CONVERSION RATIOS FOR PLUTONIUM RECYCLE IN LIGHT WATER REACTORS - BREEDING POTENTIAL IN D_2O-H_2O COOLED REACTORS

by

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I wish to express my gratitude to the originator of the concepts investigated here. His guidance and encouragement have been invaluable in the preparation of this paper. Also, I would like to thank at the University of California, Santa Barbara, for his help in obtaining the microgroup cross sections used in this study.

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I. INTRODUCTION

It has been estimated that by 1981, if the projected fuel reprocessing capacity is reached, not only will there be around 10,000 kg of plutonium from light water reactors available each year, but approximately 30,000 kg of plutonium will be stored in a backlog of discharged fuel.

Plutonium can be used much more efficiently in a harder neutron spectrum than is found in existing light water reactors. It is well known that an increase in the fast effect can be obtained by a reduction in the water volume fraction resulting in a harder spectrum. In reactors fueled with U-235 this increase in the fast effect is more than offset by a decrease in η, the average number of neutrons produced for each neutron absorbed in the fuel material. However, in plutonium fueled reactors η increases with a hardening of the spectrum. These considerations lead us to the possibility of achieving greatly improved conversion ratios in light water reactors fueled with recycled plutonium. Further, through the use of heavy water it may be possible to construct a reactor with breeding characteristics comparable to those of a liquid metal cooled breeder reactor. This may be accomplished by raising the fuel to water ratio through the use of closely packed lattices, resulting in a considerable hardening of the neutron spectrum and a consequent improvement in conversion.

For instance, recycling plutonium with the fuel to water ratios in existing PWR's result in conversion ratios around 0.5, while with tightly packed lattices, conversion ratios in the 0.8-0.9 range appear

to be obtainable in existing PWR systems (1).

Unfortunately a lattice can only be packed so tightly before the pressure drop through the core rises beyond practical limits. It is possible though, to obtain a substantial further hardening of the spectrum by replacing light water with heavy water. This leads us to the possibility of a water cooled breeder using a close packed lattice with a mixture of light water and heavy water as the coolant.

The neutronics properties of a range of these lattices with both light water and light-heavy water mixtures are studied here. Also some preliminary design considerations for a D_2O-H_2O breeder reactor are presented.

II. METHODS OF ANALYSIS

The multiplication factors, conversion ratios, and multi-group cross sections for this study were calculated using a modified version of the spectral code FASCON (2). The program was expanded to cover energies down to the thermal region, and resonance absorption was added to the model. Hydrogen and deuterium were added to the isotope list and a section to calculate three-group microscopic cross sections for each isotope was added.

The microgroup resonance escape probabilities were calculated using REP (3). Self shielding factors were obtained using Bell's approximation (4). The microscopic cross sections were revised using APRFX-1 neutron cross section collapsing code of Pickard's (5) applied to the Reactor Shielding Information Center data library collection at Oak Ridge National Laboratory based on ENDF/B-III data.

Criticality and flux distributions for the preliminary D_2O-H_2O breeder were calculated using ODMUG (6), a three-group diffusion code.

Burnup calculations were carried out using the zero-dimensional depletion code, FUELBURN (7). The twenty year history of the D_2O-H_2O breeder was calculated using a linkage of the expanded FASCON and FUELBURN. FASCON was used to adjust the D_2O fraction for criticality, to recalculate the spectrum each time step, and to adjust plutonium concentration each 20,000 MWD/MT of burnup to simulate fuel shuffling and reprocessing.

III. CLOSE PACKED LATTICES WITH ORDINARY WATER AS COOLANT

Ideally, we would like to remove as much moderator (coolant) as possible in order to obtain a harder spectrum, and hence, improved conversion. However, the amount of coolant which can be removed is limited by thermal-hydraulic considerations. As the water fraction is lowered, the pressure drop rises and the pumping power required for adequate heat removal increases rapidly. Two sets of volume fractions are studied here. The first set has a water fraction of 0.215. The pressure drop through this lattice is low enough to permit replacement of existing pressurized water reactor cores (1). The second set is a drier lattice with a water fraction of 0.139. The pressure drop in a lattice using these volume fractions is considerably higher, of course. However, by appropriate mechanical design, high pressure fuel assemblies can be manufactured to meet the required pressure drop in new P.W.R. designs.

The fuel is taken to be mixed oxides of plutonium and uranium. The uranium is tails from gaseous diffusion plants with 0.25 Wt. % U-235. The plutonium isotopes are distributed to represent the discharge distribution of typical light water reactors. The cladding material is stainless steel-304.

The neutron spectra in these lattices resembles that of a fast reactor with a large tail into the resonance region. A histogram of the neutron distribution for a typical case is given in figure 1.

TABLE I

Volume Fractions		
	Set 1	Set 2
Water	0.215	0.139
Pellet	0.633	0.691
Steel	0.128	0.143
Void	0.024	0.027

PU Isotope Distribution	
	Wt %
PU-239	63.8
PU-240	19.9
PU-241	12.9
PU-242	3.4

The infinite multiplication factors for a range of both operating and voided conditions have been computed. Note that a negative void coefficient is assured for plutonium concentrations of less than ~ 13 Wt %, but that problems with positive void coefficients could be encountered at higher plutonium concentrations (see figures 2 and 3).

The internal conversion ratio is defined here as;

$$ICR = \frac{\text{Rate of neutron capture in U-238 and PU-240 in core}}{\text{Rate of neutron absorption in U-235, PU-239 and PU-241 in core}}$$

The blanket conversion is estimated assuming a blanket efficiency of 80% (calculations with FASCON indicated that 80% of the neutrons absorbed in the blanket were absorbed in U-238), and a leakage probability corresponding to a core size such that the initial unpoisoned K_{eff} of the reactor is 1.04. More careful calculations using ODMUG and FASCON were used to check the validity of this method of estimation and it was found to be in close agreement with the more detailed methods. The blanket conversion ratio is defined as;

$$BCR = \frac{\text{(Rate of neutron production)x(Leakage probability)x(Blanket eff.)}}{\text{Rate of neutron absorption in PU-239 and PU-241}}$$

The internal and overall conversion ratios for beginning of life conditions are presented in figures 4 and 5. Note that the internal conversion ratio falls off rapidly with increased plutonium concentration. This is due to the decrease in the ratio of fertile to fissile isotopes. This decrease in internal conversion is nearly compensated for by increased blanket conversion brought about by the

smaller cores and hence greater leakage which results from increasing the fissile content.

Thus the overall conversion ratio in such a core will not be strongly dependent on the plutonium fraction chosen.

Non-dimensional burnup characteristics of the 10 Wt % plutonium case for each set of volume fractions have been calculated. The infinite multiplication factor, the internal conversion ratio, and the mass densities of PU-239, 240 and 241 are plotted as functions of burnup in figures 6-9.

The rate of reactivity decrease with burnup in these lattices is somewhat smaller than that of normal P.W.R.'s. This is to be expected due to the increase in conversion and the decreased absorption in fission products brought about by the hardened spectrum. Also note that the internal conversion ratio increases with burnup. This can be attributed to the shift in the fertile to fissile ratio due to the burning out of PU-239 and the buildup of PU-240 (see figures 8 and 9).

Fuel burnup calculations for a reactor designed to permit replacement of existing PWR cores, using volume fraction set 1, have been carried out (1). These calculations indicate that the average plutonium consumption for the first ten years of operation is 0.186 Grams/MWD.

