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	PAGE 1 OF 20	
AUTHOR: W. R. Lahs — DEPT. & GROUP NO.: 726-60	DATE 2-7-64	
	GO NO. 7561	RSHart
TITLE: Long Term SNAP 10A Reactor Operation Analysis	S/A NO. 1100	TWR

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PROGRAM: SNAP 10A

SUBACCOUNT TITLE: System Safety

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STATEMENT OF PROBLEM

Investigation of the long term SNAP 10A reactor operating history, considering the long term reactivity effects and the feedback to reactor power caused by the heat transfer characteristics of the system.

ABSTRACT:

This report presents the description and results of the long term reactor operation code used to solve the above problem. The code represents the heat transfer and fluid flow in a five node reactor representation coupled with a radiator heat transfer equation and a reactivity relationship. The model is solved at discrete points in time based on the assumption that for the operating histories considered, time dependent terms involving changes in heat capacities can be neglected without significant error. The code does not solve for any power or temperature transients but instead calculates reactor temperatures and powers under conditions of relatively slow coolant flow and/or radiator emissivity coating degradations. A 0.1 year time increment is generally used between calculation points; however, a 0.01 year increment is sometimes used to eliminate convergence problems. Assuming the SNAP 10A system with time dependent NaK flow and emissivity coating degradation as input data, the resulting reactor inlet and outlet coolant temperatures and the reactor power are presented as a function of time.

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PURPOSE

The study was initiated to determine the long term SNAP 10A reactor power operation and associated reactor coolant outlet temperature primarily under conditions of degrading NaK flow. The power operation could subsequently be translated into the time dependent fission product inventory used as a starting point for hazard analysis. Coolant outlet temperature would be of value in determining the effectiveness of the temperature actuated band release device as a reflector ejection initiating mechanism or, for that matter, any other safety systems which depend on the magnitude or variation in outlet temperature.

PROCEDURE AND ASSUMPTIONS

The reactor model incorporated in the code is a simplified version of that presented in Reference 1 with the exception that terms involving time derivatives of temperature were neglected. One equation representing heat balance through the radiator served as a relation between reactor outlet and inlet temperatures. Transport time delays, heat capacity changes, etc., were not necessary for the cases studied and, in fact, contribute insignificantly to the resulting steady state values.

The reactivity equation used is essentially a reactivity balance of all the incorporated separate contributions:

a) grid plate temperature change

b) average fuel temperature change

c) losses from fission product production and uranium burnup

d) equilibrium xenon changes

e) hydrogen leakage

f) hydrogen redistribution

g) samarium burnout

Relationships for (f) and (g) were derived from data obtained from Reference 2. Existing relationships were used for the other reactivity contributions. These were also generally supplied by Reference 2.

Coupling the relationships above at a particular time, the procedure of solution is one of minimized brute force. An educated guess is made for the reactor coolant inlet temperature. Based on the NaK coolant flow at the time under study, the heat balance equation through the radiator yields a coolant outlet temperature. Assuming all the reactor power is transferred through the coolant (not a bad assumption for the cases under study, but one which is being eliminated by intended code modifications), reactor power and all the nodal reactor fuel and coolant temperatures are computed. A reactivity balance is then attempted based on these results. Unless the balance falls between set tolerances (usually $-0.1¢ \leq R \leq 0.1¢$), the coolant inlet temperature estimate is revised accordingly. Rapid convergence has resulted (less than 5 guesses) for all the cases studied thusfar. The code then advances to the next time point repeating the same procedure after accumulating irreversible reactivity changes-hydrogen leakage, fission product buildup, uranium burnup, and samarium burnout.

DESCRIPTION OF MODEL

Figure 1 shows a schematic of the reactor model. The power transferred to the coolant from the fuel is represented by the following equations (See table of nomenclature):

$$P_i \frac{n(t)}{no} = \frac{U_f A_f}{5} (T_{fi} - \overline{T}_i) \qquad i = 1, 2 \cdots, 5$$

where i refers to a particular node.

Heat transferred out of the node by the coolant is represented by

$$\frac{U_f A_f}{5} (T_{fi} - \overline{T}_i) = W(t)Wo\ Cc\ (T_{i+1} - T_i) \qquad i = 1, 2, \cdots 5$$

The heat balance across the radiator is determined as follows:

Assume a small length of radiator dl. Heat lost by the coolant in passing through dl is radiated to space. No conduction or change in heat capacities is assumed significant. Then:

$$-W(t)Wo\ Cc\ dT = K(l)\ \epsilon(t)\ (T^4 - T_s^4)\ dl$$

or since $T \gg T_s$

$$-W(t)Wo\ Cc\ dT \cong K(l)\ \epsilon(t)\ (T^4)\ dl$$

where:

