',I)
        C
0187            ORIGIN(1)=I0-JIFIX(0.267*8000.0)
0188            ORIGIN(2)=I1+JIFIX(1.2*8000.0)
0189            CALL TNDFPI(GGROUP,ANGL,LEVEL,TNF,TSF,TS,ORIGIN,RTNCD,
           1  YLABEL(2),NOATT)
0190            WRITE(10,236) RTNCD
0191            ORIGIN(1)=I0-JIFIX(0.267*8000.0)
0192            ORIGIN(2)=I1+JIFIX(2.4*8000.0)
0193            CALL TNDFPI(GGROUP,ANGL,LEVEL,TNF,TSF,TS,ORIGIN,RTNCD,
           1  YLABEL(3),NOATT)
0194            WRITE(10,236) RTNCD
```

```
0096            IXLAST=XMAX/10.0**NX
0097            JXMIN=XMIN
0098            ZJXMIN=JXMIN
0099            IF(XMIN.EQ.ZJXMIN) GO TO 9
0100            IF(XMIN.LT.0.0) IXFRST=IXFRST-1
0101       9    JXMAX=XMAX
0102            ZJXMAX=JXMAX
0103            IF(XMAX.EQ.ZJXMAX) GO TO 10
0104            IF(XMAX.GT.0.0) IXLAST=IXLAST+1
0105       10   CONTINUE
                C
                C
0106            XLAST=IXLAST
0107            XFRST=IXFRST
0108            XDIFF=(XLAST-XFRST)/5.0
0109            DO 7 I=1,6
0110            XTICK(I)=XFRST+(I-1)*XDIFF
0111       7    CONTINUE
                C
                C
0112       500  FORMAT(6(2X,F8.1))
0113            YY=ABS(YMIN)
0114            IF(ABS(YMAX).GT.ABS(YMIN)) YY=ABS(YMAX)
0115            IF(YY.LT.1.0) GO TO 14
0116       15   YY=YY/10.0
0117            IF(YY.LE.1.0) GO TO 16
0118            NY=NY+1
0119            GO TO 15
0120       14   YY=YY*10.0
0121            IF(YY.GE.10.0) GO TO 16
0122            NY=NY-1
0123            GO TO 14
0124       16   IYFRST=YMIN/10.0**NY
0125            IYLAST=YMAX/10.0**NY
0126            JYMIN=YMIN
0127            ZJYMIN=JYMIN
0128            IF(YMIN.EQ.ZJYMIN) GO TO 19
0129            IF(YMIN.LT.0.0) IYFRST=IYFRST-1
0130       19   JYMAX=YMAX
0131            ZJYMAX=JYMAX
0132            IF(YMAX.EQ.ZJYMAX) GO TO 20
0133            IF(YMAX.GT.0.0) IYLAST=IYLAST+1
0134       20   CONTINUE
                C
                C
0135            YLAST=IYLAST
0136            YFRST=IYFRST
0137            YDIFF=(YLAST-YFRST)/5.0
0138            DO 17 I=1,6
0139            YTICK(I)=YFRST+(I-1)*YDIFF
0140       17   CONTINUE
                C
                C
0141            WRITE(10,*) YMIN,YMAX
0142            WRITE(9,502) NY
0143       502  FORMAT(I3)
```

```
0046            LEVEL=63
0047            ANGL=0.0
0048            ORIGIN(1)=I0
0049            ORIGIN(2)=I1
0050            CALL CLDFFI(LEVEL,GGROUP,ANGL,SC,CELL,ORIGIN,VIEW,
     *  RTNCD,NDATT,SPECS)
0051            OPEN (UNIT=9,FILE='DS1:[50,15]PLOT.DAT',STATUS='OLD')
      C
0052            IF(RO.EQ.1) OPEN(UNIT=8,FILE='DS1:[50,15]PTEMP.DAT',STATUS='OLD')
0053            IF(RO.EQ.2) OPEN(UNIT=8,FILE='DS1:[50,15]PHYGAS.DAT',STATUS='OLD')
0054            IF(RO.EQ.3) OPEN(UNIT=8,FILE='DS1:[50,15]PHYLIQ.DAT',STATUS='OLD')
0055            IF(RO.EQ.4) OPEN(UNIT=8,FILE='DS1:[50,15]PCONC.DAT',STATUS='OLD')
0056            IF(RO.EQ.5) OPEN(UNIT=8,FILE='DS1:[50,15]PVISCO.DAT',STATUS='OLD')
0057            IF(RO.EQ.6) OPEN(UNIT=8,FILE='DS1:[50,15]RTEMP.DAT',STATUS='OLD')
0058            IF(RO.EQ.7) OPEN(UNIT=8,FILE='DS1:[50,15]RHYGAS.DAT',STATUS='OLD')
0059            IF(RO.EQ.8) OPEN(UNIT=8,FILE='DS1:[50,15]RHYLIQ.DAT',STATUS='OLD')
0060            IF(RO.EQ.9) OPEN(UNIT=8,FILE='DS1:[50,15]RCONC.DAT',STATUS='OLD')
      C
      C
0061            JMAX=R1+2
0062            IF(R1.EQ.0) JMAX=4
0063            IF(RO.EQ.5) JMAX=3
0064            DO 1 I=1,101
0065     26     READ(8,*,ERR=26,END=2) (A(J),J=1,JMAX)
0066            X(I)=A(1)
0067            Y(I)=A(JMAX)
0068            WRITE(10,*) I,X(I),Y(I)
0069     1      CONTINUE
0070     2      CLOSE (UNIT=8)
0071            N=I-1
0072            XMIN=X(1)
0073            YMIN=Y(1)
0074            XMAX=X(1)
0075            YMAX=Y(1)
0076            DO 3 I=1,N
0077            IF(X(I).LT.XMIN) XMIN=X(I)
0078            IF(Y(I).LT.YMIN) YMIN=Y(I)
0079            IF(X(I).GT.XMAX) XMAX=X(I)
0080            IF(Y(I).GT.YMAX) YMAX=Y(I)
0081     3      CONTINUE
      C
      C
0082            NX=0
0083            NY=0
0084            XX=ABS(XMIN)
0085            IF(ABS(XMAX).GT.ABS(XMIN)) XX=ABS(XMAX)
0086            IF(XX.LT.1.0) GO TO 4
0087     5      XX=XX/10.0
0088            IF(XX.LE.1.0) GO TO 6
0089            NX=NX+1
0090            GO TO 5
0091     4      XX=XX*10.0
0092            IF(XX.GE.1.0) GO TO 6
0093            NX=NX-1
0094            GO TO 4
0095     6      IXFRST=XMIN/10.0**NX
```

```
PDP-11 FORTRAN-77 V4.0-1       10:26:40    14-May-84          Page 1
PLOT.FTN;202            /F77/TR:BLOCKS/WR

 001            REAL*4 X,Y,XFRST,YFRST,XLAST,YLAST,XMIN,XMAX,YMIN,YMAX
0002            REAL*4 A
0003            INTEGER*2 I,N,NX,NY,IXFRST,IYFRST,IXLAST,IYLAST,IX,IY
 004            INTEGER*2 JMAX,J,NN