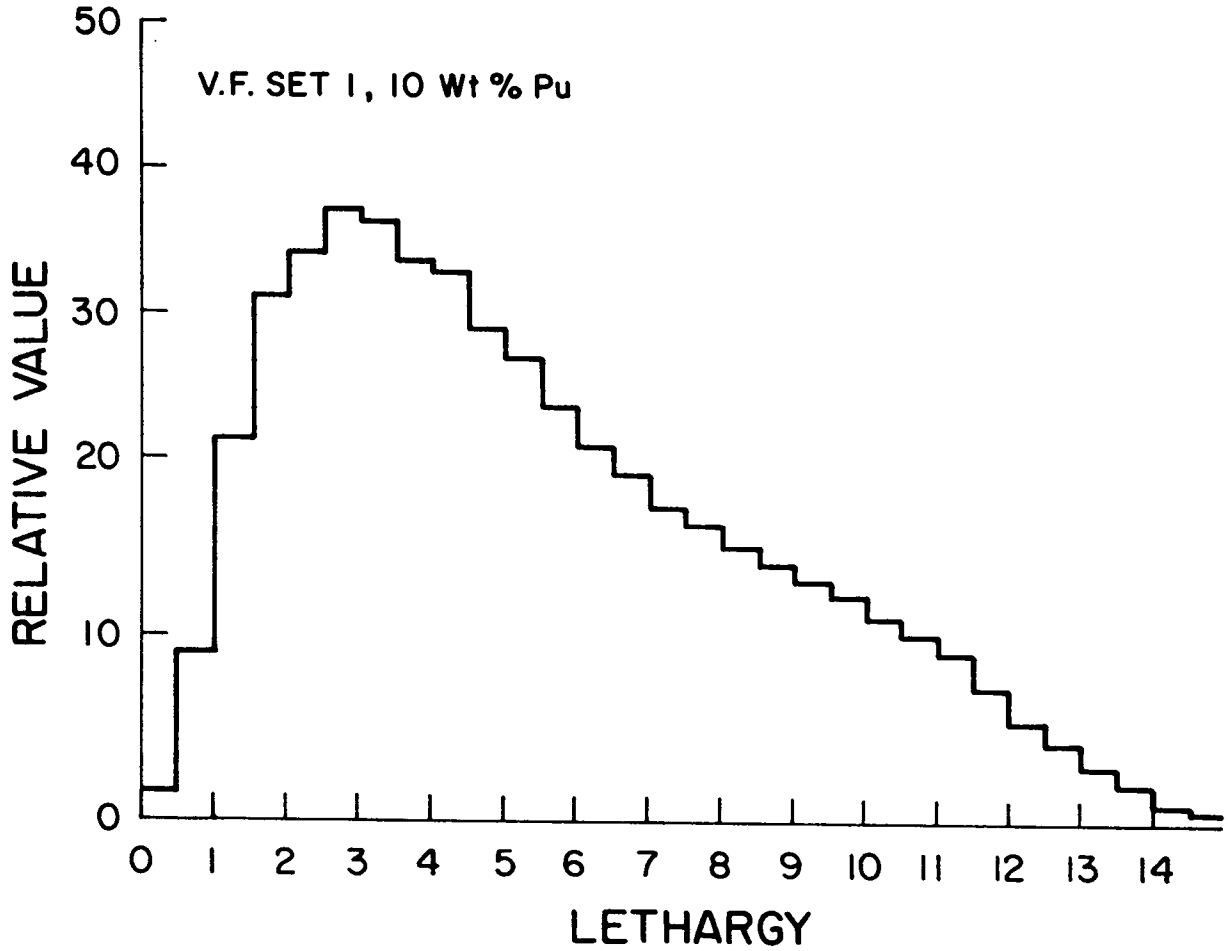

FIG. 1. NEUTRON FLUX DISTRIBUTION

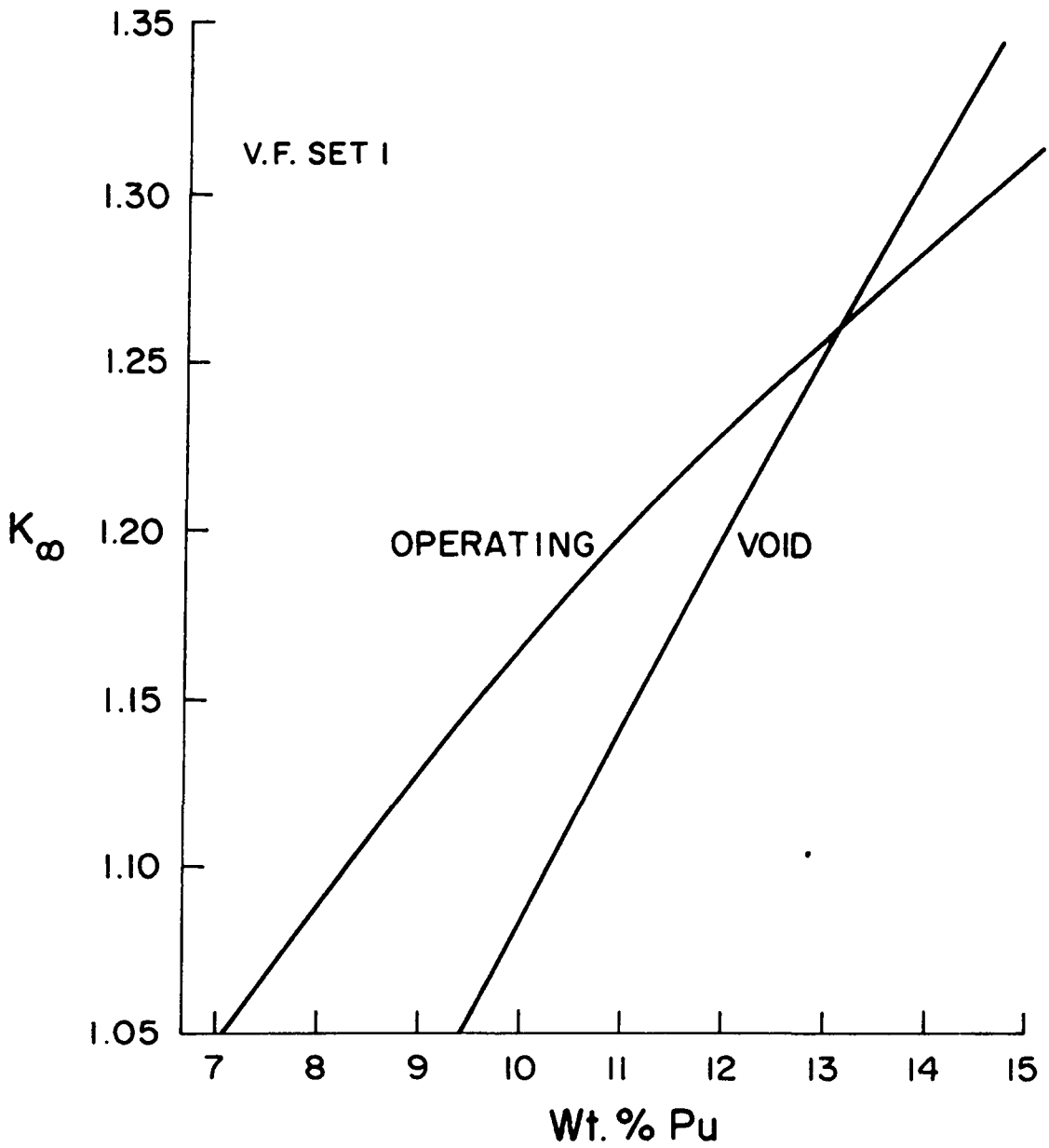

FIG. 2. K_∞ vs Wt % Pu

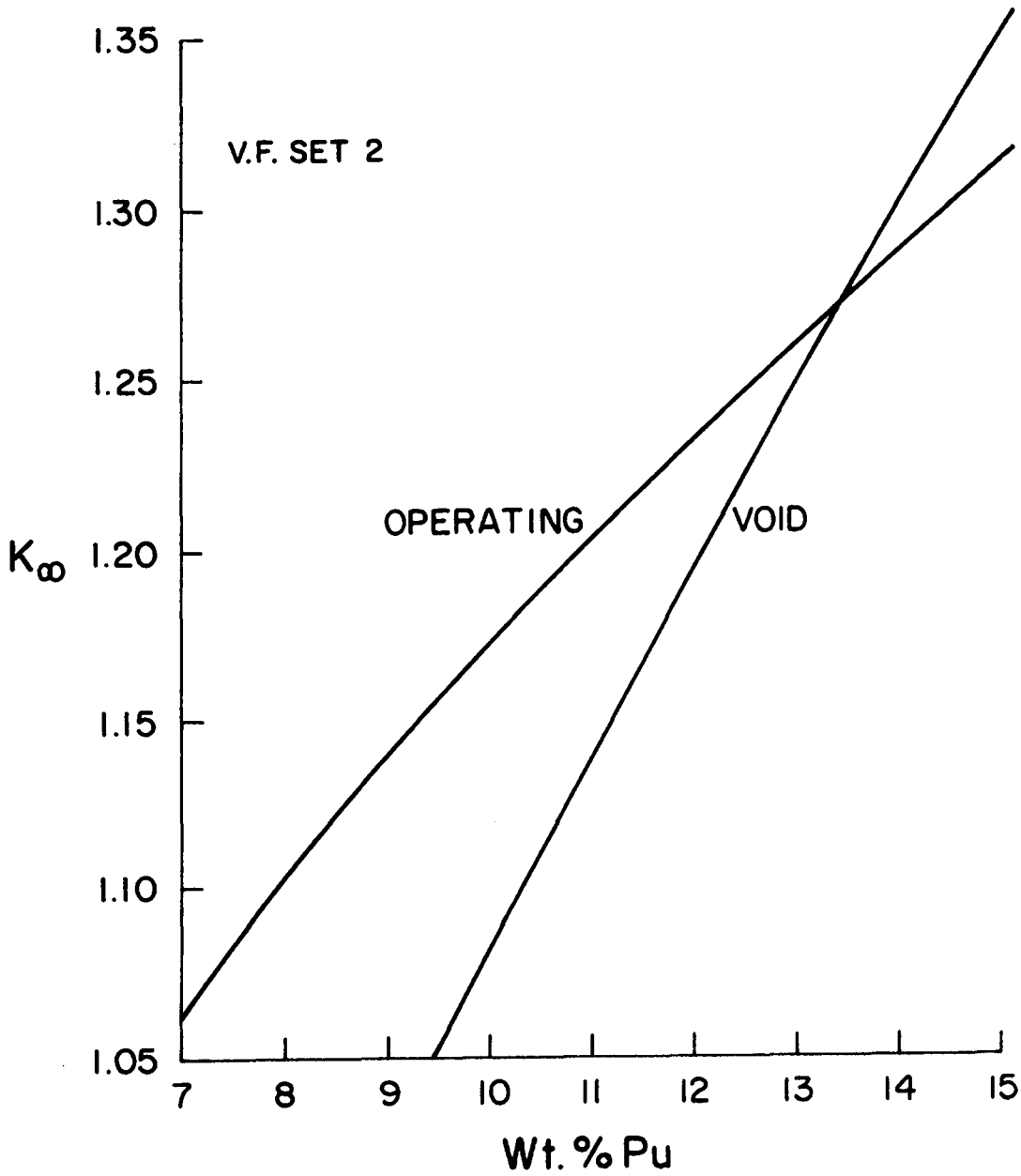

FIG. 3. K_∞ vs Wt % Pu

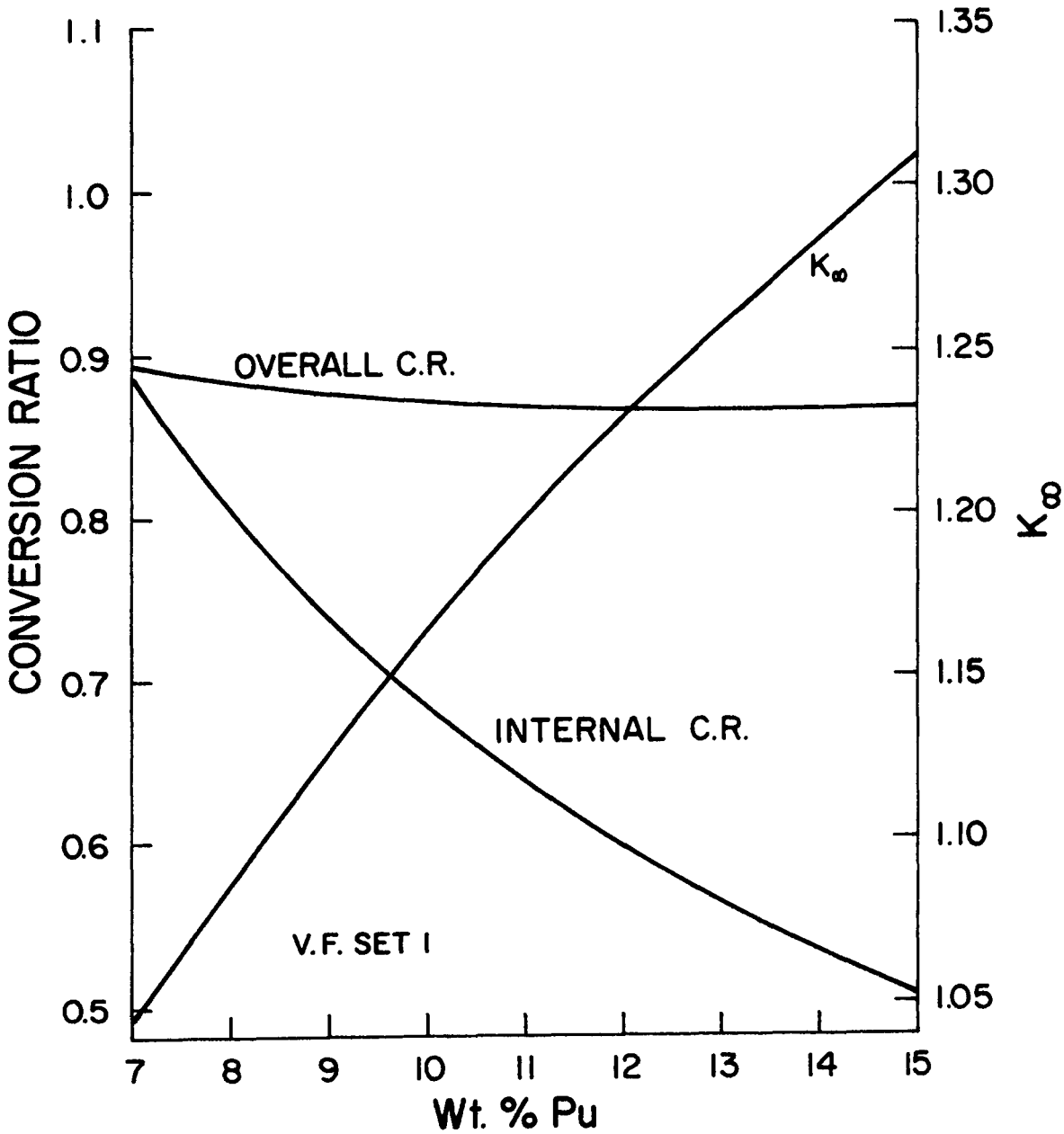

FIG. 4. CONVESION RATIO vs Wt % Pu

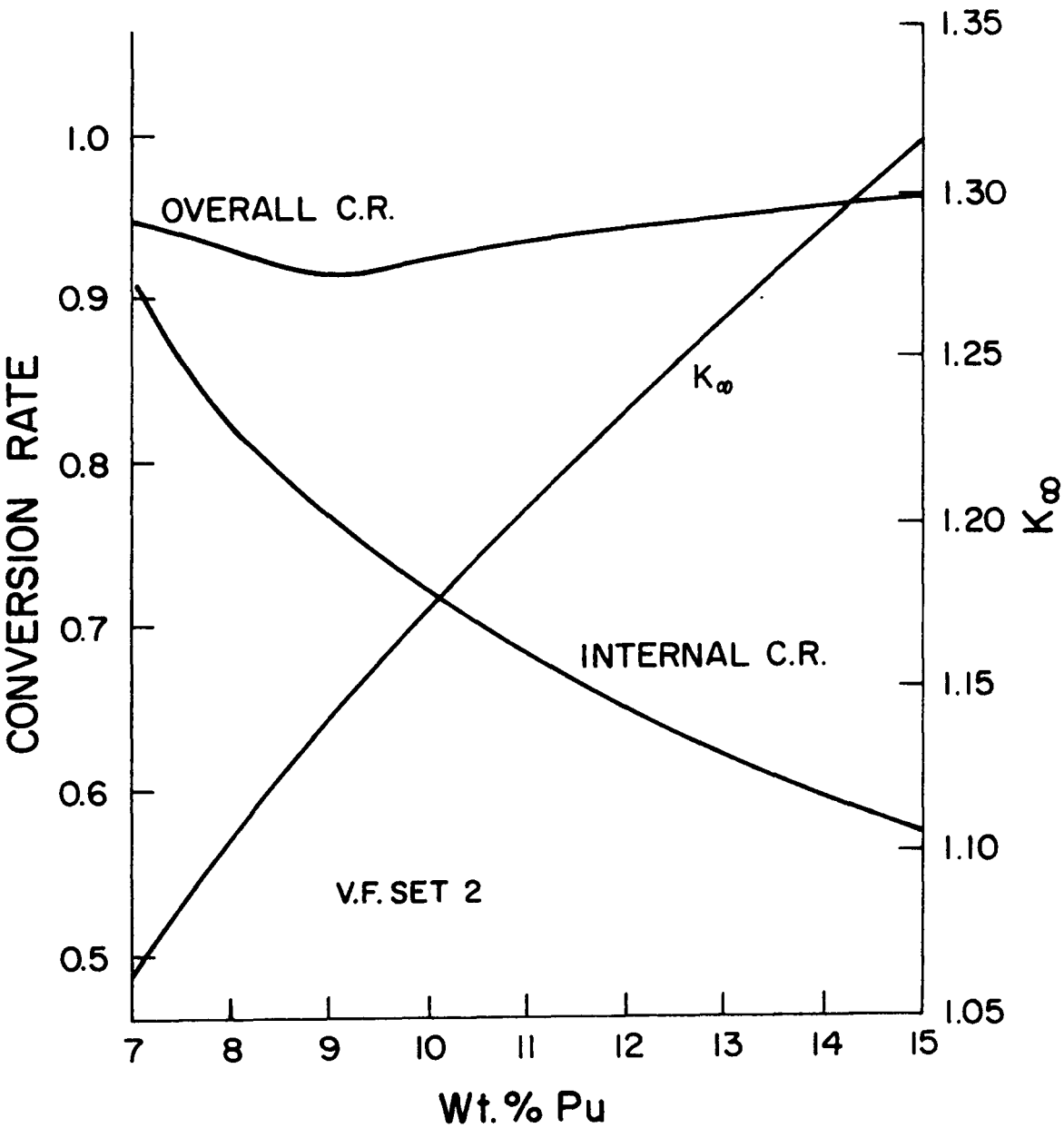

FIG. 5. CONVERSION RATIO vs Wt % Pu

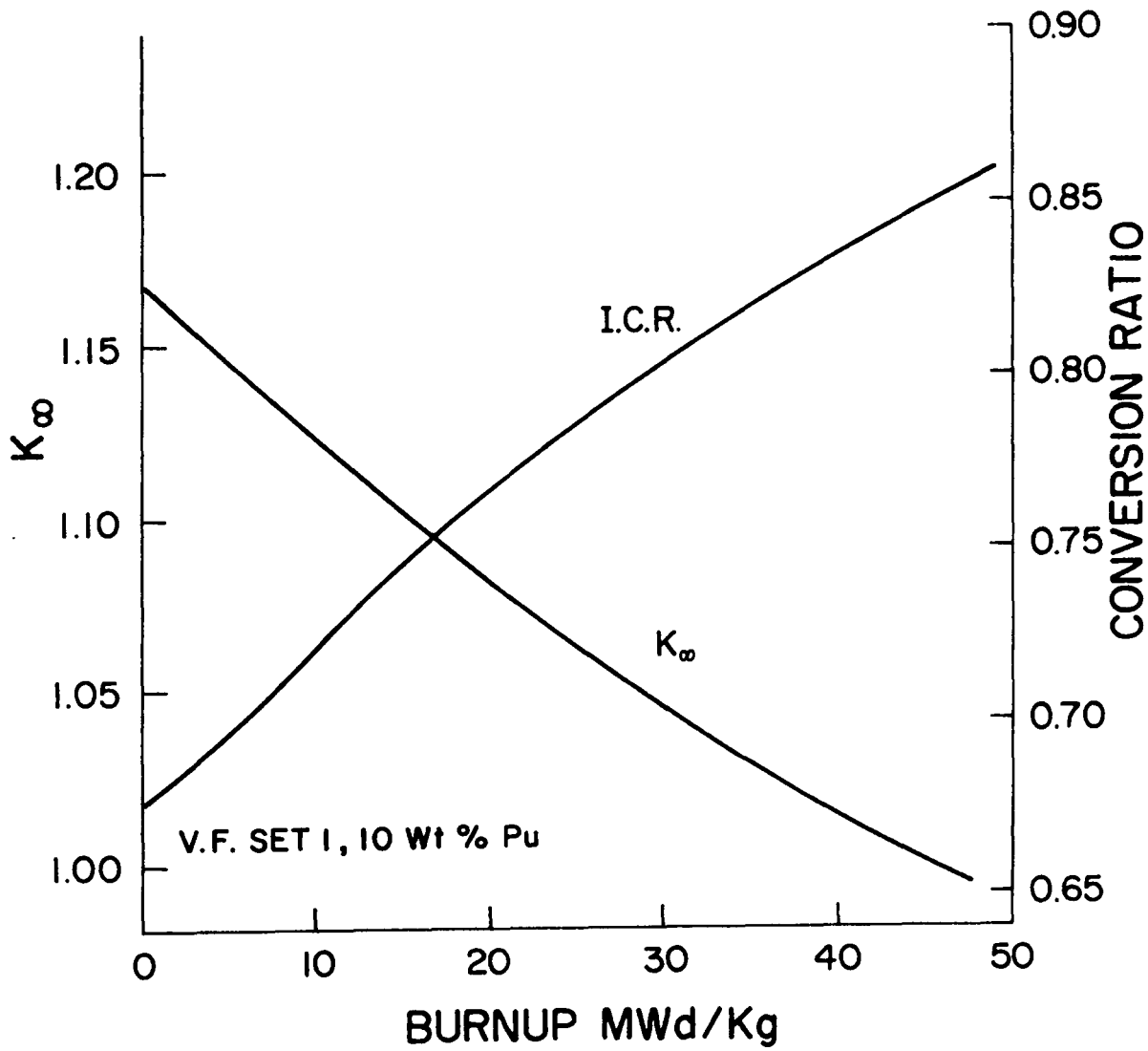

FIG. 6. K_∞ AND I.C.R. vs BURNUP

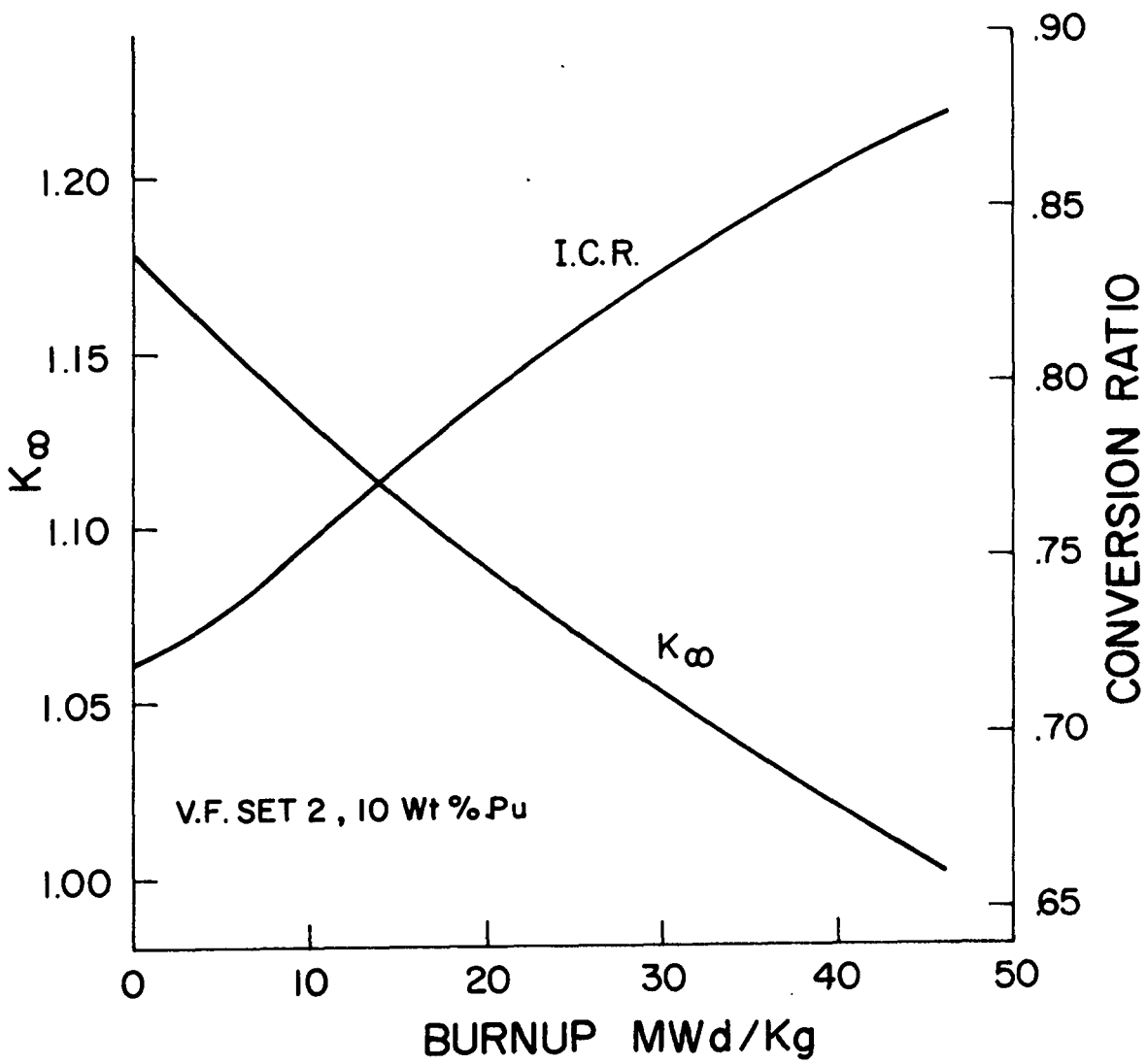

FIG. 7. K_∞ AND I.C.R. vs BURNUP

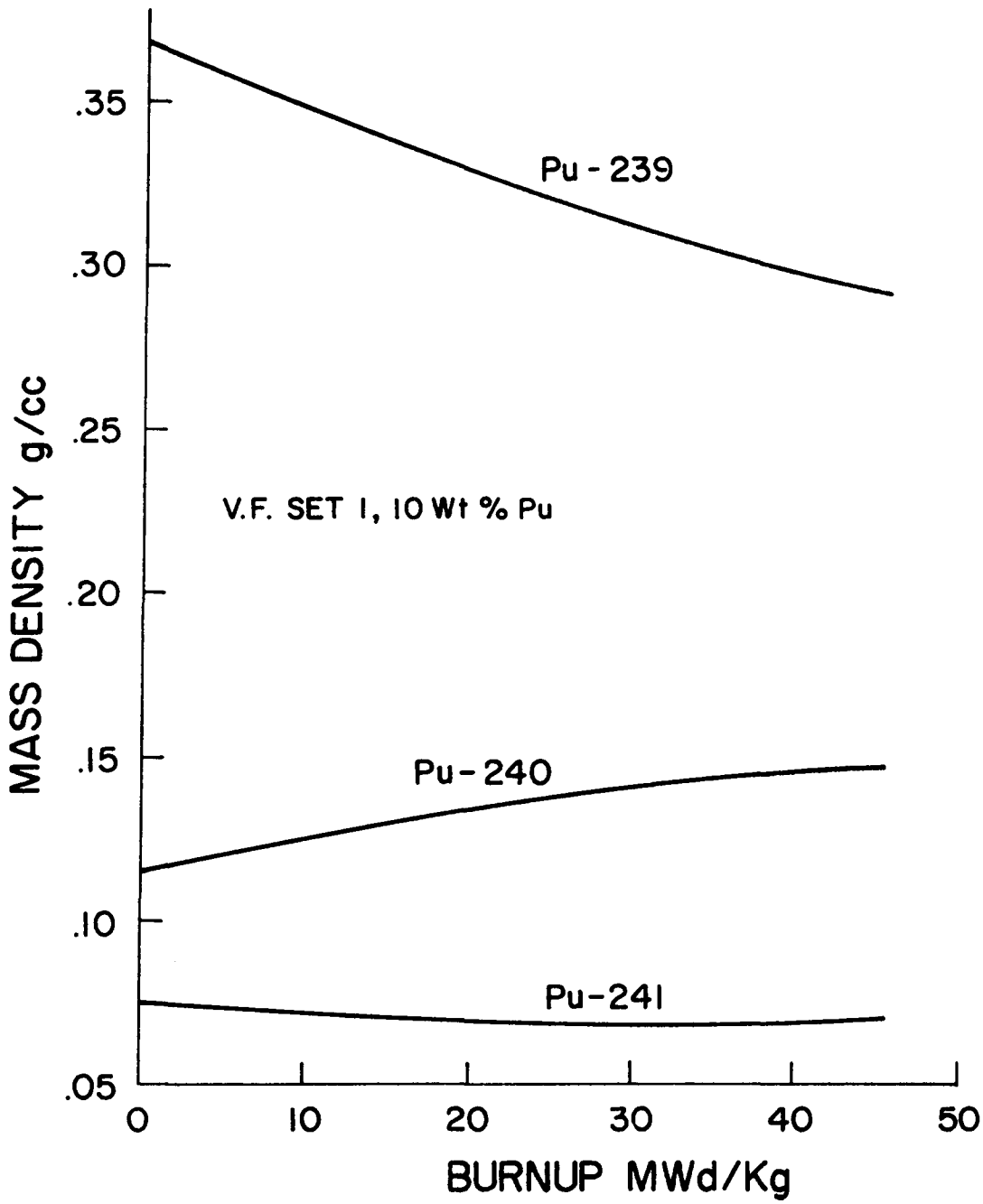

FIG. 8. Pu MASS DENSITIES vs BURNUP

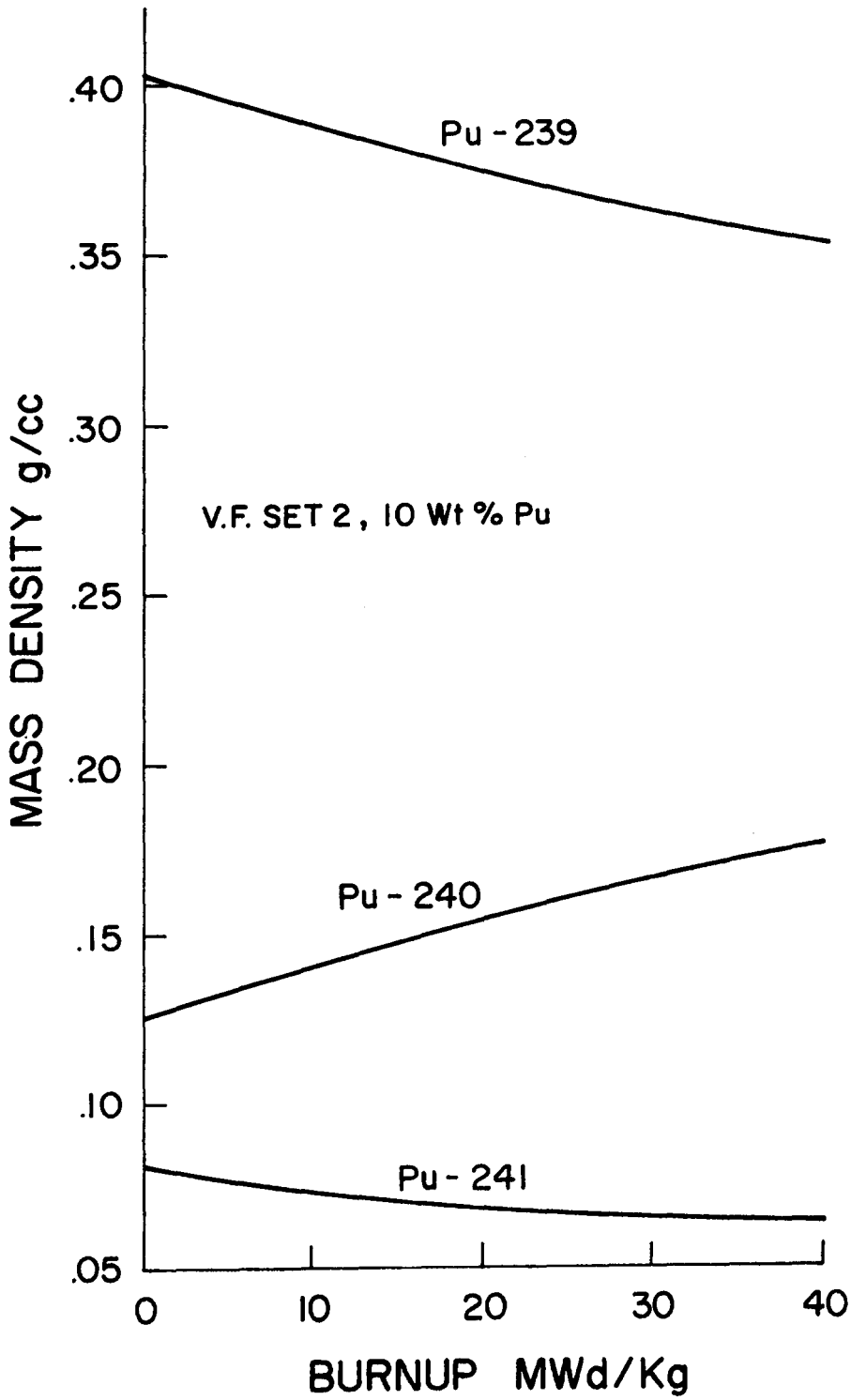

FIG. 9. Pu MASS DENSITIES vs BURNUP

IV. CLOSE PACKED LATTICES WITH HEAVY WATER - LIGHT WATER MIXTURES AS COOLANT

The spectra in lattices of this type can be hardened considerably by replacing a portion of the ordinary water with heavy water. This effect results from the greater mass of the deuteron which makes heavy water a much less effective degrader of neutron energy. The slowing down power of heavy water is around seven times less than that of ordinary water (8).

In order to obtain the hardest spectrum, and consequently the maximum breeding, we would like to replace all of the ordinary water with heavy water. This does not appear to be practical however, as large, positive void coefficients would result. Thus, a range of D_2O-H_2O mixtures which might produce a reasonable compromise are studied here.

The spectra in cases with 80-100% D_2O are comparable to those found in LMFBR's. A histogram of the flux distribution in an 80% D_2O case and a typical LMFBR are shown in figure 10 for comparison.

Lattices with 50, 80, and 90% D_2O and from 9 to 14 Wt. % plutonium are studied. The same two sets of volume fractions and the same plutonium isotope distribution as used previously are assumed here also.

The infinite multiplication factors for this range of parameters are presented in table 1 and figures 11 and 12. Note that a positive void coefficient will exist in a large portion of the range studied. Note also, that K_∞ is strongly dependent on D_2O concentration (figure

13). This provides us with a convenient, non-parasitic method of shim control as reactivity can be controlled by small shifts in the D_2O concentration (9, 10).

As in the case of light water lattices, the overall breeding ratio is found not to be a strong function of the plutonium concentration. The breeding ratio is, however, a strong function of the D_2O fraction, indicating that we will most likely want to maintain as high a D_2O fraction as practical to maximize breeding (see figures 14 and 15).

These calculations indicate that it may indeed be possible to build a breeder reactor using an D_2O-H_2O mixture as coolant. A preliminary design for such a core is presented here and a twenty year mass balance is calculated to demonstrate the breeding potential of this concept. The core size, plutonium concentration, and heavy water fractions were chosen to provide a core with maximized breeding on one hand and yet to have a negative void coefficient on the other. Volume fraction set 2 is assumed as it provides a significant increase in breeding potential over the wetter lattice. A core height of 79.5 cm, a plutonium concentration of 10.5 Wt. % and a heavy water fraction of 0.8 with 30 cm blankets of depleted uranium seemed to best fill the above requirements.