T = radiator temperature

T_s = space temperature

$\epsilon(t)$ = radiator emissivity at time (t)/ emissivity at t = 0

TABLE OF NOMENCLATURE

Page 3

P_i	fraction of full power produced in node i
$\frac{n(t)}{n_o}$	total power at time t/total power at time t = 0
$U_f A_f$	total heat transfer coefficient
T_{f_i}	fuel temperature of node i
$\overline{T}_i$	average coolant temperature of node i
W(t)	fraction of full flow at time t
Wo	coolant flow #/sec
C_c	specific heat $\frac{\text{Kw-sec}}{\# \, °F}$
T_i	internode temperatures (see Figure 1)
K(l)	an unknown function of radiator length
$\epsilon(t)$	emissivity at time (t)/emissivity at t = 0

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$T_{1\,int}$	initial reactor coolant inlet temperature
$T_{6\,int}$	initial reactor coolant outlet temperature

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$\overline{T}_f$	average of the five node fuel temperatures at time t

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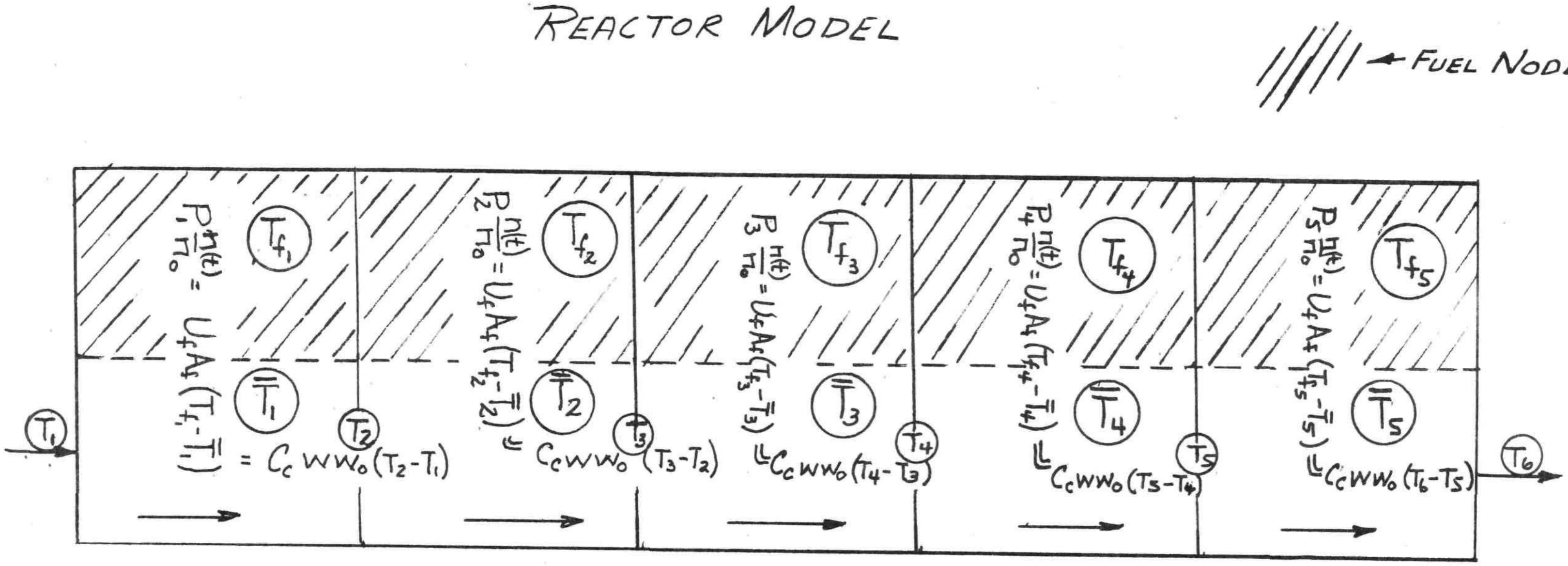
$\bar{T}_{f\,int}$	average of the five node fuel temperatures at time t = 0
α_f	fuel temperature coefficient
α_{gu}	upper grid plate coefficient
α_{gl}	lower grid plate coefficient
$\frac{n_j}{n_o}$	power during time increment Δt_j/power at time t = 0
Δt_j	time increment
K_2, K_3, K_4, K_5, K_6	constants
$T_{f_{ij}}$	fuel temperature of node i during time increment Δt_j
ΔT_c	coolant temperature difference across core during time increment Δt_j
$\Delta T_{c\,int}$	coolant temperature difference across core at time t = 0 (111°F)

FIG 1

REACTOR MODEL



T_{f_i} Nodal fuel temperature

$\bar{T}_i$ Average nodal coolant temperature

T_i Boundary nodal coolant temperature

Using the axial power distribution equation of reference 1 $\frac{P}{P_{max}} = \cos \frac{\pi Z}{35.5}$ Z = distance from center.