 005            DIMENSION X(101),Y(101),IX(101),IY(101)
 006            DIMENSION A(12)
0007            DIMENSION XTICK(6),YTICK(6)
0008            REAL*8 ANGL,SC(2)
 009            CHARACTER*2 RR1
 010            CHARACTER*25 DGNFIL,DGNF
0011            CHARACTER*3 CHX,CHY
0012            CHARACTER*6 CELL
0013            CHARACTER*4 YLABEL(6)
 014            INTEGER*2 TMP(5),TSP(6),TS(7)
 015            INTEGER*2 OBUFF(1),IDS
0016            INTEGER*2 IBUFF(9),ITERM,LEVEL,GGROUP(2),VIEW(2),RTNCD,R0,R1
0017            INTEGER*2 NOATT(2),SPECS(5)
 018            INTEGER*2 TSKCI(2),DGNBLK(7),WHATEV
 019            INTEGER*4 I0,I1,ORIGIN(2),OR(10)
 020            EQUIVALENCE (ITERM,IBUFF(3))
0021            EQUIVALENCE (R0,IBUFF(4))
0022            EQUIVALENCE (R1,IBUFF(5))
 023            EQUIVALENCE (I0,IBUFF(6))
 024            EQUIVALENCE (I1,IBUFF(8))
0025            DATA GGROUP/0,0/
0026            DATA SC/1.0,1.0/
 027            DATA NOATT/0,0/
 028            DATA VIEW/1,1/
 029            DATA SPECS/0,0,0,1,0/
0030            DATA DGNFIL/'DB1:[050,015]BINCHART.DGN'/
C
C
C
C
0031            OPEN (UNIT=10,FILE='DB1:[50,153]OUT.DAT',STATUS='NEW')
C
 032            CALL VREDVM(,IBUFF,9,IDS)
C
0033            CALL SWFWRD(I0,1)
C
 034            CALL SWFWRD(I1,1)
C
 035            CALL LKTCSI(DGNFIL,DGNBLK,25,0,RTNCD)
C
0036            CALL INQFFI(WHATEV,DGNBLK,0,0,0,1,RTNCD,ITERM)
 037            IF(R0.EQ.1) CELL='RTEMP'
 038            IF(R0.EQ.2) CELL='PHYGAS'
 039            IF(R0.EQ.3) CELL='PHYLIQ'
 040            IF(R0.EQ.4) CELL='PCONC'
 041            IF(R0.EQ.5) CELL='PVISCO'
 042            IF(R0.EQ.6) CELL='RTEMP'
 043            IF(R0.EQ.7) CELL='RPHYGAS'
0044            IF(R0.EQ.8) CELL='RPHYLIQ'
0045            IF(R0.EQ.9) CELL='RCONC'
C
C
```

PLOT.UCM

(USER COMMAND PROGRAM)

```
        SET     CONTRL=CONTRL! 768
        KEY     'RC=GS1:CE0,153DOE.CEL'
        KEY     'LV=63'
        KEY     'AS=1'
        KEY     'AA=0'
        KEY     'WT=1'
        KEY     'FT=10'
        KEY     'TH=1.1'
        KEY     'TW=1.1'
        SET     R0=0
        SET     R1=0
        CMD     TXJ96
        KEY     'DR=DOEMENU.DAT'
        MSG     'ER '
A:      MSG     'PREnter Key from Menu'
        MSG     'STORE TO EXIT'
        GET     P,S,R,B,K,C,C,B
B:      TST     NUM EQ 8,EX
        MSG     'ERINVALID INPUT!   ENTER AGAIN'
        GO      A
        :       MSG     'ER '
        SET     R0=KEY
        TST     KEY EQ 4,H
        GO      I
        :       TST     KEY EQ 9,H
        GO      J
H:      MSG     'PREnter Species Code'
        MSG     'STORE TO EXIT'
        GET     P,K,R,K,K,L,C,K
        :       TST     NUM EQ 3,EX
        MSG     'ERINVALID INPUT!   ENTER AGAIN'
        GO      H
L:      SET     R1=KEY
        :       CMD     UPDAT2
        :       MSG     'PREnter Start Point'
        MSG     'STORE TO EXIT'
        GET     P,F,F,E,K,E,C,E
        :       TST     NUM EQ 6,EX
        MSG     'ERINVALID INPUT!   ENTER AGAIN'
        GO      D
F:      MSG     'ERPROCESSING'
        SET     I0=XUR
        SET     I1=YUR
        TSK     'PLOT',R0,R1,I0,I1
        WT      'PLOT'
        MSG     'PRPLOT COMPLETE'
        MSG     'ERNORMAL EXIT'
        GO      G
        :       MSG     'STUC EXITED'
G:      UCM     'GS1:E17,173EXIT.UCM'
        END
```

DATABASE SCHEMA

```
PR='QS1:I50;15ISIM1.PRT'
DB='QS1:I50;15ISIM1.DBS'
;
1.   PROCESS_CONDITIONS    DF='QS1:I50;15ICONDITIQ1.ENT'  OCC=100
    .1 LINE_DESIGNATION    F=AN(20)
    .2 FLOW_RATE_SLURRY    F=F
    .3 FLOW_RATE_GAS       F=F
    .4 TEMPERATURE         F=F
    .5 HYD_CONC_GAS        F=F
    .6 HYD_CONC_LIQ        F=F
    .7 CONC_SPECIES_1      F=F
    .8 CONC_SPECIES_2      F=F
    .9 CONC_SPECIES_3      F=F
    .10 CONC_SPECIES_4      F=F
    .11 CONC_SPECIES_5      F=F
    .12 CONC_SPECIES_6      F=F
    .13 CONC_SPECIES_7      F=F
    .14 CONC_SPECIES_8      F=F
    .15 CONC_SPECIES_9      F=F
    .16 CONC_SPECIES_10     F=F
    .17 SPARE_A             F=F
    .18 SPARE_B             F=F
    .19 SPARE_C             F=I(10I197)
    .20 SPARE_D             F=I(10090)
    .21 SPARE_E             F=AN(5)
    .22 SPARE_F             F=AN(30)
    .23 LEVEL               F=AN(2)
2.   EQUIPMENT_COST  P=0    DF='QS1:I50;15IEQUIPCQS1.ENT'  OCC=100
    .1 EQUIPMENT_TYPE       F=AN(20)
    .2 CAPITAL_COST         F=F
    .3 OPERATING_COST       F=F
    .4 MAINTENANCE_COST     F=F
    .5 FIXED_COST           F=F
    .6 VARIABLE_COST        F=F
    .7 SPARE_A              F=F
    .8 SPARE_B              F=F
    .9 SPARE_C              F=I(10I197)
    .10 SPARE_D             F=I(10090)
    .11 SPARE_E             F=AN(5)
    .12 SPARE_F             F=AN(30)
    .13 LEVEL               F=AN(2)
END
```

SOURCE PROGRAM TO ATTACH DATA TO GRAPHICS