This configuration results in the reactor being just critical when completely voided, thus insuring a negative or zero void coefficient. Effective multiplication factors for voided cores of various heights and plutonium concentrations are given in figure 16.

TABLE II

K_∞ AND BREEDING RATIO

Volume Fraction Set 1

	K_∞				Overall Breeding Ratio		
Wt.%PU	50% D_2O	80% D_2O	90% D_2O	Void	50% D_2O	80% D_2O	90% D_2O
9	1.125	1.059	1.020	1.024	0.908	1.007	--
10	1.158	1.096	1.061	1.087	0.910	1.014	1.082
11	1.189	1.131	1.100	1.147	0.915	1.021	1.088
12	1.218	1.165	1.138	1.204	0.920	1.028	1.092
13	1.245	1.198	1.174	1.258	0.927	1.034	1.097
14	1.275	1.235	1.214	1.315	0.931	1.037	1.098

Volume Fraction Set 2

	K_∞				Overall Breding Ratio		
Wt.%PU	50% D_2O	80% D_2O	90% D_2O	Void	50% D_2O	80% D_2O	90% D_2O
9	1.087	1.022	0.995	1.023	1.023	1.201	--
10	1.124	1.066	1.042	1.086	1.030	1.203	1.233
11	1.159	1.108	1.087	1.145	1.037	1.204	1.233
12	1.193	1.148	1.131	1.202	1.044	1.205	1.232
13	1.226	1.188	1.173	1.256	1.051	1.207	1.231
14	1.259	1.226	1.214	1.309	1.057	1.208	1.231

A rod O.D. of 0.3 inches with rods on a hexagonal pitch is used. The power is assumed to be 2850 $MW_{(th)}$. Details of this configuration are given in table 2.

The thermal-hydraulics of this core are not analyzed in detail here because heat transfer correlations for this range of rod spacing do not exist. Preliminary calculations indicate that the pressure drop through this core will be less than 120 psi which is not an unreasonable value. The coolant fraction in the blankets has been adjusted to lower the total pressure drop. The blanket volume fractions are taken to be;

Blanket Volume Fractions	
Water	0.35
Pellet	0.52
Steel	0.11
Void	0.02

The internal breeding ratio at the beginning of life is 1.077 and the blanket breeding ratio is calculated to be 0.170, thus yielding an overall breeding ratio of about 1.25.

The blanket breeding ratio was calculated using average three-group fluxes from ODMUG and group constants from FASCON and is assumed to remain constant throughout the life of the core. The internal breeding ratio fluctuates with D_2O concentration and shifts in isotope distribution.

In order to examine the breeding potential of such a core, a twenty year burnup history has been calculated. It is assumed that

the D_2O concentration is adjusted to maintain criticality as the reactor runs. At the end of each cycle, the fission products are removed and plutonium is added or removed to adjust for criticality with 80% D_2O. This represents the history of an 'average' batch of fuel. The blanket provides 170 kg of fissile plutonium each cycle. A cycle represents one years operation with a capacity factor of 80%. This gives a burnup of 20,000 MWD/MT each cycle. The mass balance for this core taking into account 1.5% reprocessing losses is given in table 3. Note that the fissile inventory has reproduced itself in less than fourteen years.

The spectrum in this reactor will, of course be shifted as the D_2O concentration changes. During the first few cycles it will be softened to maintain criticality. Later, as the isotopic composition shifts causing an increase in breeding, reactivity must be reduced and the spectrum is hardened by increasing the D_2O concentration slightly (see figure 19). The lowest D_2O concentration was reached at the end of the first cycle when D_2O makes up only 61% of the coolant. This corresponds to a ΔK of about -0.035. The highest D_2O concentration of 88%, which corresponds to a ΔK of +0.018, was reached at the end of cycle 19.