$P_1 = 0.11\, P_T$
$P_2 = 0.24\, P_T$
$P_3 = 0.30\, P_T$
$P_4 = 0.24\, P_T$
$P_5 = 0.11\, P_T$

$P_T = 33.5$ kw

$\frac{n(t)}{n_0}$ = power fraction at time t

$U_f A_f$ = total heat transfer coefficient (ref. 3) kw/°F

C_c = specific heat $\frac{\text{Kw-sec}}{\# \,°F}$

W = fraction of full flow at time (t)

W_0 = flow #/sec

Separation of variables yields

$$\frac{-dT}{T^4} = K(l) \frac{\epsilon(t)}{W(t)} \frac{dl}{WoCc}$$

Integrating between a reactor outlet temperature T_6 and inlet temperature T_1

$$\int_{T_1}^{T_6} \frac{dT}{T^4} = \frac{\epsilon(t)}{W(t)Cc} \int_o^l \frac{K(l)}{Wo} dl$$

where the minus sign has been eliminated by changing the limits of integration.

Therefore,

$$\frac{-1}{3\,T^3} \Bigg|_{T_1}^{T_6} = \frac{\epsilon(t)}{W(t)Cc} \int_o^l \frac{K(l)}{Wo} dl$$

or

$$\frac{1}{T_1^{\,3}} - \frac{1}{T_6^{\,3}} = \frac{3\epsilon(t)}{W(t)Cc} \int_o^l \frac{K(l)}{Wo} dl$$

But values for T_1 and T_6 are known when initial equilibrium is reached ($\epsilon(t) = 1$; $W(t) = 1$) subsequent to reactor startup. Therefore, the right side of the equation for all inlet and outlet conditions is:

$$\frac{1}{T_1^{\,3}} - \frac{1}{T_6^{\,3}} = \frac{\epsilon(t)}{W(t)} \left(\frac{1}{T_{1int}^{\;3}} - \frac{1}{T_{6int}^{\;3}} \right)$$

The limitations of the model are fairly obvious:

(1) Heat transferred into a radiator node is by fluid flow only. Therefore, as other means of heat transfer (conduction) become of comparable magnitude, the model breaks down.

(2) The radiator node temperature is assumed much greater than space temperature.

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The final relationship in the long term reactor operation model sets equal to zero the sum of all changes in reactivity from initial conditions at full power subsequent to startup. These changes include the following contributions and their source.

(a) $\int_{T_{fint}}^{\bar{T}_f} \alpha_f \, dT$ — average fuel temperature change

(b) $\alpha_{gu} (T_6 - T_{6int})$ — upper grid plate temperature change

(c) $\alpha_{gl} (T_1 - T_{1int})$ — lower grid plate temperature change

(d) $K_2 \sum_{j=1}^{m} \frac{n_j}{n_o} \Delta t_j$ — cumulative effect of fission product poisoning and uranium burnup

(e) $K_3 \left(1 - \frac{n_j}{n_o}\right)$ — change in equilibrium xenon

(f) $K_4 \sum_{i=1}^{5} \sum_{j=1}^{m} 2^{\frac{T_{f_{ij}} - 950}{50}} \Delta t_j$ — cumulative effect of hydrogen leakage

(g) $K_5 \left(\frac{\Delta T_c - \Delta T_{cint}}{100}\right)^{1.54}$ — hydrogen redistribution

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(h) $$\sum_{j=1}^{m} (K_6 - AI_j)(1 - e^{-0.348 \frac{n_j}{n_o} \Delta t_j})$$

where $$AI_j = \sum_{j=1}^{m-1} (K_6 - AI_{j-1})(1 - e^{-0.348 \frac{n_j}{n_o} \Delta t_j})$$

and $AI_1 = 0$ samarium burnout

Term (a) is the reactivity input resulting from changes in average fuel temperature. $\overline{T}_{fint}$ for the SNAP 10A system is 982.7°F. The fuel temperature coefficient, α_f, was determined by the following equation:

$$\alpha_f = - \left[0.074 + \frac{0.066\ T}{1000} \right] ¢/°F$$

Term (b) used values of -0.06 ¢/°F and 1010°F for αgu and T_{6int} respectively. Likewise term (c) used a value of -0.04 ¢/°F for αgl and 899°F for T_{lint}. The constant, K_2, in term (d) was based on an estimated loss of 6¢/yr under conditions of constant reactor power (33.5 Kwt). The

$$\sum_{j=1}^{m} \frac{n_j}{n_o} \Delta t_j$$

(where m is such that $\sum_{j=1}^{m} \Delta t_j$ equals the time point of interest)

represents the sum of the products of the normalized power fraction multiplied by the time increment Δt_j.

The xenon equilibrium change from cold critical to full power (33.5 Kwt) contributes a 14¢ loss in reactivity. Therefore, reactivity changes from equilibrium at full power can be represented by term (e), setting K_3 equal to +14¢.

The rate of hydrogen leakage as a function of fuel temperature was approximated from the function presented in Figure 2 (Reference 3). This function was normalized to yield a leakage rate of 3 ¢/yr if the initial fuel temperature profile was maintained for one year. With this criteria K_4 was determined as 1.62 ¢/yr.