```
SET     CONTRL=CONTRL! 768
KEY     'RA=1.*.1!'
SET     I0=960000000
SET     I1=960000000
SET     MSG='AE=1.*.1=0047Preheater Inlet0047!'
KEY     MSG
CMD     ATCPTO
SET     I2=I0+28524
SET     I3=I1+43712
PNT     I2,I3
PNT     1000,1000
SET     MSG='AE=1.*.1=0047Preheater Outlet0047!'
KEY     MSG
CMD     ATCPTO
SET     I2=I0+36188
SET     I3=I1+38961
PNT     I2,I3
PNT     1000,1000
SET     MSG='AE=1.*.1=0047Reactor Outlet0047!'
KEY     MSG
CMD     ATCPTO
SET     I2=I0+40840
SET     I3=I1+39731
PNT     I2,I3
PNT     1000,1000
KEY     'RA=2.*.1!'
SET     MSG='AE=2.*.1=0047Preheater0047!'
KEY     MSG
CMD     ATCPTO
SET     I2=I0+31044
SET     I3=I1+38403
PNT     I2,I3
PNT     1000,1000
SET     MSG='AE=2.*.1=0047Reactor0047!'
KEY     MSG
CMD     ATCPTO
SET     I2=I0+36804
SET     I3=I1+42824
PNT     I2,I3
PNT     1000,1000
MSG     'PRUCM COMPLETE'
UCM     'DS1:[17,17]EXIT.UCM'
END
```

SOURCE PROGRAM FOR DATA ENTRY INTO DATABASE

```
0001            IMPLICIT INTEGER*2 (A-Z)
0002            CHARACTER*30 A
0003            CHARACTER*20 LINE
0004            CHARACTER*42 L
0005            REAL X,X1,X2
0006            LOGICAL SETCB
        C
0007            INCLUDE 'DB0:[14,35]HOL.PAR/NOLIST'
0074            INCLUDE 'DB0:[14,35]HOLDB.COM/NOLIST'
        C
0150            CBMIG1=0
0151            IF(SETCB(ATTACH,0)) STOP 'ATTACH'
0152            IF(SETCB(USECOP,'DB='//'DB1:[50,15]DIM1.DB0'//'1')) STOP 'USE'
0153            OPEN (UNIT=1,FILE='DB1:[50,15]DIM1.DAT',STATUS='OLD')
        C
0154            DO 1 I=1,4
0155     1      READ(1,2) A
0156            WRITE(5,2) A
0157     2      FORMAT(A30)
0158            READ(1,3) NOSPEC
0159            WRITE(5,3) NOSPEC
0160     3      FORMAT(59X,I2)
0161            READ(1,7) X1
0162            WRITE(5,7) X1
0163            READ(1,7) X2
0164            WRITE(5,7) X2
0165            DO 4 I=1,2
0166     4      READ(1,2) A
0167            WRITE(5,2) A
        C
0168            DO 100 J=1,3
0169            READ(1,5) LINE
0170            WRITE(5,5) LINE
0171     5      FORMAT(30X,A20)
0172            ENCODE(42,6,L) LINE
0173     6      FORMAT(9H1,1.1.1=',A20,2H'1)
0174            IF(SETCB(FINDCP,L)) STOP 'FIND1'
0175            ENCODE(42,16,L) X1
0176     16     FORMAT(9H1,1.1.2=',E20.8,2H'1)
0177            IF(SETCB(CHNGCP,L)) STOP 'CHNG0.1'
0178            ENCODE(42,17,L) X2
0179     17     FORMAT(9H1,1.1.3=',E20.8,2H'1)
0180            IF(SETCB(CHNGCP,L)) STOP 'CHNG0.2'
0181            READ(1,7) X
0182            WRITE(5,7) X
0183     7      FORMAT(59X,E)
0184            ENCODE(42,8,L) X
0185     8      FORMAT(9H1,1.1.1=',E20.8,2H'1)
0186            IF(SETCB(CHNGCP,L)) STOP 'CHNG1'
0187            READ(1,7) X
0188            WRITE(5,7) X
0189            ENCODE(42,9,L) X
0190     9      FORMAT(9H1,1.1.2=',E20.8,2H'1)
0191            IF(SETCB(CHNGCP,L)) STOP 'CHANG2'
0192            READ(1,7) X
0193            WRITE(5,7) X
```

```
0194            ENCODE(42,10,L) X
0195      10    FORMAT(9H1,1.1.6=',E20.9,2H'1)
0196            IF(SETCB(CHNGCP,L)) STOP 'CHNG3'
0197            READ(1,2) A
0198            WRITE(5,2) A
0199            DO 200  K=1,NOSPEC
0200            K1=K+6
0201            READ(1,7) X
0202            WRITE(5,7) X
0203            ENCODE(42,11,L) K1,X
0204      11    FORMAT(6H1,1.1.,I2,2H=',E19.9,2H'1)
0205            IF(SETCB(CHNGCP,L)) STOP 'CHNG4'
0206      200   CONTINUE
0207            READ(1,2) A
0208            WRITE(5,2) A
0209      100   CONTINUE
          C
0210            DO 12 I=1,3
0211      12    READ(1,2) A
0212            WRITE(5,2) A
0213            DO 300 J=1,2
0214            READ(1,13) LINE
0215            WRITE(5,13) LINE
0216      13    FORMAT(14X,A20)
0217            ENCODE(42,14,L) LINE
0218      14    FORMAT(9H1,2.1.1='A20,2H'1)
0219            IF(SETCB(FINDCP,L)) STOP 'FIND3'
0220            DO 400 K=1,5
0221            K1=K+1
0222            READ(1,7) X
0223            WRITE(5,7) X
0224            ENCODE(42,15,L) K1,X
0225      15    FORMAT(6H1,2.1.,I2,2H=',E19.9,2H'1)
0226            IF(SETCB(CHNGCP,L)) STOP 'CHNG5'
0227      400   CONTINUE
0228            READ(1,2) A
0229            WRITE(5,2) A
0230      300   CONTINUE
0231            IF(SETCB(DETACH,0)) STOP 'DETACH'
0232            CLOSE (UNIT=1)
0233            STOP 'JOB DONE'
0234            END
```

PROGRAMS TO GENERATE GRAPHICAL REPORT

SIMREPORT.UCM

(USER COMMAND PROGRAM)

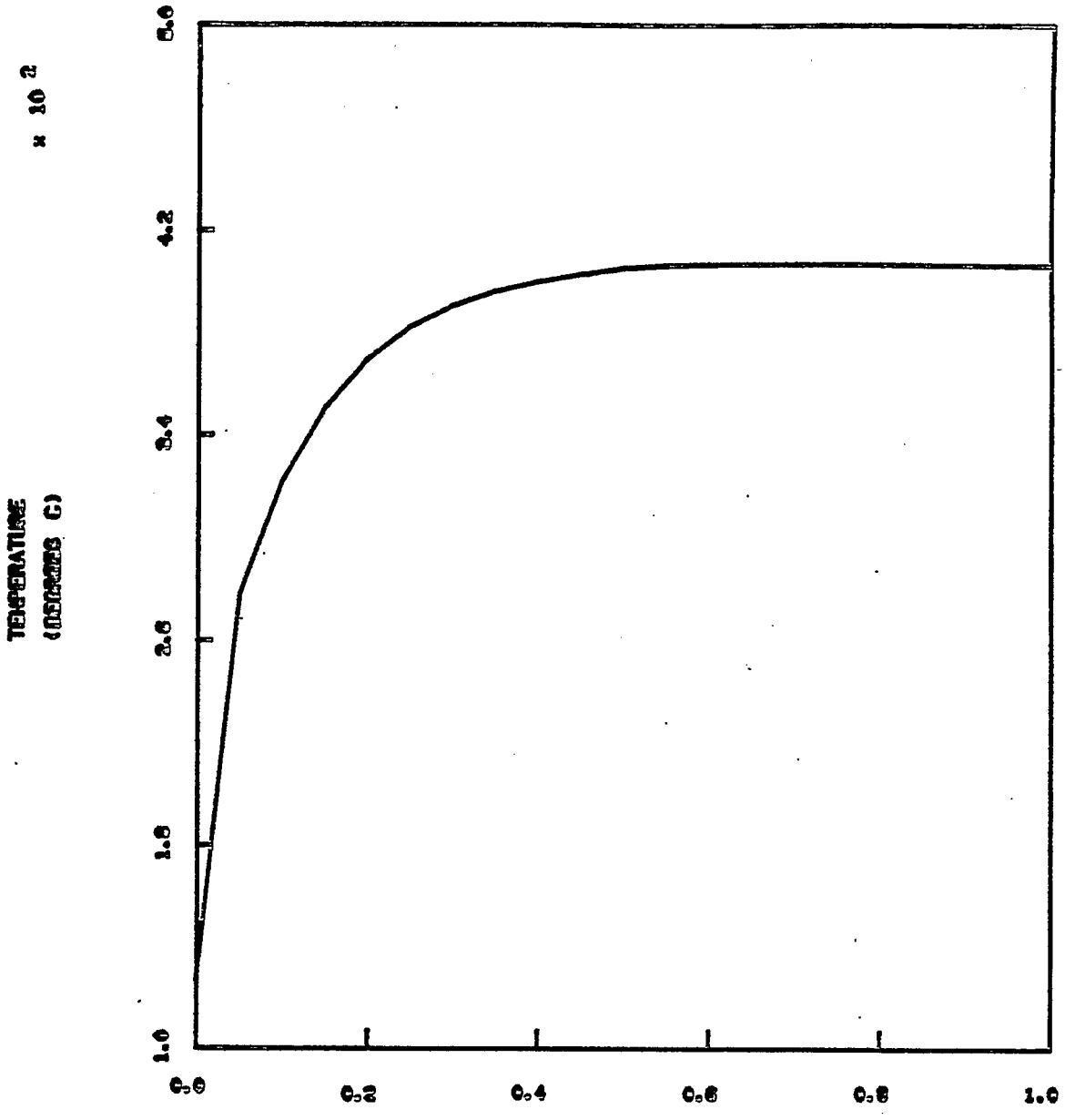
```
SET     CONTRL=CONTRL ! 768
MSG     'CF GRAPHICAL REPORT'
MSG     'ST CBS TO EXIT'
SET     MSG='Q81:D50,15]SIMREPORT.RPT'
CMD     REPORT
KEY     ' '
KEY     ' '
KEY     MSG
MSG     'ST NORMAL EXIT'
UCM     'Q81:D17,17]EXIT.UCM'
END
```

SIMREPORT.RPT

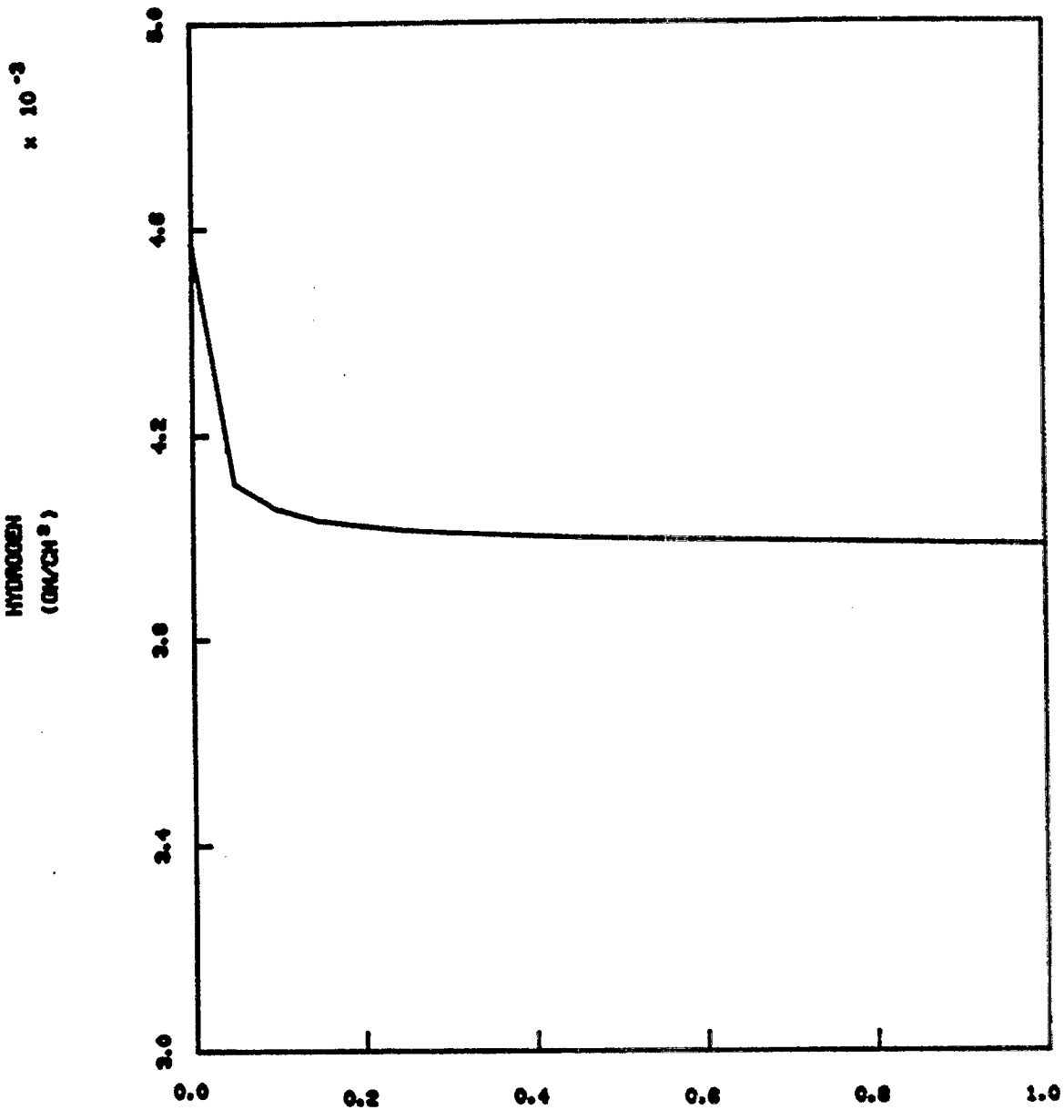
(OUTPUT FORMATING PROGRAM)

```
ORDER 11,2,2,:,6!