The three-group fluxes for beginning and end of several cycles are given in table 4 to illustrate how the spectrum shifts during the cycles. Also beginning and end of cycle spectra for cycles 1 and 10 are shown in figure 18.

TABLE III

A SUMMARY OF REACTOR PARAMETERS

Active core height	79.5 cm
Active core radius	162.4 cm
Axial blanket thickness	30 cm
Number of rods	156,480
Rod O.D.	0.3 in.
Pellet O.D.	0.269 in.
Pitch (Hex lattice)	0.3008 in.
Total length of active rod	408,140 ft
Maximum core power	2850 $MW_{(th)}$
Average lineal power rating	7 kw/ft
Total core heat transfer area	32,055 sq ft
Average heat flux	304,400 BTU/ft^2hr
Power density	434 kw/l.
K_{eff} at beginning of life (80% D_2O)	1.0054
ΔK for complete voiding	-.0054
Heavy metal inventory	41.28 M.T.
Fissile inventory (beginning of life)	3.166 M.T.
Average burnup	60,000 MWD/M.T.
Core volume	6582 l.

TABLE IV

MASS BALANCE

End of Cycle	Core PU-239 (kg)	Core PU-241 (kg)	Core & Blanket Fissile	Total Fissile Available
1	-118.9	-18.1	33	33.0
2	-47.3	-6.0	116.7	149.7
3	-16.2	-1.9	151.9	301.6
4	338	3.7	207.5	509.1
5	50.9	5.3	226.2	735.3
6	70.3	7.4	247.7	983.0
7	88.0	9.5	267.5	1250.5
8	88.0	9.5	267.5	1518.0
9	118.8	12.9	301.7	1819.7
10	101.2	11.5	282.7	2102.4
11	104.1	11.8	285.9	2388.3
12	117.9	13.6	301.5	2689.8
13	101.6	11.7	283.3	2973.1
14	134.6	15.7	320.3	3293.4
15	117.3	13.8	301.1	3594.5
16	83.4	9.8	263.2	3857.7
17	117.0	14.0	301.0	4158.7
18	117.2	14.0	301.2	4459.9
19	134.2	15.9	320.1	4780.0
20	100.4	12.2	282.6	5062.6

20 year accumulation

	239 (kg)	241 (kg)
Core	1496.3	166.3
Blanket	3298	102.0
Total	4794.3	268.3

TABLE V

THREE-GROUP FLUXES

Beginning of Cycle

Cycle Number	1	5	10	20
ϕ_1	0.521	0.525	0.526	0.526
ϕ_2	0.394	0.394	0.394	0.394
ϕ_3	0.085	0.081	0.080	0.080

End of Cycle

Cycle Number	1	5	10	20
ϕ_1	0.526	0.530	0.531	0.531
ϕ_2	0.366	0.391	0.397	0.401
ϕ_3	0.107	0.079	0.071	0.068

Group Structure -

Group	Energy
1	10 Mev → 67.4 Kev
2	67.4 Kev → 2.03 Kev
3	2.03 Kev → thermal

The shift in isotope distribution also causes an increase in fissile inventory to compensate for increased absorption in PU-240. Once equilibrium is reached (around cycle 17), the fissile inventory has risen to 3690 kg at the beginning of a cycle. The average production rate at equilibrium is 0.0148 kg/MWD, which will reproduce the core inventory once each 12.5 years.

This type of reactor has a much lower fissile fraction than most LMFBR designs. This is a result of the increased fuel volume fraction and the slightly softer spectrum. These factors also allow high internal conversion ratios to be attained because the ratio of fertile to fissile isotopes is high. In addition, larger cores are possible because positive void coefficients are not as large a problem as in LFMBRs. This is due to a greater increase in leakage upon voiding and a smaller increase in multiplication from spectral hardening.

This design does not represent an attempt at an optimization. Many of the parameters have been selected arbitrarily while other factors have not been considered. The complexity of problems involved with the design of a core of this nature make anything other than a superficial analysis a major undertaking requiring considerable manpower and capital.