Term (g) was originally a very crude approximation for reactivity loss due to hydrogen redistribution. The -14.86¢ portion of this term was deduced from redistribution reactivity losses during startup; namely, from cold critical to equilibrium conditions at full power (coolant ΔT across core ~100°F - 950°F average coolant temperature). The only other data on hydrogen redistribution which existed at this time was for other ΔTs (200°, 300°, and 400°) for the same average coolant temperature and power. The first portion of term (g) is essentially a function derived from these four data points (K_5 = 4.18¢). This function was believed at first to be an underestimate of the negative reactivity contribution from hydrogen redistribution as the average coolant temperature declined from 950°F. However, the more recent data of Table 1 indicated that the underestimate resulting from lower average coolant temperature was counterbalanced. This counterbalance was due to the fact that the data points used were for constant power of 33.5 Kw. In reality a reduction of power would cause an overestimate of the negative reactivity contribution of hydrogen redistribution. Thus, a happy ending. One final point about this term should be mentioned. As average fuel temperature decreases, approaching 700-800°F, the time for the hydrogen redistribution to take place becomes equal in magnitude to the time increment (0.1 yr). Thus, below 800°F the negative hydrogen redistribution effect is, indeed, an overestimate.

Table 2

Negative Hydrogen Redistribution Reactivities (¢)

	Power (Kwt) \ Coolant Inlet (°F)	800	900	1000	1100	1200	1300
ΔT=100°F	32.5	17.34	14.86	12.88	11.27	9.94	8.84
	50.0	25.22	21.71	18.88	16.57	14.66	13.07
	100.0	46.33	40.12	35.08	30.94	27.49	24.59
ΔT=200°F	32.5	21.12	17.87	15.31	13.26	11.60	10.23
	50.0	28.39	24.22	20.91	18.23	16.04	14.22
	100.0	47.88	41.33	36.05	31.72	28.13	25.12
ΔT=300°F	32.5	27.04	22.64	19.22	16.50	14.31	12.53
	50.0	33.72	28.52	24.43	21.15	18.49	16.29
	100.0	51.68	44.39	38.54	33.78	29.15	26.57

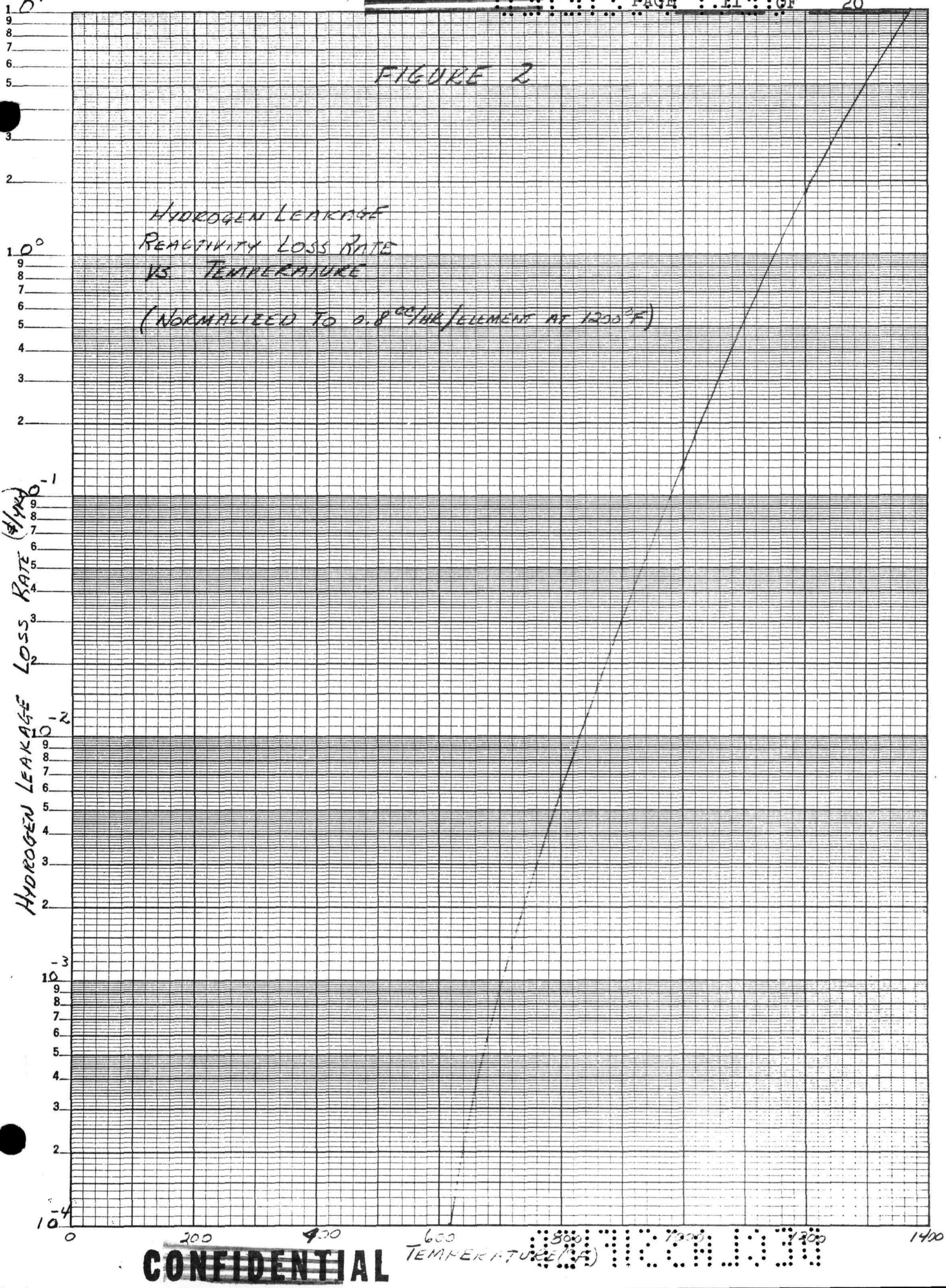
FIGURE 2
HYDROGEN LEAKAGE
REACTIVITY LOSS RATE
VS TEMPERATURE
(NORMALIZED TO 0.8 cc/HR/ELEMENT AT 1200°F)
HYDROGEN LEAKAGE LOSS RATE (¢/YR)
TEMPERATURE (°F)
0
200
400
600
800
1000
1200
1400