REPORT
 =U(2)
J=50,131,,'091:[50,15]SIMREPORT.OUT'
C T
  L=2,1
   V='COMPREHENSIVE GRAPHICAL-REPORT',O(45)
  L=0,1
    V='DATE: ',O(10)
    V=%D%,O(18),'ZZ/ZZ/ZZ'
    V='PAGE',O(115)
    V=%P%,*,'Z9'
   L=4,0
        V='CAPITAL',O(30)
        V='OPERATING',O(45)
        V='MAINTENENCE',O(60)
        V='FIXED',O(75)
        V='VARIABLE',O(90)
L=0,0
        V='COST',O(31)
        V='COST',O(47)
        V='COST',O(63)
        V='COST',O(75)
        V='COST',O(92)
 =0,0
        V='( $ )',O(31)
        V='($/YR)',O(46)
        V='($/YR)',O(62)
        V='($/YR)',O(75)
        V='($/YR)',O(91)
 =0,2
        V='-------',O(30)
        V='---------',O(45)
        V='-----------',O(60)
        V='-----',O(75)
        V='--------',O(90)
C=D
 L=2,0
        V=E(2)A(1),O(10)
        V=E(2)A(2),O(30),'E10.4'
        V=E(2)A(3),O(45),'E10.4'
        V=E(2)A(4),O(60),'E10.4'
        V=E(2)A(5),O(75),'E10.4'
        V=E(2)A(6),O(90),'E10.4'
 =F
 L=1,0
   V='----------',O(30)
   V='----------',O(45)
   V='----------',O(60)
   V='----------',O(75)
   V='----------',O(90)
L=0,0
   V='Total',O(10)