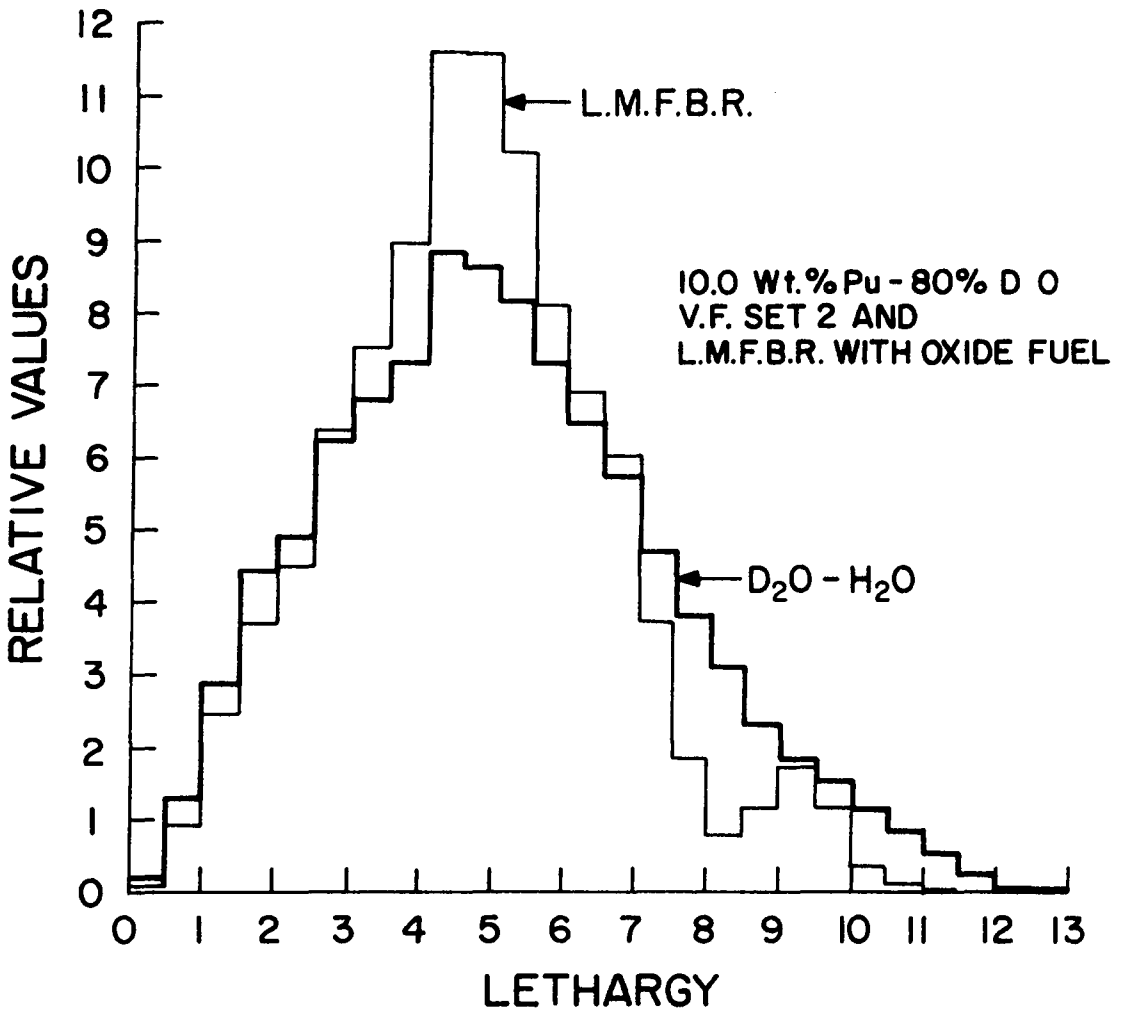

FIG. 10. NEUTRON FLUX DISTRIBUTIONS

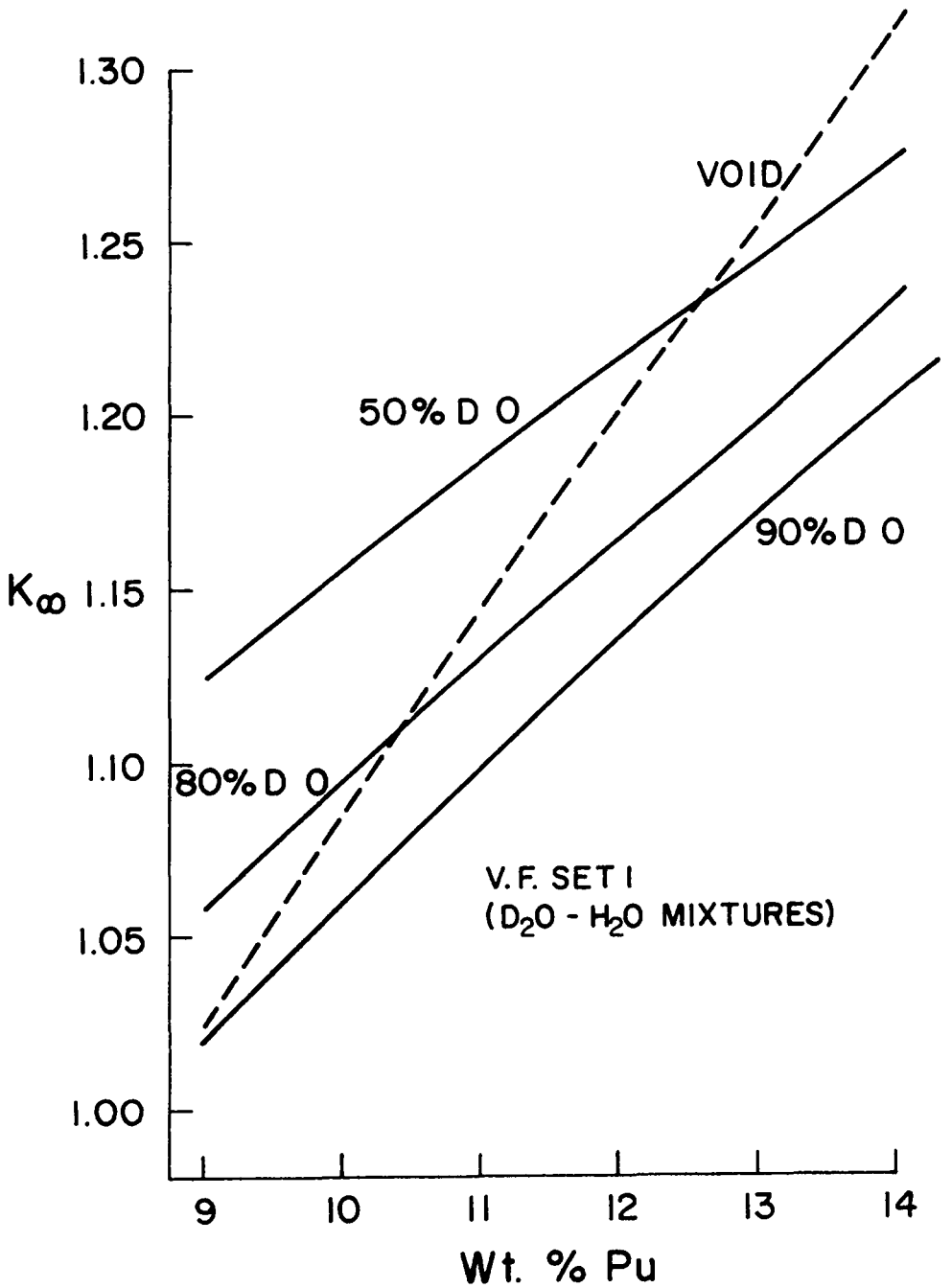

FIG. 11. K_∞ vs Wt % Pu

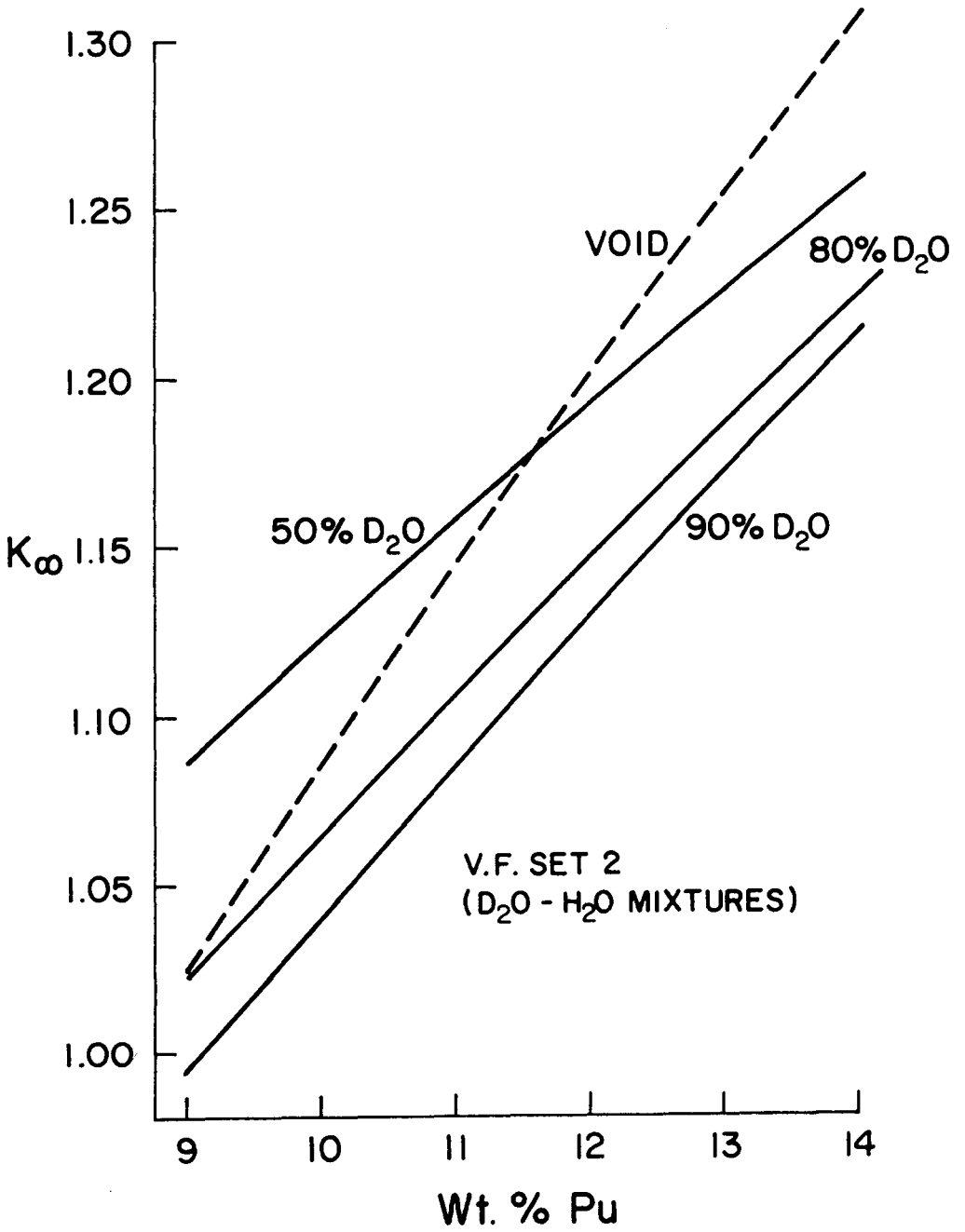

FIG. 12. K_∞ vs Wt % Pu

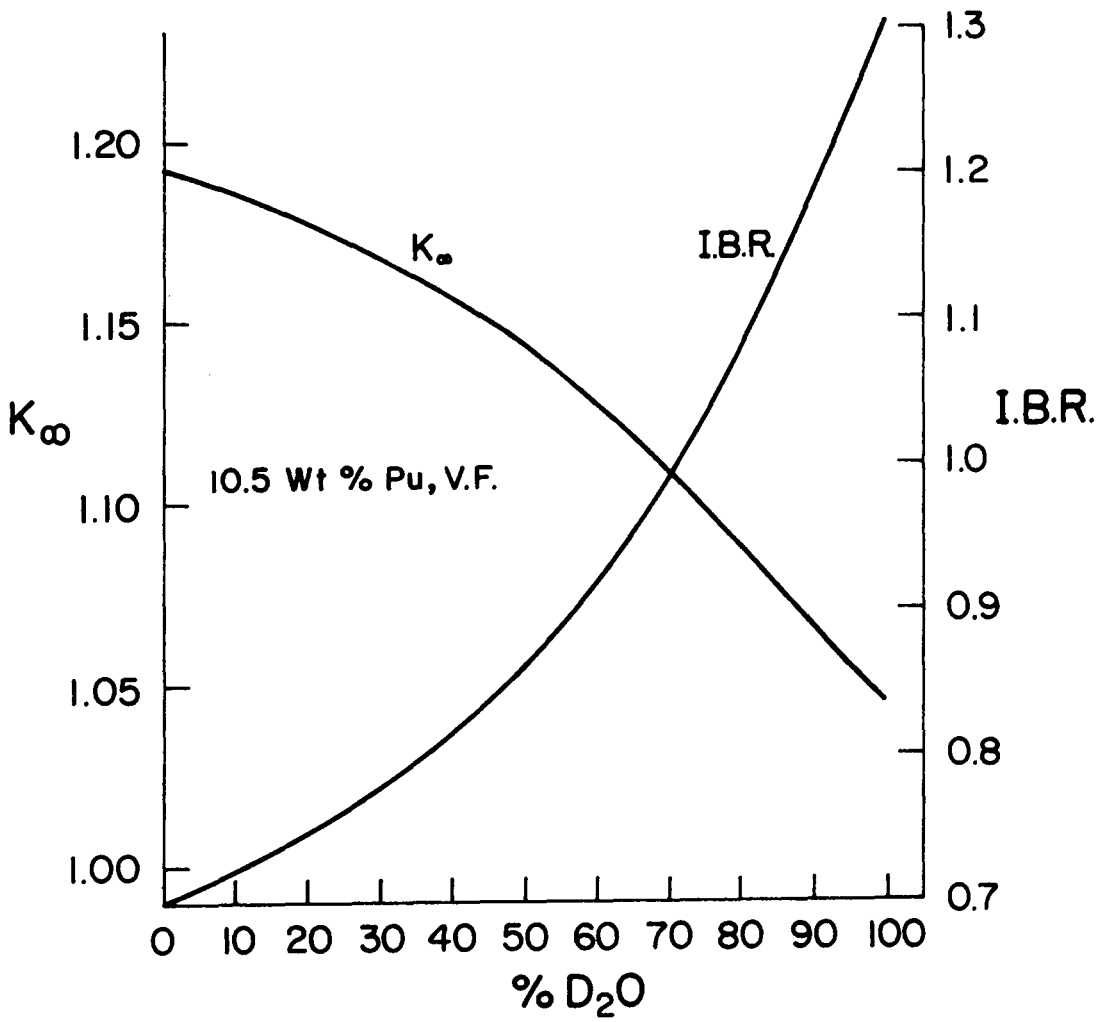

FIG. 13. K_∞ AND I.B.R. vs % D_2O

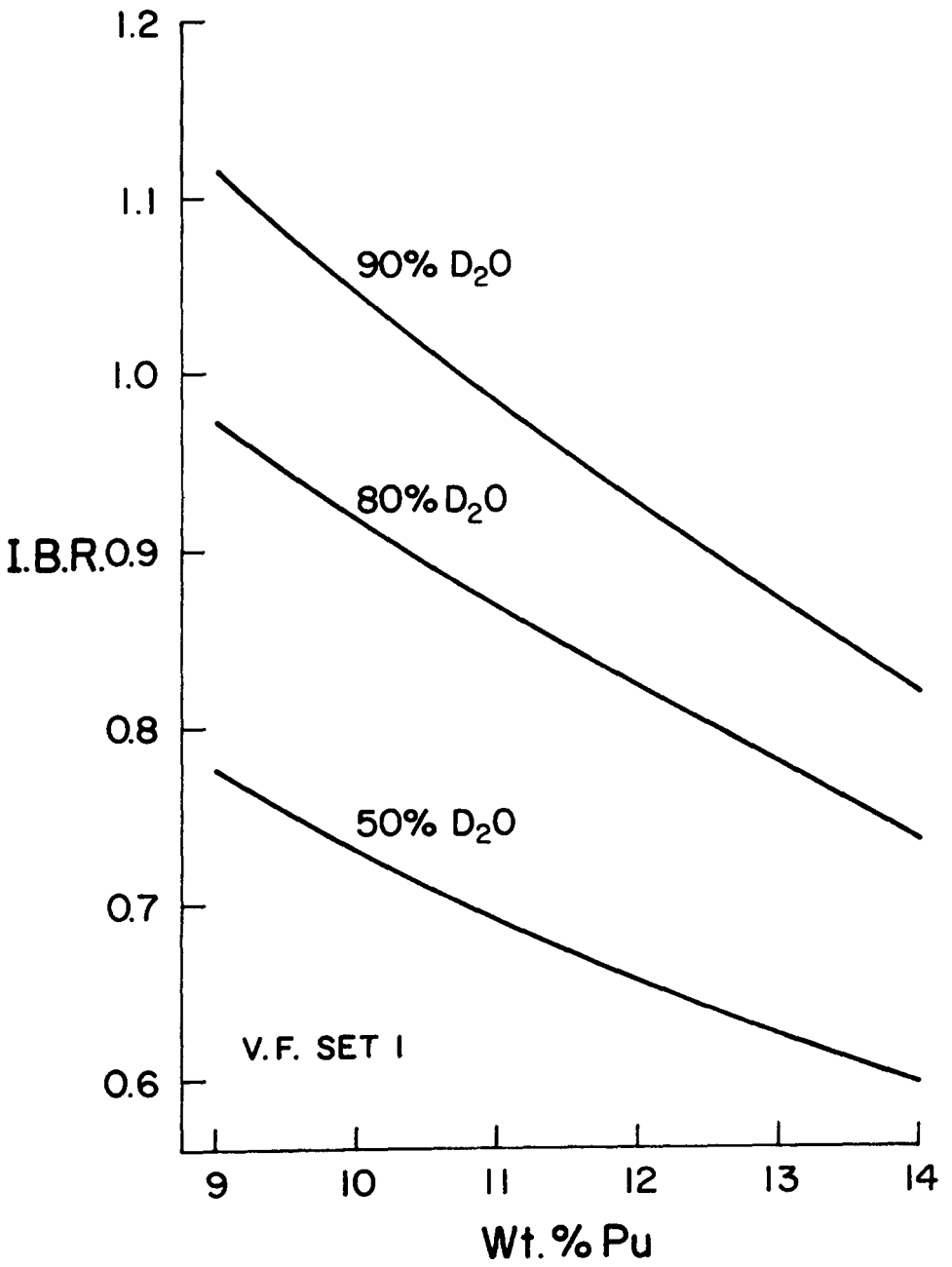

FIG.14. I.B.R. vs Wt % Pu

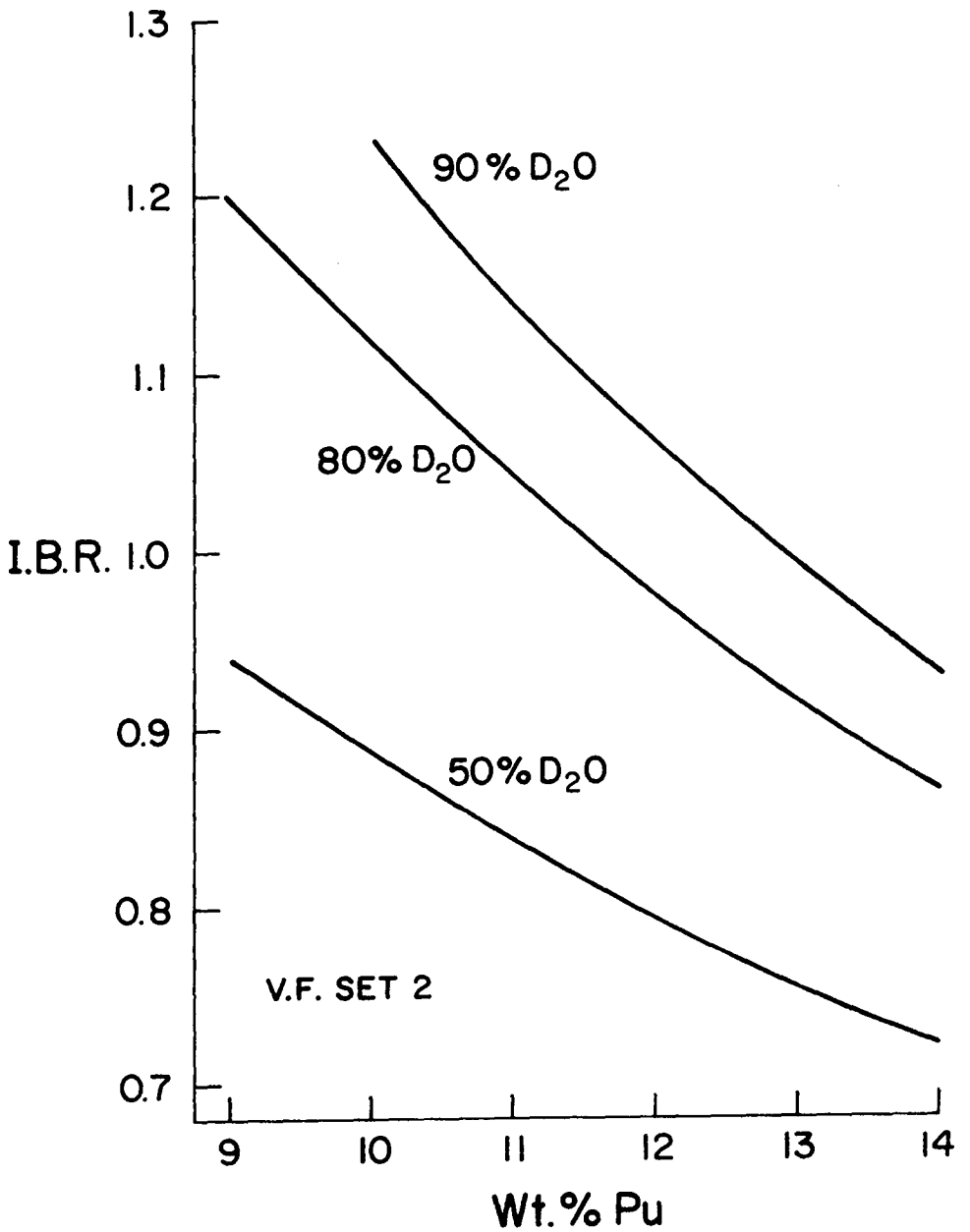

FIG. 15. I.B.R. vs Wt % Pu

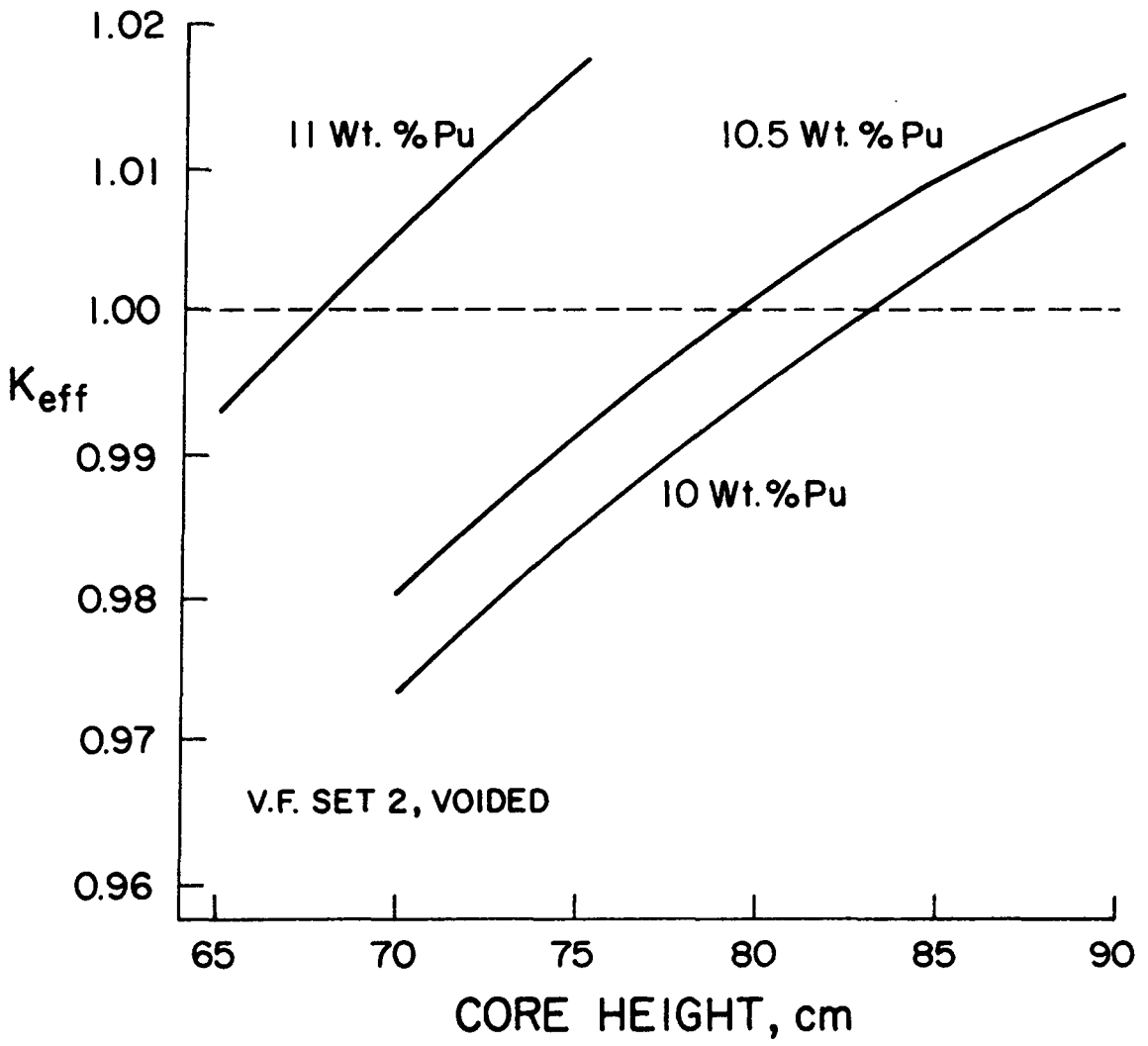

FIG. 16. K_{eff} vs CORE HEIGHT

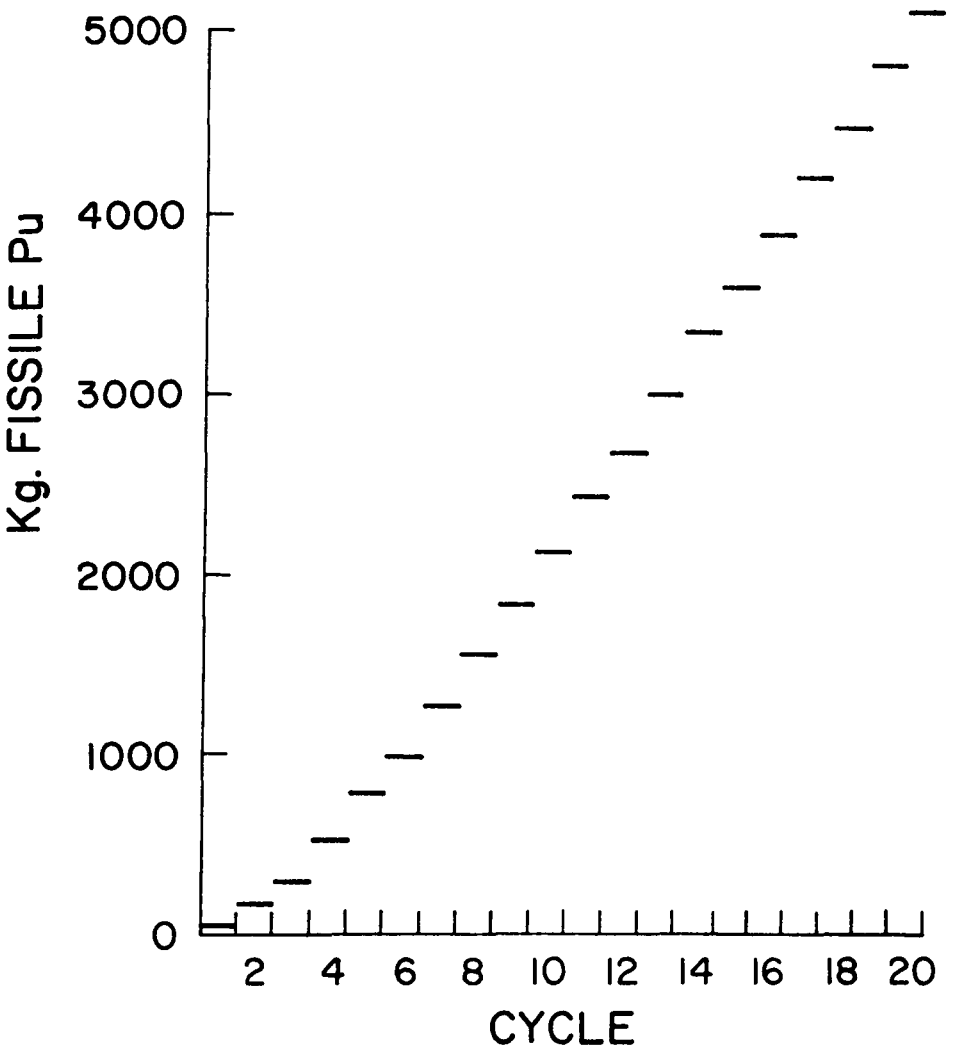

FIG. 17. EXCESS Pu AVAILABLE AT END OF EACH CYCLE

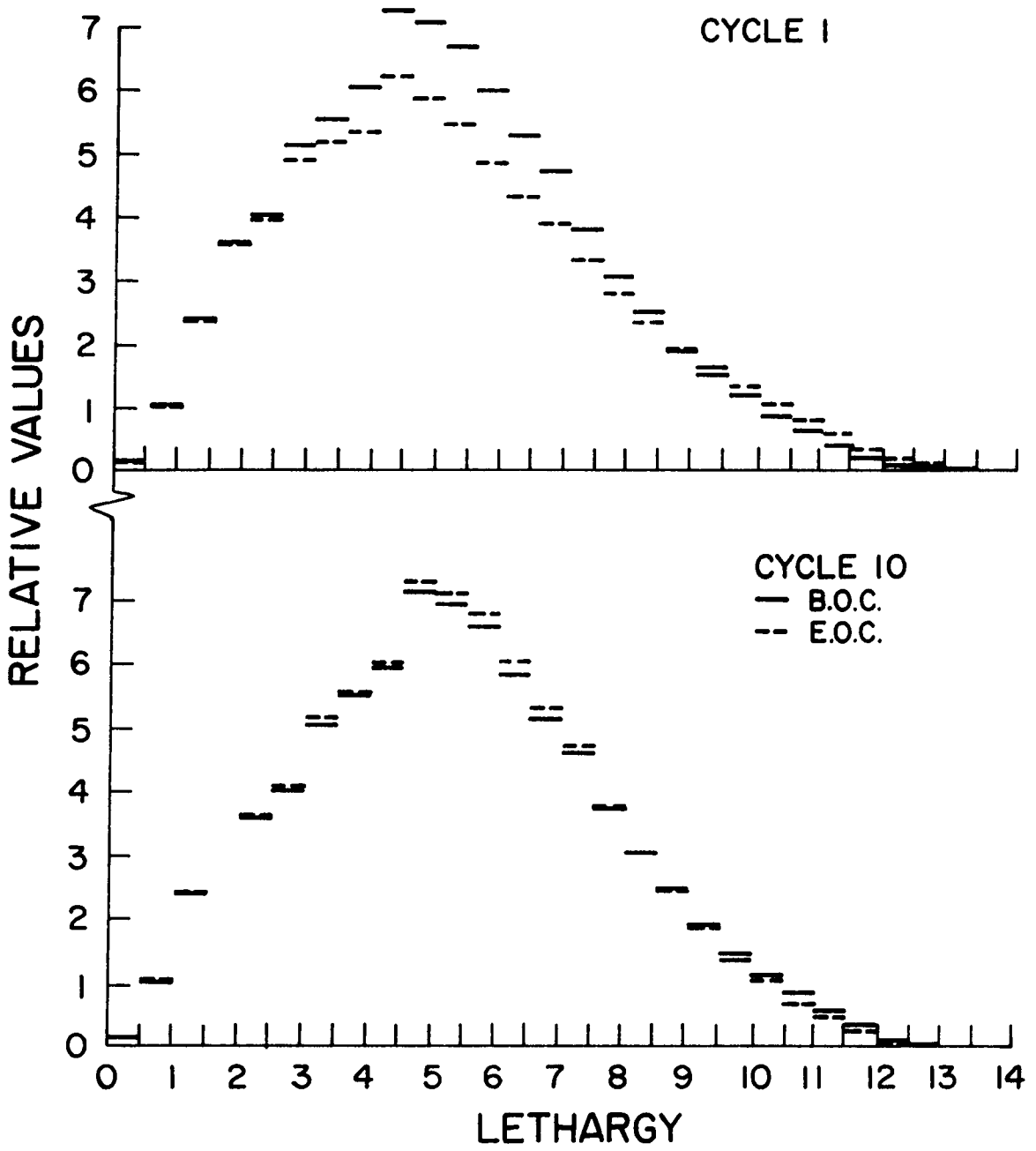

FIG. 18. NEUTRON FLUX DISTRIBUTIONS

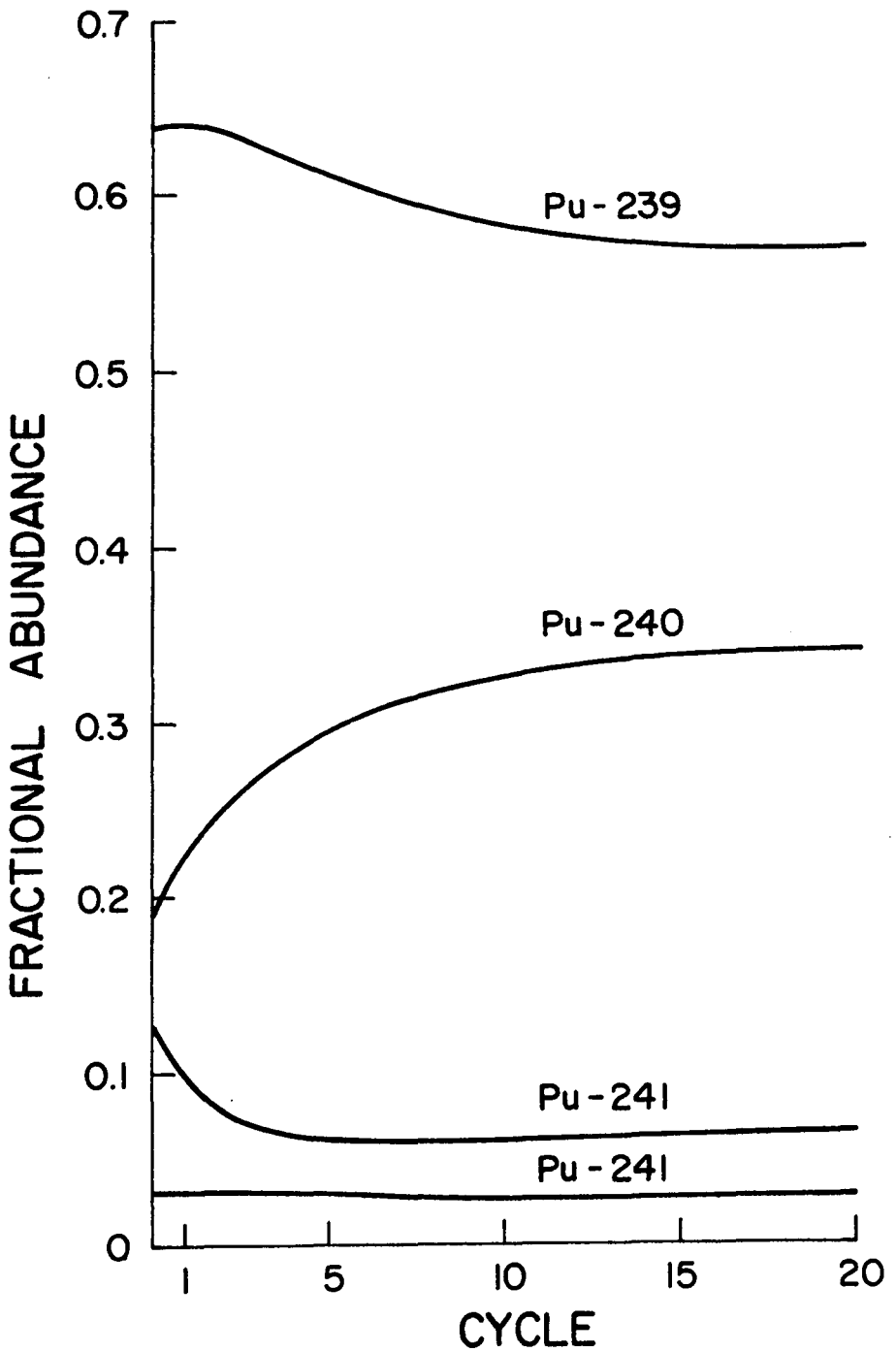

FIG. 19. Pu ISOTOPE DISTRIBUTION

V. CONCLUSIONS AND COMMENTS

The conversion properties of closely packed lattices makes them an attractive prospect for the use of plutonium. In the case of existing P.W.R.'s, replacement cores could most likely be fabricated with only minor extrapolations in current techniques. In the case of the D_2O-H_2O breeder, much more analysis is necessary before any conclusions can be reached, but the neutronics properties of the core studied here are encouraging. The potential impact of this type of reactor on the future supplies of fissionable material is quite large. It is conceivable that breeding ratios comparable to LMFBR's could be attained with the use of technology most of which, is already in existence. Considerable operating experience with light and heavy water systems has already been accumulated. The use of tightly packed lattices and H_2O-D_2O mixtures merely represents modifications of existing designs. Thus the time required to develop this concept would most likely be considerably less than that needed to bring the LMFBR to a commercially viable status. This is an important consideration since the impact of breeder reactors on uranium demand curves is strongly influenced by their date of introduction.

The calculations presented here demonstrate that close packed lattices have many favorable characteristics for the use of plutonium fuel to generate electricity. It is hopeful that further research will demonstrate the usefulness of this concept.