Term (h) represents the positive reactivity resulting from samarium burnout. The initial excess samarium poisoning over equilibrium samarium was evaluated as 44.5¢. K_6 was set equal to 44.5¢ and term (h) then represents the cumulative reactivity input as a function of time and power.

RESULTS

Examination of Reference 4 revealed a minimum flow degradation to date of 0.3 gpm/1000 hours. Reference 5 recommended a 10% emissivity coating degradation over a 5 year period. Using these conditions as input data, Figure 3 (solid lines) shows the coolant inlet and outlet temperature, average fuel temperature, and the reactor power fraction as a function of time. The early drop in temperature and power results from initial hydrogen redistribution. The following gentle increase is caused by samarium burnout. Figure 4 shows the reactivity contributions from hydrogen leakage, hydrogen redistribution, and samarium burnout as a function of time.

Since average fuel element temperature drops below 800°F at 4.53 years, the reactivity effect from hydrogen redistribution after this time is probably overestimated and, thus, the coolant temperatures are too low. In order to obtain an upper limit for coolant outlet temperature (from a lower limit on hydrogen redistribution negative reactivity loss), a second case was programmed which considered no reactivity loss from hydrogen redistribution following the initial 14.86¢. The results are also shown on Figures 3 and 4 as dotted lines. An increasing difference in outlet coolant temperature with time should be noted. This fact is readily reconciled when one notes the rapid change in negative reactivity input from hydrogen redistribution between the two cases. The resulting higher average fuel temperatures increases hydrogen leakage while samarium burnout is almost unchanged.

A compilation of the code for the first case discussed is included as Appendix A.

CONCLUSIONS

The conclusion reached from this preliminary study is illustrated by Figure 3; namely, that slow coolant flow degradation does not seem to result in the high coolant outlet temperatures previously expected to cause expansion compensator failure or fuel element rupture. Although a complete transition to a NaK stagnation mode (no flow) was not possible with this simplified model, the important effect of hydrogen redistribution is indicated. Further, the heat transfer effects neglected (i.e., conduction) will, at low flow, generally further inhibit rapid increases in outlet temperature. It should be noted that work in progress may demonstrate the transition of interest.

Finally, as estimates of pump failure mode become more sophisticated, the most probable fission product inventory will be exactly determined.

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Obviously, the inventory from full power operation for 10 years expediently used in the Final Safeguards Report - SNAP 10A Flight Tests (NAA-SR-7774) seems very conservative from a safety viewpoint.

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1. P. Pekrul — SNAP 10A Total System Simulation AI Memo 6721 (S), October 3, 1961

2. K. Birney — Personal Communication with Author

3. S. R. Fields — SNAP 10A Reactor Temperatures and Power Decay in Space for Zero NaK Flow and Loss of NaK NAA-SR-MEMO-7877 (S), October 11, 1962

4. B. Katz, L. Lepisto — SNAP 10A Thermoelectric Pump Data Analysis for Pumps Dev. #8, FD-1, FS-1, FSM-1, FQ-1, and FQ-2 (C), September 9, 1963