   V=+E(2)A(2),O(30),'E10.4'
   V=+E(2)A(3),O(45),'E10.4'
   V=+E(2)A(4),O(60),'E10.4'
   V=+E(2)A(5),O(75),'E10.4'
   V=+E(2)A(6),O(90),'E10.4'
```

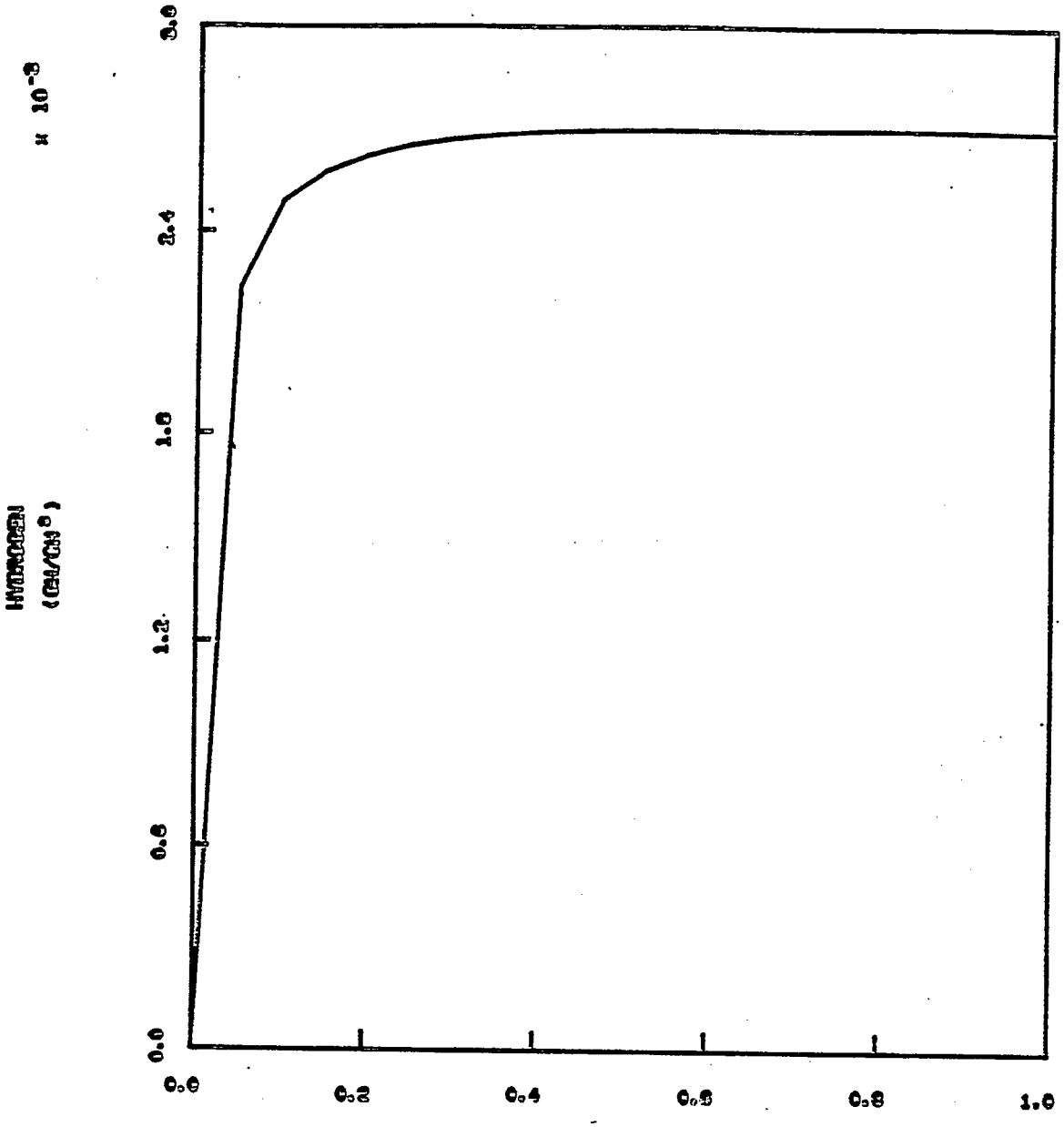
GRAPHICAL OUTPUT



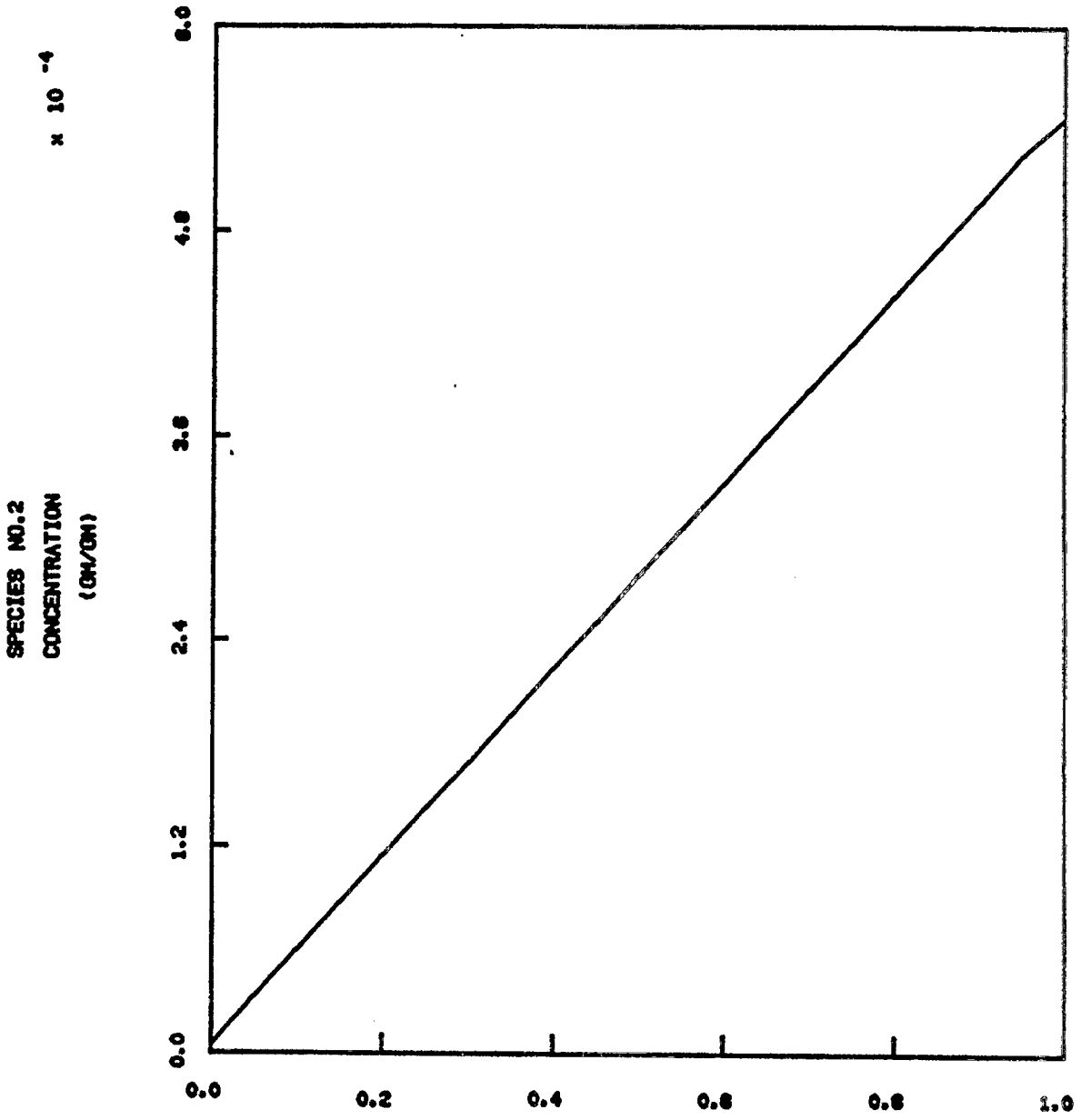
PREHEATER TEMPERATURE PROFILE



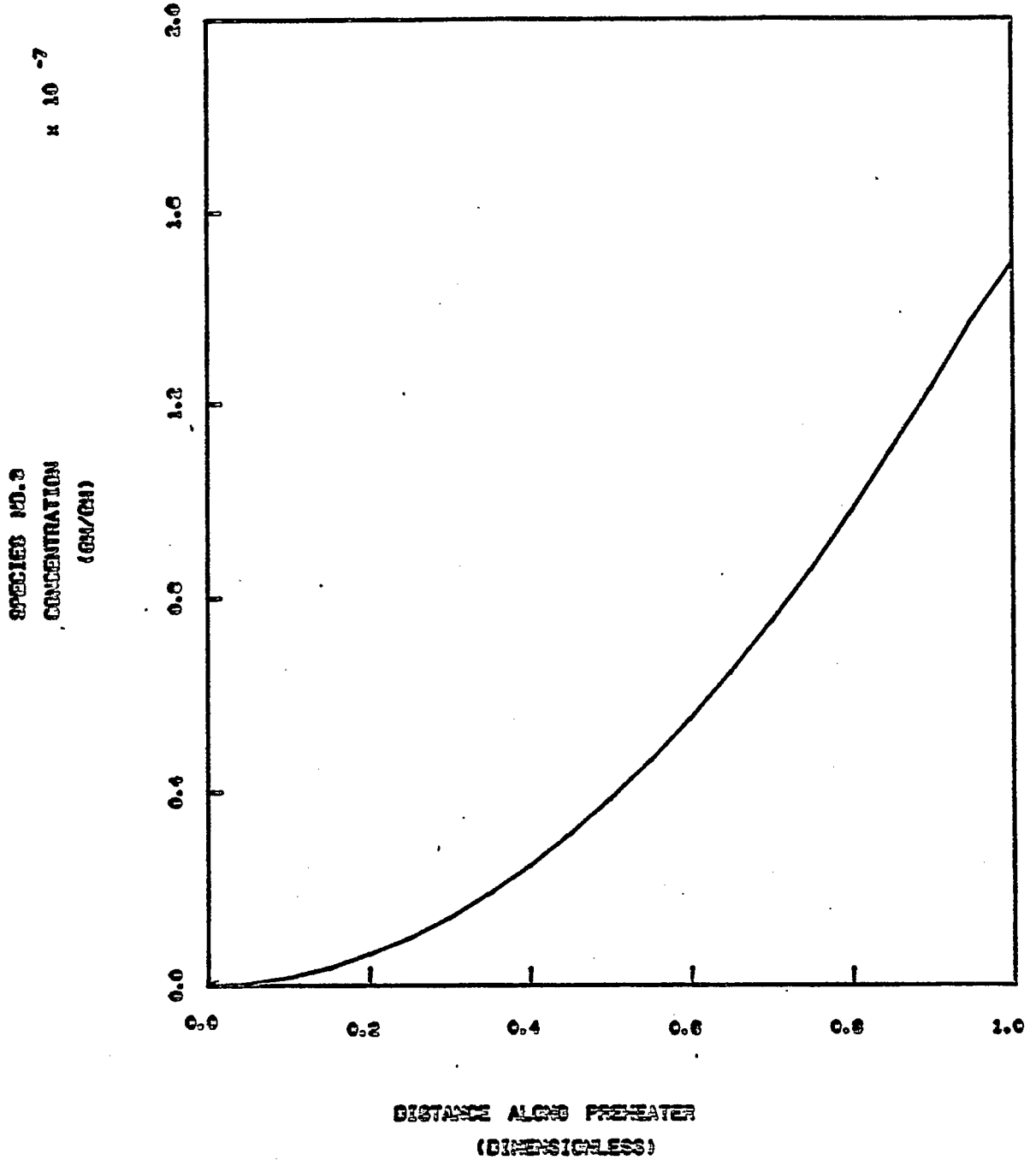
PREHEATER HYDROGEN PROFILE
(GAS PHASE)



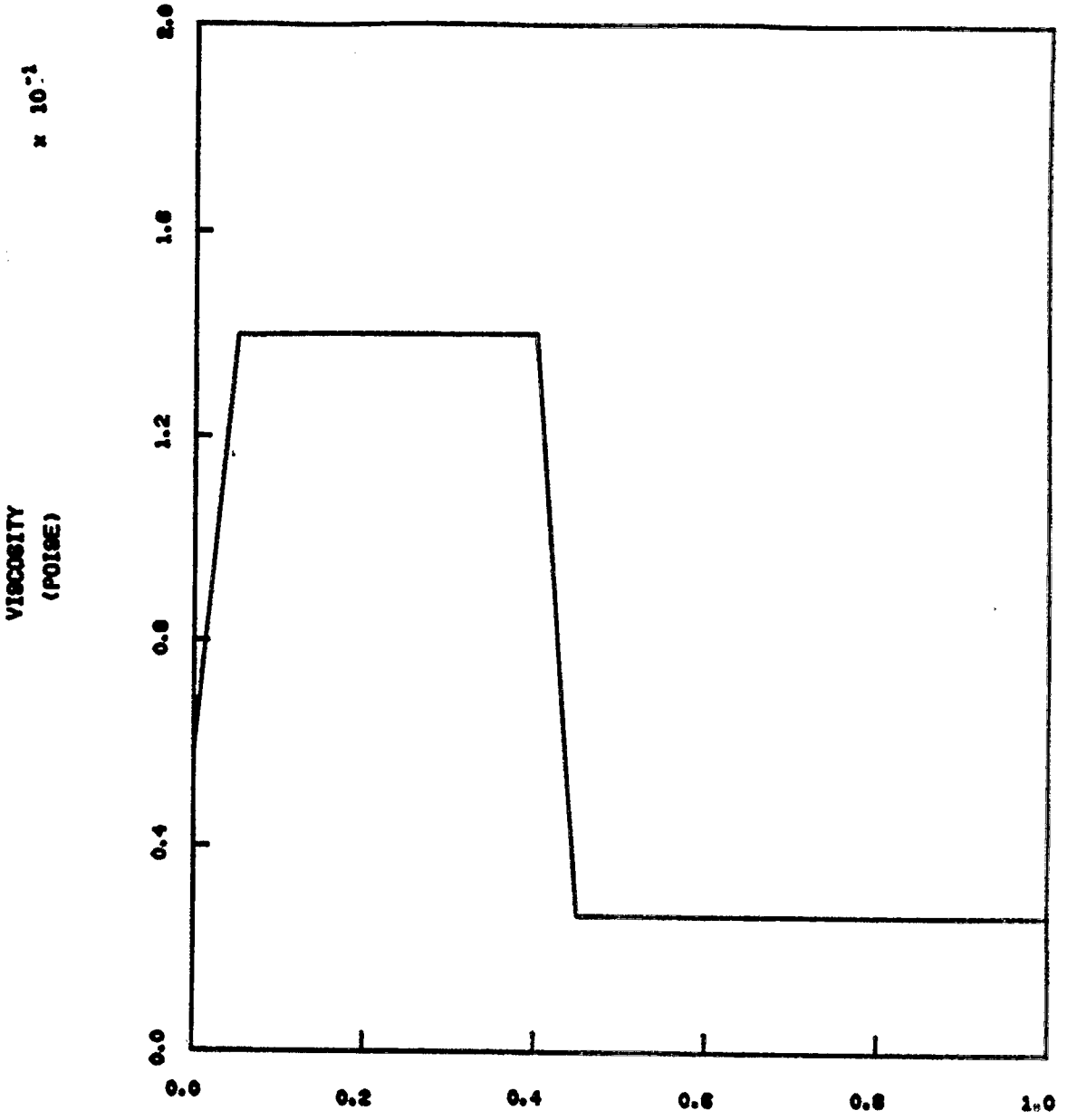
PREHEATER HYDROGEN PROFILE
(LIQUID PHASE)



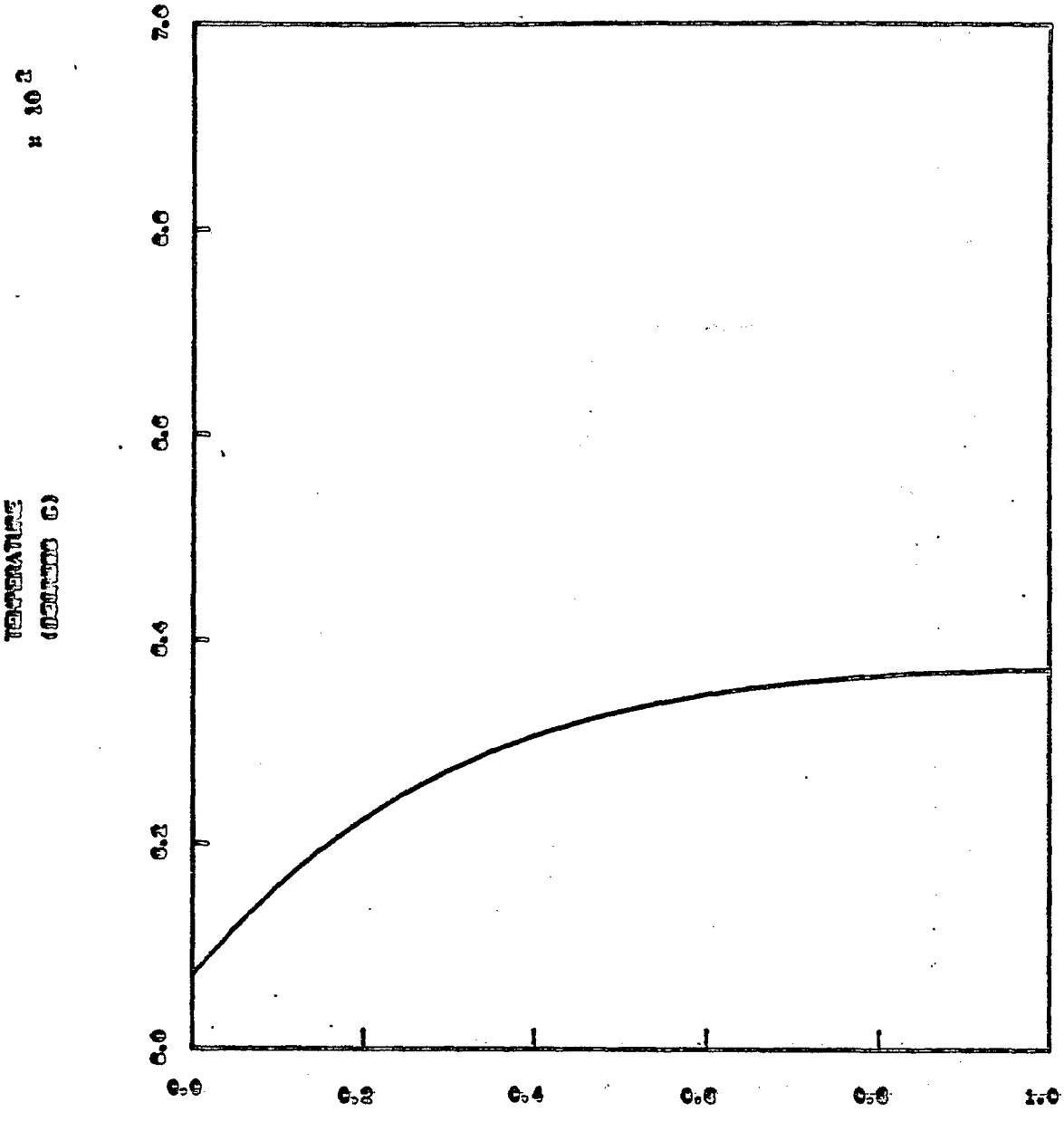
PREHEATER CONCENTRATION PROFILE



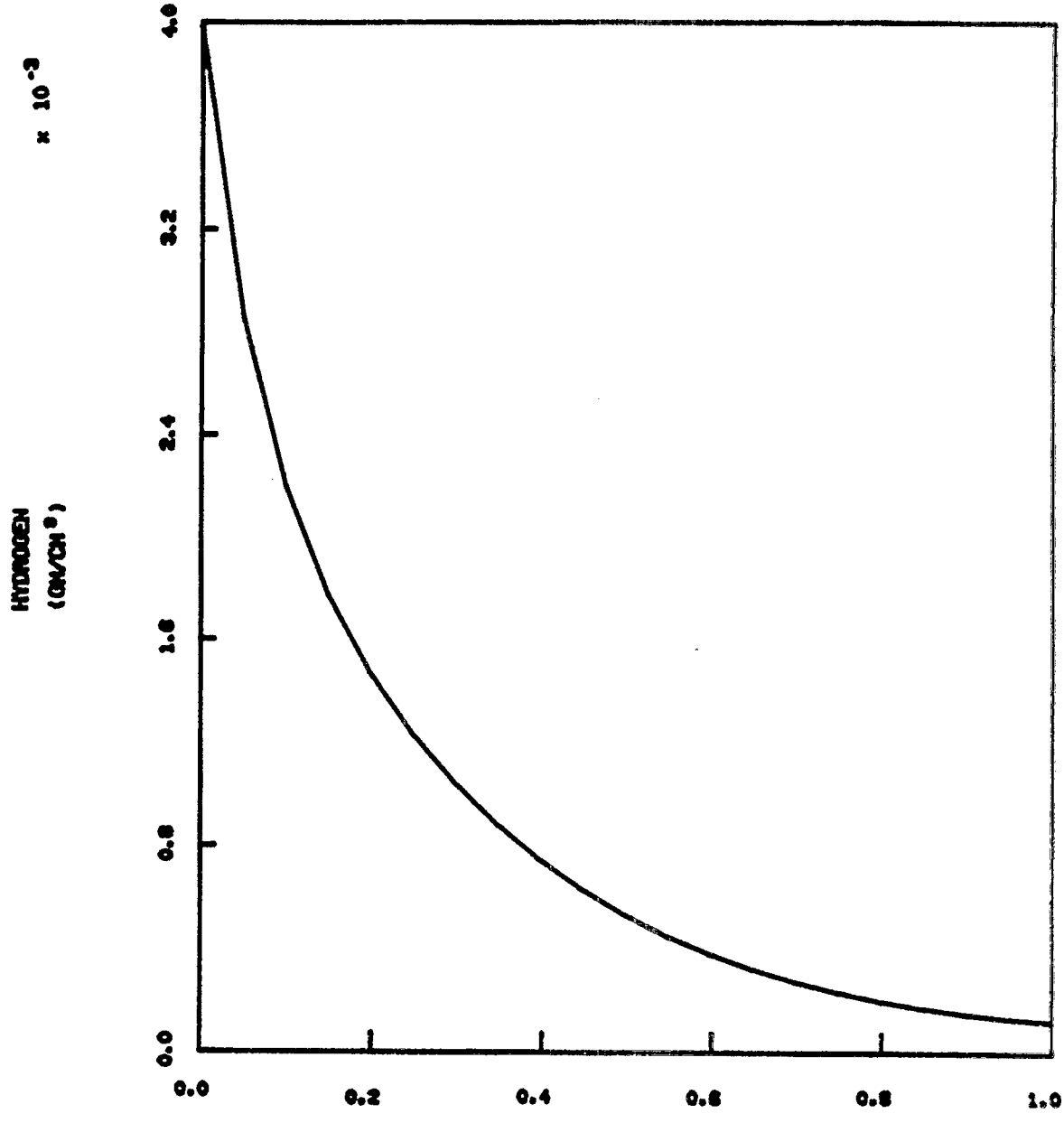
PREHEATER CONCENTRATION PROFILE



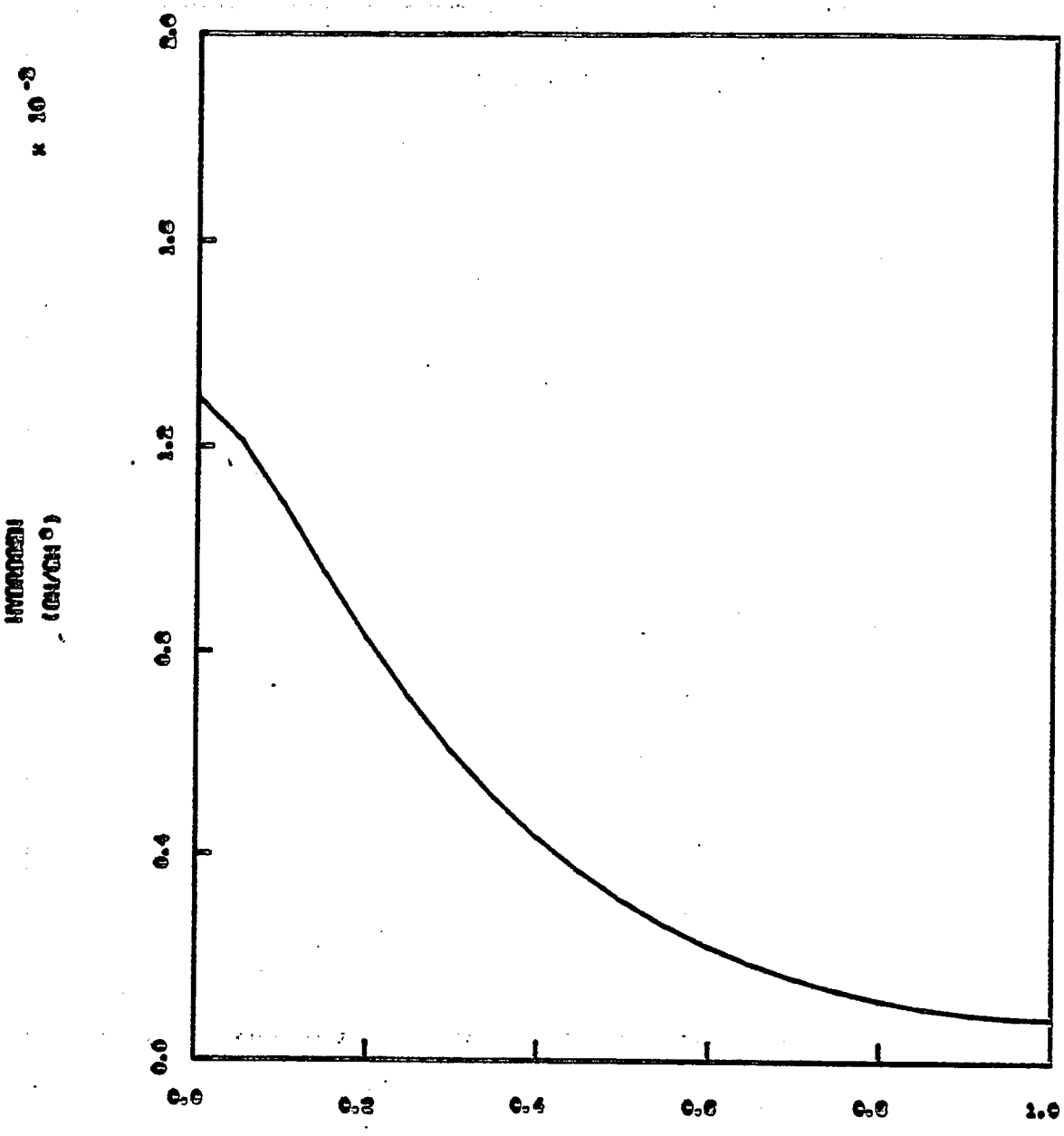
PREHEATER VISCOSITY PROFILE



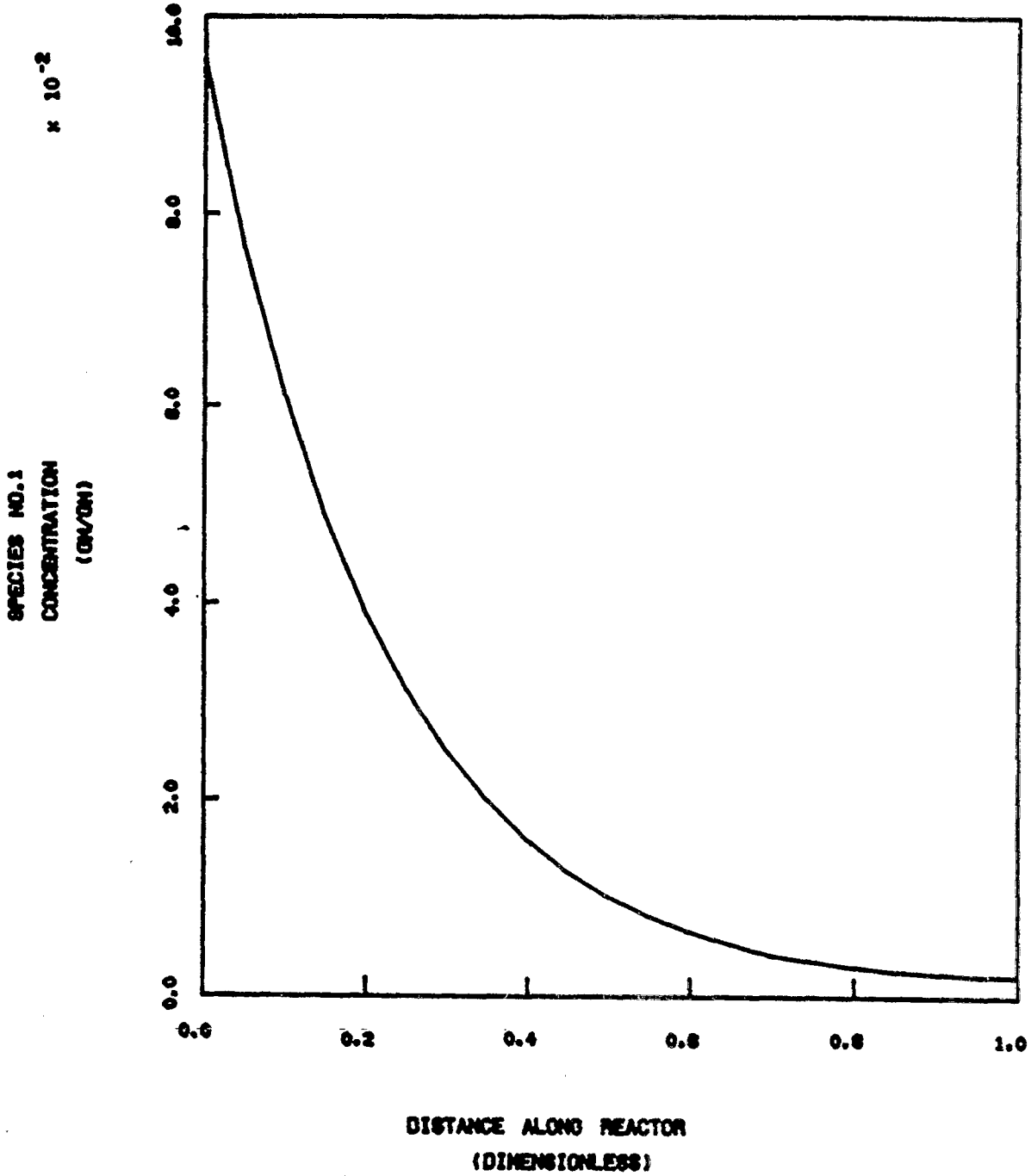
REACTOR TEMPERATURE PROFILE



REACTOR HYDROGEN PROFILE
(GAS PHASE)



REACTOR HYDROGEN PROFILE
(LIQUID PHASE)



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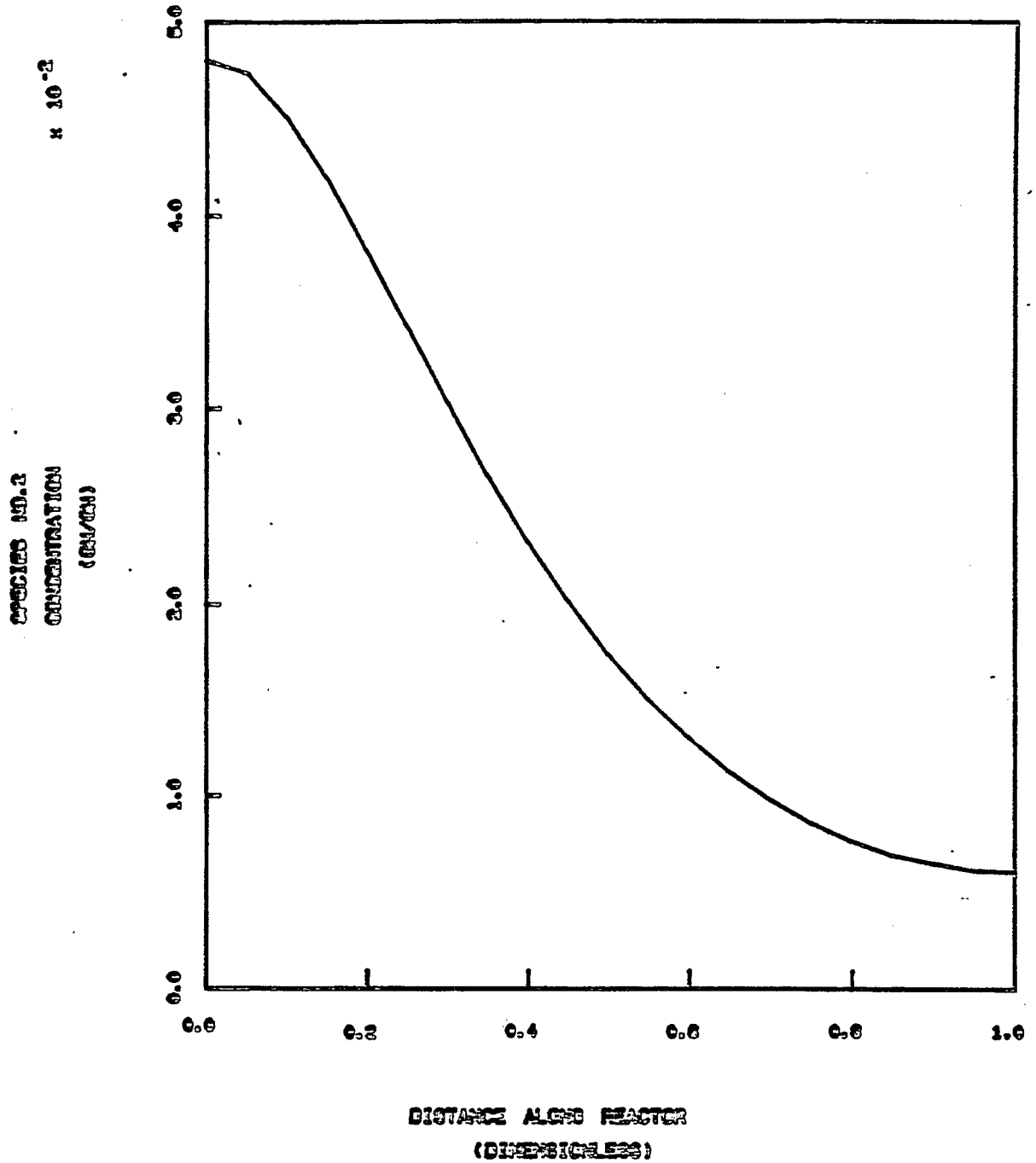
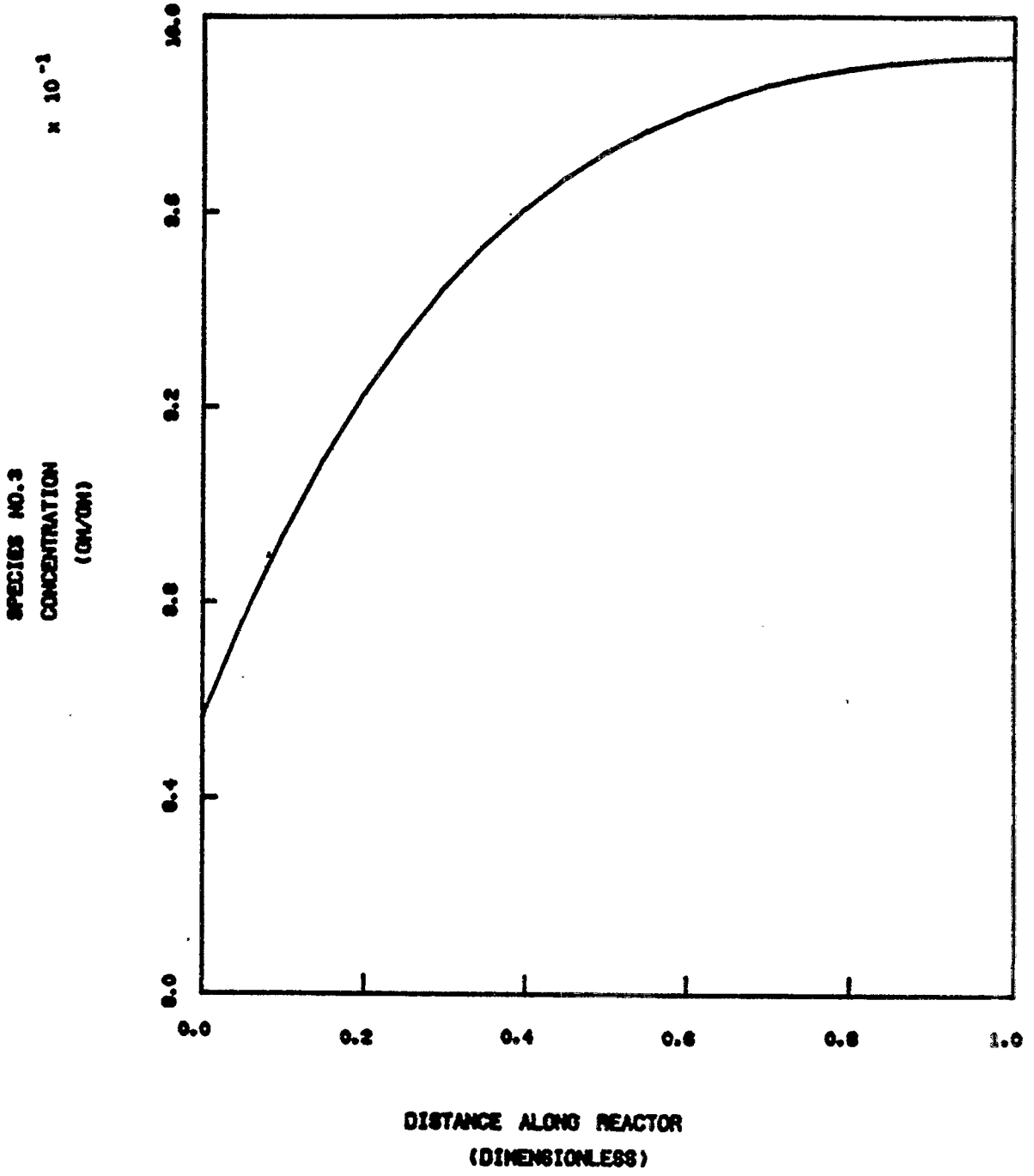


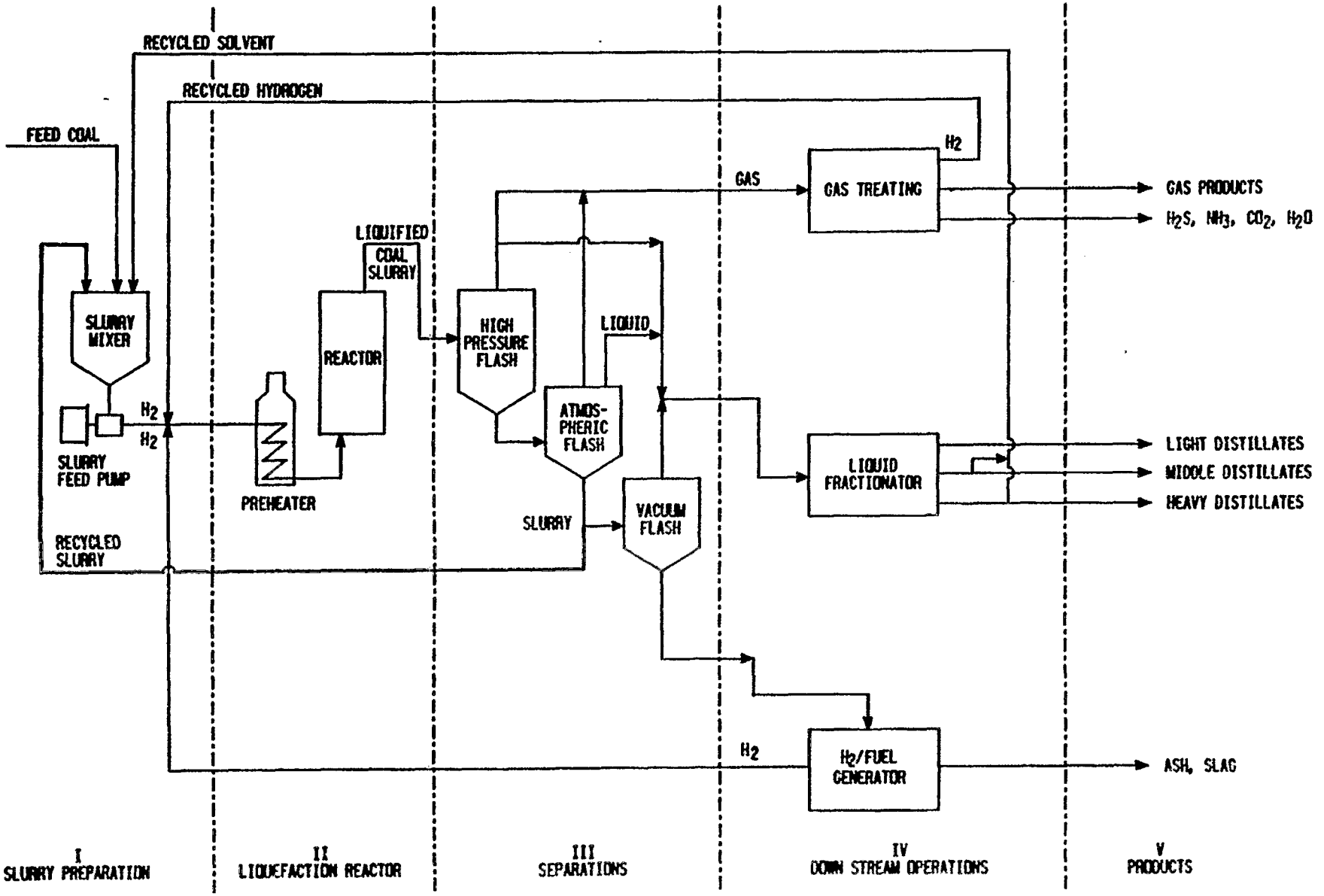
REACTOR CONCENTRATION PROFILE



REACTOR CONCENTRATION PROFILE

PROCESS FLOWSHEET AND GRAPHICAL REPORT

SRC-II PROCESS



COMPREHENSIVE GRAPHICAL-REPORT

DATE: 5/07/84

	CAPITAL COST ($)	OPERATING COST ($/YR)	MAINTENENCE COST ($/YR)	FIXED COST ($/YR)	VARIABLE COST ($/YR)
Reactor	0.6361D+08	0.1738D+07	0.1738D+07	0.9541D+06	0.7812D+06
Preheater	0.6699D+08	0.4368D+09	0.1831D+07	0.1005D+07	0.4359D+09
Total	0.1306D+09	0.4385D+09	0.3569D+07	0.1959D+07	0.4366D+09

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Technology Administration
National Technical Information Service
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