5. J. Brunings — Personal Communication with Author

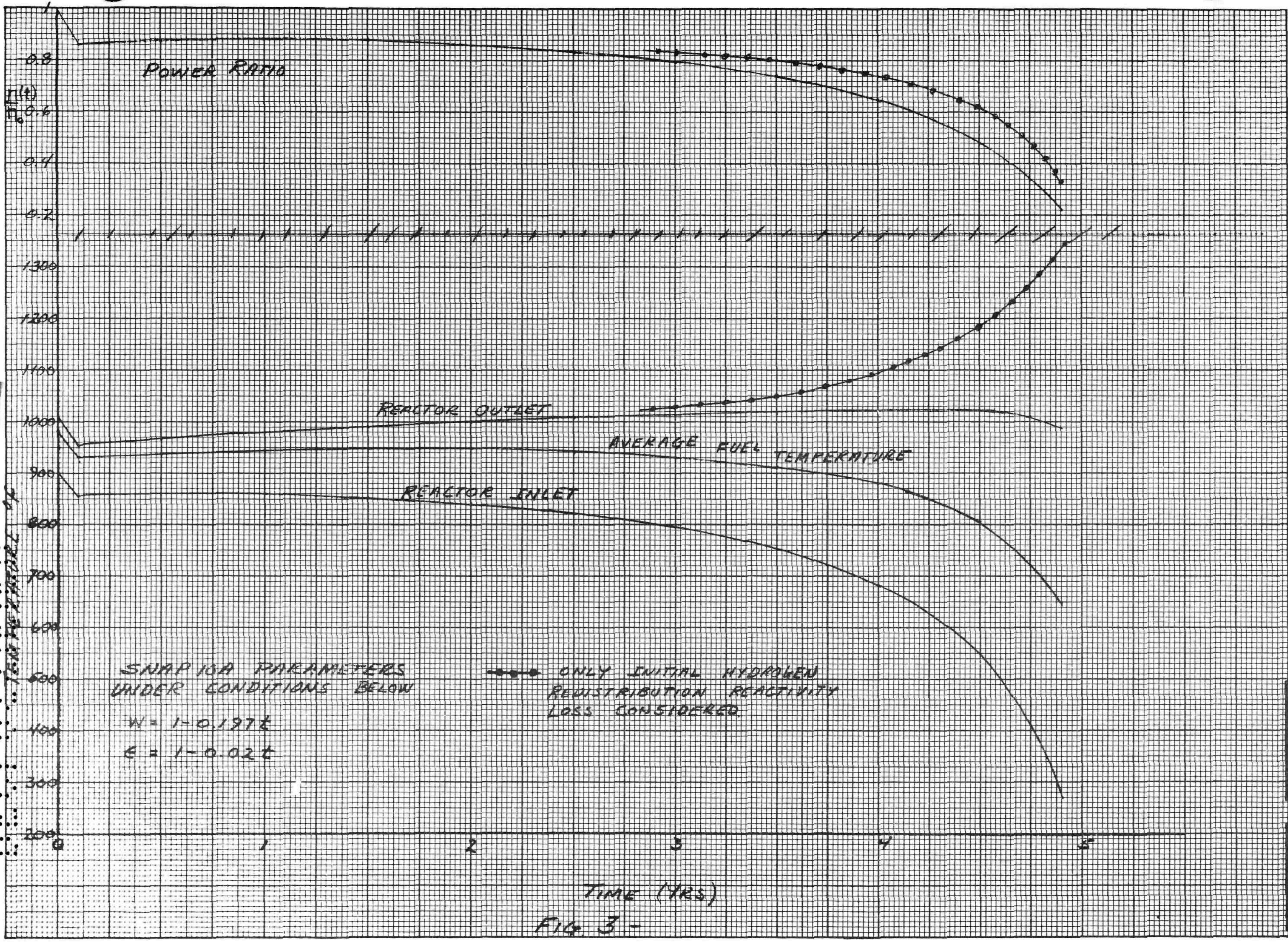

FIG 3 -

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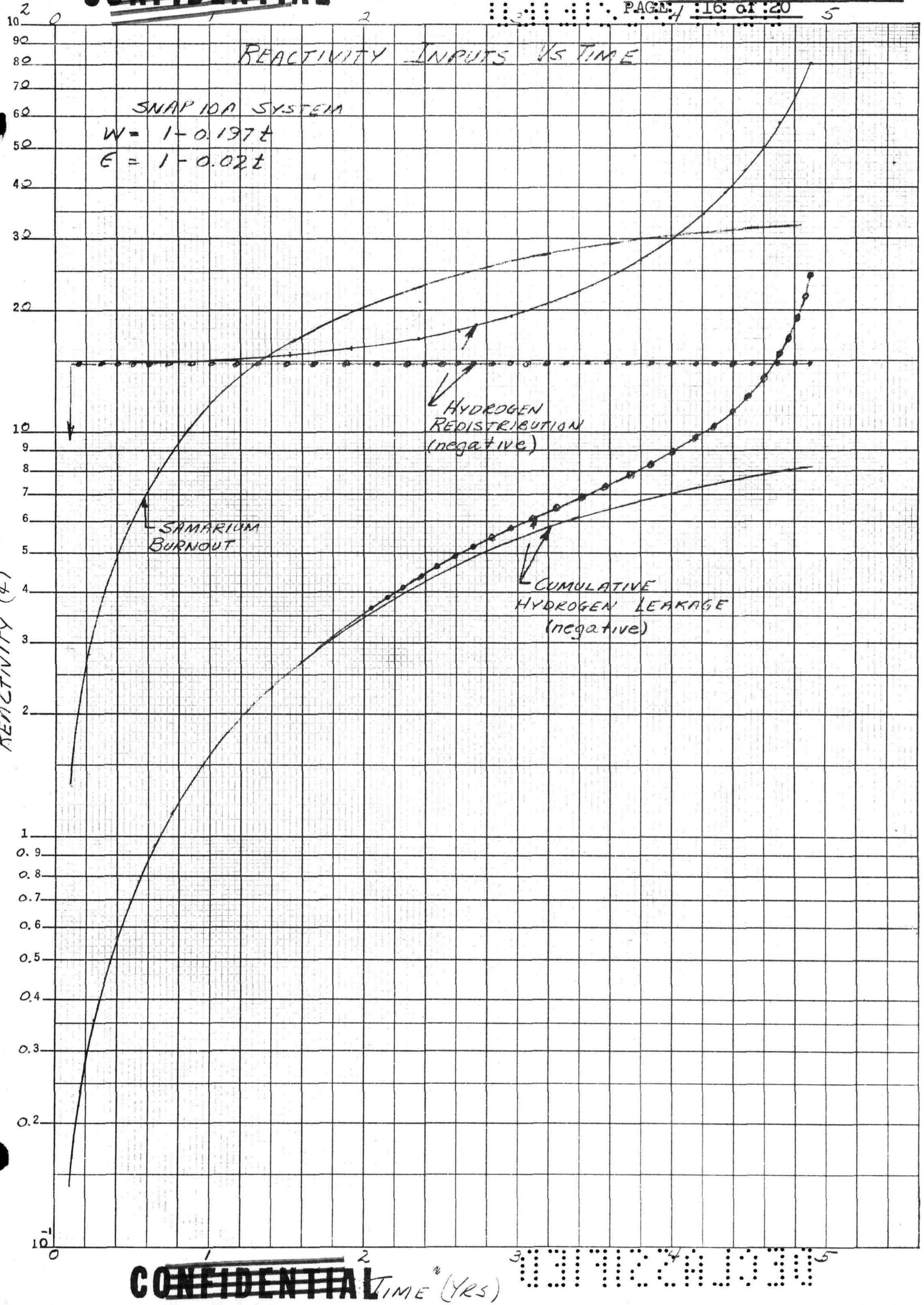
FIGURE 4


REACTIVITY INPUTS VS TIME
SNAP 10A SYSTEM
W = 1-0.197t
ε = 1-0.02t
HYDROGEN
REDISTRIBUTION
(negative)
SAMARIUM
BURNOUT
CUMULATIVE
HYDROGEN LEAKAGE
(negative)
REACTIVITY (¢)
TIME (YRS)

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```
C     LONG TERM REACTOR OPERATION                                      00000002
      DIMENSION T(6),TBAR(5),P(5),A(5),TF(5),COE6(6),TITLE(12)         00000003
      COMMON PT,TIN,TOUT,WO,DELTIM,TMAX,A,COE6                         00000004
      CALL READ                                                        00000008
  500 READ INPUT TAPE 5,1,TITLE                                        00000009
    1 FORMAT(12A6)                                                     00000010
      CALL READ                                                        00000011
      SUMENI=DELTIM                                                    00000012
      CAY4=.324*DELTIM                                                 00000013
      GUESS=50.                                                        00000015
      TIME=DELTIM                                                      00000016
      DEL=0.                                                           00000017
      WRITE OUTPUT TAPE 6,2,TITLE                                      00000018
    2 FORMAT(1H1 12A6)                                                 00000019
      TOL=.1                                                           00000021
      TMAX=TMAX+.01                                                    00000022
      T1P=TIN                                                          00000023
      C2= (TIN+460.)**(-3)-(TOUT+460.)**(-3)                           00000040
      DELTCI=TOUT-TIN                                                  00000050
      DO 420 I=1,5                                                     00000052
  420 P(I)=A(I)*PT                                                     00000054
      TFBARI=982.7                                                     00000990
      TOI=TOUT                                                         00000991
      T1I=TIN                                                          00000992
      N4=1                                                             00000995
      LL=0                                                             00000996
      T(1)=TIN                                                         00000997
      SUMAI=0.                                                         00000998
      DELTI=.348*DELTIM                                                00000999
      SUMI=0.                                                          00010100
  104 T(1)=T(1)-GUESS                                                  00001000
      W= 1.-.197*TIME                                                  00001001
      E= 1.-.02*TIME                                                   00001002
      CI=44.5-SUMAI                                                    00001003
      L=1                                                              00001005
      DO 105 KKK=1,30                                                  00001005
   79 TRANK=T(1)+460.                                                  00001006
      RAD=1.-C2*E/W*TRANK**3                                           00001007
      IF (RAD) 80,80,84                                                00001008
```

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```
 80 T(1)=(.992*W/(C2*E))**.3333-460.                                        00001009
    IF (ITRY) 81,81,82                                                      00001010
 81 ITRY=1                                                                  00001011
    GO TO 79                                                                00001012
 82 WRITE OUTPUT TAPE 6,83,KKK,T(1),TP,DELP,TM,DELM                         00001013
 83 FORMAT(41H-CONVERGENCE OF T(1) WAS NOT ACCOMPLISHED/I4,1P5E15.5)        00001014
    CALL DUMP                                                               00001016
    GO TO 500                                                               00001015
 84 T(6)=TRANK/RAD**.3333-460.                                              00001016
    TGAP=(T(1)+T(6))/2.+26.                                                 00001017
    DELI=DEL                                                                00001018
    DELTC=T(6)-T(1)                                                         00001020
    EN=W*DELTC/DELTCI                                                       00001030
    CON=PT*EN/2.                                                            00010404
    C1=EN/(.211*W*W0)                                                       00010105
    DO 100 I=1,4                                                            00010110
    T(I+1)=P(I)*C1+T(I)                                                     00010130
100 TBAR(I)=(T(I)+T(I+1))/2.                                                00010140
    TBAR(5)=(T(5)+T(6))/2.                                                  00010150
    TCBA =0.                                                                00010160
    DO 110 I=1,5                                                            00010180
110 TCBA =TCBA +TBAR(I)                                                     00010190
    TCBAR=TCBA /5.                                                          00010210
    TFBAR=(T(1)+T(6))/2.+26.                                                00010400
    TGAP=(TFBAR+TCBAR)/2.                                                   00010402
    DO 130 N=1,20                                                           00010406
    UFAF=  (((( COE6(6)*TGAP+COE6(5))*TGAP+COE6(4))*TGAP+COE6(3))*TGAP00010410
   1+COE6(2))*TGAP+COE6(1)                                                  00010420
    TGAP1=CON/UFAF+TCBAR                                                    00010422
    IF (ABSF(TGAP1-TGAP)-1.) 131,131,130                                    00010426
130 TGAP=(TGAP+TGAP1)/2.                                                    00010430
131 TFBA=0                                                                  00010432
    CONST=5.*EN/UFAF                                                        00010440
    SUM=0                                                                   00010442
    DO 120 I=1,5                                                            00010450
    TF(I)= P(I)*CONST+TBAR(I)                                               00010460
    SUM=SUM+2.**((TF(I)-950.)/50.)                                          00010462
120 TFBA =TFBA +TF(I)                                                       00010470
    PAR=(DELTC-DELTCI)/100.                                                 00010472
```

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```
      Q=ABSF(PAR)/PAR                                                  00010473
  134 SUMJ=SUM                                                         00010478
      TFBAR=TFBA /5.                                                   00010480
      DBLSUM=SUMI+SUMJ                                                 00010500
      ALPHA6=-.074-6.6E-5*(TFBAR+TFBARI)/2.                            00010510
      CAY5=CAY4*DBLSUM                                                 00010515
      AI=CI*(1.-EXPF(-EN*DELTI))                                       00010516
      SUMMAI=SUMAI+AI                                                  00010517
      DEL=ALPHA6*(TFBAR-TFBARI)-.06*(T(6)-TOI)-.04*(T(1)-T1I)+14.*(1.-EN00010520
     1)-6.*SUMENI-CAY5-4.18*Q*ABSF(PAR)**1.54+SUMMAI-14.86              00010530
      LIM=KKK                                                          00010540
  401 WRITE OUTPUT TAPE 6,325,TIME,T(1),DEL                            00010543
  400 IF (ABSF(DEL)-TOL) 160,160,320                                   00010547
  320 GO TO (151,170),L                                                00010550
  325 FORMAT (0PF15.1,1P2E15.5)                                        00010552
  151 L=2                                                              00010570
      T1=T(1)                                                          00010575
      IF (DEL) 175,160,180                                             00010580
  175 T(1)=.99*T(1)                                                    00010590
      GO TO 105                                                        00010600
  180 T(1)=1.01*T(1)                                                   00010610
      GO TO 105                                                        00010620
  170 T2=T(1)-DEL*(T(1)-T1)/(DEL-DELI)                                 00010630
      T1=T(1)                                                          00010632
      T(1)=T2                                                          00010634
  105 CONTINUE                                                         00010640
  160 SUMI=SUMI+SUMJ                                                   00010650
      SUMAI=SUMAI+AI                                                   00012029
      WRITE OUTPUT TAPE 6,600,TIME,EN,DEL,T(1),T(6),TFBAR,CAY5,TBAR,T,TF00012000
     1,SUMAI,LIM                                                       00012001
  600 FORMAT(54H- TIME    N/NO    DEL    T(1)    T(6)    TFBAR   HYDROGEN /00012005
     16H  (YR)40X7HLEAKAGE /0PF5.1,0PF7.3,0PF8.3,0PF7.0,0P2F8.0,1PE11.2/00012010
     242X7HTBAR(I)/0P5F15.2/43X4HT(I)/0P6F15.2/43X5HTF(I)/0P6F15.2     00012015
                                                          5
     3/1H01PE14.5,I4)                                                  00012016
      TIME=TIME+DELTIM                                                 00012030
  332 SUMENI=SUMENI+EN*DELTIM                                          00012031
      IF (LL) 210,210,215                                              00012032
  210 LL=1                                                             00012034
      GUESS=2                                                          00012036
```

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      GO TO 104                                         00012038
  215 IF (TIME-TMAX) 202,202,500                        00012040
  202 GUESS=T1P-T(1)+2.                                 00012044
      T1P=T(1)                                          00012045
      ITRY=0                                            00012046
      GO TO 104                                         00012050
      END(1,0,0,0,0,0,1,0,0,1,0,0,0,0,0)
```


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