VI. LITERATURE CITED

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VII. APPENDIX

1. Listing of FASCON-2
2. Listing of FUELBURN
3. Listing of FUELBURN-FASCON Linkage
4. FASCON Output - H_2O
5. FUELBURN Out - H_2O
6. FASCON Output - D_2O-H_2O
7. FUELBURN-FASCON Linkage Output
8. ODMUG Output

1. Listing of FASCON-2

```
C                                   FASCON 2                                    A   3
C                                                                               A   4
      IMPLICIT REAL*4(A-H,M-Z)                                                  A   5
      REAL KAPPA(6),KSIGF(3),KSIGF1                                             A   6
      DIMENSION XSF(14,34), XSI(14,34), XXF(14,34), XXA(14,34), XDS(9,34        A   7
     1,34)                                                                      A   8
      DIMENSION MU(14,34), ZYF(14,34), NU(6,34), SO(34), A(14), NAME(28)        A   9
      DIMENSION SUMA(34), SUMFS(34), SUMIS(34), SUMNF(34), SUMKF(34)            A  10
      DIMENSION D(34), BETA(34), GAMMA(34), TERM3(34), TOTAL(34), ELETH(        A  11
     134)                                                                       A  12
      DIMENSION PHI(34), PHIU(34), QF(34), APHI(34), DBSQPH(34), DBSQFI(        A  13
     13)                                                                        A  14
      DIMENSION ENPHI(34), FKPHI(34), SIGRF(3), SIGR(3), SIGR2(3), NSIGF        A  15
     1(3)                                                                       A  16
      DIMENSION PHIM(3), APHIM(3), ENPHIM(3), FKPHIM(3), DM(3), DF(3), S        A  17
     1IGA(3)                                                                    A  18
      DIMENSION FRCDN(14),BILBO(14),P(34),ABS(14,34),FIS(14,34)
      DIMENSION XDS1(34,34),SXA(14,34),SXF(14,34),SSF(14,34),SSI(14,34)
      DIMENSION XA(14,3),XF(14,3),XC(14,3),SDS(9,15,15)
C                                                                               A  19
C           SECTION FOR INPUT AND INITIALIZATION OF DATA                        A  20
C                                                                               A  21
      DATA KAPPA/3.12E-11,3.09E-11,2*3.24E-11,3.27E-11,0.0/                     A  22
      DATA XXF/476*0.0/,NU/204*0.0/,XDS/10404*0.0/                              B  22
      DATA SO/34*0.0/
      DATA P/18*1.0,0.989,0.905,0.993,0.984,0.952,0.956,1.0,0.891,0.895,
     11.0,0.675,5*1.0/
      DO 1 I=1,14                                                               A  25
      DO 1 J=1,34                                                               A  26
      READ (5,36) XXA(I,J),XSF(I,J),XSI(I,J),MU(I,J),ZYF(I,J)                   A  27
1     CONTINUE                                                                  A  28
      DO 2 I=1,3                                                                A  29
```

```
      DO 80 J=1,31,3
      READ (5,37) XXF(I,J),NU(I,J),XXF(I,J+1),NU(I,J+1),XXF(I,J+2),NU(I,    A  31
     1J+2)                                                                   A  32
   80 CONTINUE
      READ(5,37) XXF(I,34),NU(I,34)
 2    CONTINUE                                                               A  33
      READ (5,26) (SC(I),I=1,18)                                             A  34
      READ (5,30) (((XOS(I,J,K),K=2,15),J=1,15),I=1,9)                       A  35
      READ (5,45) (NAME(I),I=1,28)                                           A  36
  116 CONTINUE
      IA = 0
      DO 105 J=1,34
      SUMXF(J) = 0.0
      SUMNF(J) = 0.0
  105 CONTINUE
      DO 106  K=1,2
      SIGXF(K) = 0.0
      SIGR(K) = 0.0
      SIGR2(K) = 0.0
  106 CONTINUE
      READ (5,33) A                                                          A  37
      IF(A(1).EQ.10.0)GO TO 117
      READ (5,34) BGSQ,BGSQI,IB,IC                                           A  38
      WRITE (6,48)                                                           A  39
      WRITE (6,35)                                                           A  40
      DO 3 I=1,14                                                            A  41
      IS=2*I-1                                                               A  42
      II=2*I                                                                 A  43
      WRITE (6,32) NAME(IS),NAME(II),A(I)                                    A  44
 3    CONTINUE                                                               A  45
      IF (IC.GT.0) GO TO 8                                                   A  46
      WRITE (6,53)                                                           A  47
```

```
      DO 4 I=1,18                                                        A  48
      WRITE (6,54) I,SC(I)                                               A  49
4     CONTINUE                                                           A  50
      DO 5 I=1,9                                                         A  51
      IS=2*I-1                                                           A  52
      IT=2*I                                                             A  53
      WRITE (6,46) NAME(IS),NAME(IT)                                     A  54
      DO 5 J=1,15                                                        A  55
      WRITE (6,47) (XDS(I,J,K),K=1,15)                                   A  56
5     CONTINUE                                                           A  57
      DO 6 I=1,6                                                         A  58
      IS=2*I-1                                                           A  59
      IT=2*I                                                             A  60
      WRITE (6,50) NAME(IS),NAME(IT)                                     A  61
      DO 6 J=1,34                                                        A  62
      WRITE (6,49) J,XXA(I,J),XXF(I,J),XSE(I,J),XSI(I,J),NU(I,J),MU(I,J) A  63
     1,ZYE(I,J)                                                          A  64
6     CONTINUE                                                           A  65
      DO 7 I=7,14                                                        A  66
      IS=2*I-1                                                           A  67
      IT=2*I                                                             A  68
      WRITE (6,51) NAME(IS),NAME(IT)                                     A  69
      DO 7 J=1,34                                                        A  70
      WRITE (6,52) J,XXA(I,J),XSF(I,J),XSI(I,J),MU(I,J),ZYE(I,J)         A  71
7     CONTINUE                                                           A  72
8     CONTINUE                                                           A  73
C                                                                        A  74
C                  OBTAIN MACROSCOPIC CROSS SECTIONS                     A  75
C                                                                        A  76
      DO 10 J=1,34                                                       A  77
      DO 9 I=1,14                                                        A  78
      SXA(I,J) = XXA(I,J)
```

```
      SXF(I,J) = XXF(I,J)
      SSF(I,J) = XSF(I,J)
      SSI(I,J) = XSI(I,J)
      XXA(I,J)=XXA(I,J)*A(I)                                          A  79
      XSF(I,J)=XSF(I,J)*A(I)                                          A  80
      XSI(I,J)=XSI(I,J)*A(I)                                          A  81
    9 CONTINUE                                                        A  82
      DO 10 I=1,6                                                     A  83
      XXF(I,J)=XXF(I,J)*A(I)                                          A  84
   10 CONTINUE                                                        A  85
      DO 11 I=1,9                                                     A  86
      DO 11 J=1,15                                                    A  87
      DO 11 K=1,15                                                    A  88
      SDS(I,J,K) = XDS(I,J,K)
      XDS(I,J,K)=XDS(I,J,K)*A(I)                                      A  89
   11 CONTINUE                                                        A  90
C                                                                     A  91
C                  SUM MACROSCOPIC CROSS SECTIONS                     A  92
C                  OF ALL ELEMENTS FOR EACH MICRO-GROUP               A  93
C                                                                     A  94
   12 CONTINUE                                                        A  95
      IA=IA+1                                                         A  96
      WRITE (6,57) IA                                                 A  97
      WRITE (6,39)                                                    A  98
      IF (IA.NE.1) GO TO 15                                           A  99
      DO 13 J=1,34                                                    A 100
      DO 13 I=1,6                                                     A 101
      SUMKF(J)=SUMKF(J)+XXF(I,J)*KAPPA(I)                             A 102
      SUMNF(J)=SUMNF(J)+XXF(I,J)*NU(I,J)                              A 103
   13 CONTINUE                                                        A 104
      DO 14 J=1,34
      DO 14 K=1,34
```

```
      XDSI(K,J) =0.0                                                    A 110
      DO 14 I=1,9                                                       A 112
      XDSI(K,J) = XDSI(K,J)+XDS(I,K,J)                                  A 113
14    CONTINUE                                                          A 114
      DO 21 J=1,34                                                      A 115
      SUMA(J)=0.0                                                       A 116
      SUMFS(J)=0.0                                                      A 117
      SUMIS(J)=0.0                                                      A 119
      TERM3(J)=0.0                                                      A 120
      BETA(J)=0.0                                                       A 121
      DO 15 I=1,14                                                      A 122
      SUMA(J)=SUMA(J)+XXA(I,J)                                          A 123
      SUMFS(J)=SUMFS(J)+XSF(I,J)                                        A 124
      SUMIS(J)=SUMIS(J)+XSI(I,J)                                        A 125
      TERM3(J)=TERM3(J)+(1.0-MU(I,J))*XSF(I,J)                          A 156
      BETA(J)=BETA(J)+ZYF(I,J)*XSF(I,J)                                 A 111
15    CONTINUE                                                          A 126
C                                                                       A 127
C               CALCULATE DIFFUSION COEFFICIENT, MICRO-GROUP FLUX,      A 128
C               NEUTRON DENSITY AND SLOWING DOWN DENSITY                A 129
C                                                                       A 118
      DO 200 J=1,34                                                     A 130
      TOTAL(J)=0.0                                                      A 131
      D(J)=1.0/(3.0*(SUMA(J)+SUMIS(J)+TERM3(J)))                        A 133
      GAMMA(J)=D(J)*BGSQ+SUMA(J)+SUMIS(J)                               A 134
      IF (J.GT.1) GO TO 17                                              A 135
      PHI(J)=SQ(J)/(GAMMA(J)+4.0*BETA(J))                               A 136
      PHIU(1)=4.0*PHI(1)                                                A 137
```

```
      QF(1)=BETA(1)*PHIU(1)                                                A 136
      GO TO 20                                                             A 137
17    CONTINUE                                                             A 138
      JJ=J-1                                                               A 140
      DO 18 K=1,JJ                                                         A 142
      TOTAL(J)=TOTAL(J)+XSSI(K,J) *PHI(K)                                  A 143
18    CONTINUE                                                             A 144
19    CONTINUE                                                             A 145
      PHI(J)=(SO(J)+TOTAL(J)+(BETA(J)+BETA(JJ))*PHIU(JJ))/(GAMMA(J)+(4.0   A 146
     1*BETA(J)))                                                           A 147
      PHIU(J)=(4.0*PHI(J))-PHIU(JJ)                                        A 148
      QF(J)=BETA(J)*PHIU(J)                                                A 149
20    CONTINUE                                                             A 150
      APHI(J)=SUMA(J)*PHI(J)                                               A 151
      FNPHI(J)=SUMNF(J)*PHI(J)                                             A 152
      FKPHI(J)=SUMKF(J)*PHI(J)                                             A 153
      D2SQPH(J)=D(J)*BCSQ*PHI(J)                                           A 154
      WRITE (6,40) J,PHI(J),APHI(J),FNPHI(J),D2SQPH(J)                     A 155
 200  CONTINUE
C                                                                          A 157
C                          THREE GROUP CALCULATIONS                        A 158
C                                                                          A 159
      WRITE (6,58)                                                         A 160
      IG=1                                                                 A 161
      IH=10
      DO 23 I=1,3                                                          A 163
      PHIM(I)=0.0                                                          A 164
      APHIM(I)=0.0                                                         A 165
      DM(I)=0.0                                                            A 166
      FNPHIM(I)=0.0                                                        A 167
      FKPHIM(I)=0.0                                                        A 168
      DO 22 J=IG,IH                                                        A 169
```

```
      PHIM(I)=PHIM(I)+PHI(J)                                            A 170
      APHIM(I)=APHIM(I)+APHI(J)                                         A 171
      DM(I)=DM(I)+D(J)*PHI(J)                                           A 172
      ENPHIM(I)=ENPHIM(I)+ENPHI(J)                                      A 173
      EKPHIM(I)=EKPHIM(I)+EKPHI(J)                                      A 174
22    CONTINUE                                                          A 175
      IG=IH+1                                                           A 176
      IF (I.EQ.1) IH=17
      IF (I.EQ.2) IH=34                                                 A 178
      SIGA(I)=APHIM(I)/PHIM(I)                                          A 179
      DF(I)=DM(I)/PHIM(I)                                               A 180
      NSIGF(I)=ENPHIM(I)/PHIM(I)                                        A 181
      KSIGF(I)=EKPHIM(I)/PHIM(I)                                        A 182
      BSQFI(I)=DM(I)*BGSQ                                               A 183
      WRITE (6,40) I,PHIM(I),APHIM(I),ENPHIM(I),BSQFI(I)                A 184
23    CONTINUE                                                          A 185
C                                                                       A 186
C                          REMOVAL CROSS SECTIONS                       A 187
      SUM12=0.0                                                         A 188
      SUM13=0.0                                                         A 189
      SUM23=0.0                                                         A 190
      DC=0.0                                                            A 191
      SIGA1=0.0                                                         A 192
      NSIGF1=0.0                                                        A 193
      KSIGF1=0.0                                                        A 194
      ENUBR=0.0                                                         A 195
      FDENBR=0.0                                                        A 196
      EFENU=0.0                                                         A 197
      EFDEN=0.0                                                         A 198
C                                                                       A 199
      DO 100 I=1,10
      DO 24 K=11,17
```

```
      SUM12=SUM12+XDS1(J,K) *PHI(J)                                          A 202
24    CONTINUE                                                               A 203
      DO 100 K=16,34
100   SUM13 = SUM13+XDS1(J,K) *PHI(J)
      DO 26 K=18,34
      DO 26 J=11,17
      SUM23=SUM23+XDS1(J,K) *PHI(J)                                          A 209
26    CONTINUE                                                               A 210
      SIGRE(1)=DF(10)/PHIM(1)
      SIGRE(2)=DF(17)/PHIM(2)
      SIGR(1)=SIGRE(1)+SUM12/PHIM(1)                                         A 213
      SIGR(2)=SIGRE(2)+SUM23/PHIM(2)                                         A 214
      SIGR2(1)=SUM13/PHIM(1)                                                 A 215
      WRITE (6,41)                                                           A 216
      DO 27 I=1,3                                                            A 217
      WRITE (6,42) I,SIGA(I),NSIGF(I),SIGRE(I),SIGR(I),SIGR2(I),DF(I),KS     A 218
     1IGF(I)                                                                 A 219
27    CONTINUE                                                               A 220
C                                                                            A 221
C                          ONE GROUP CALCULATIONS                            A 222
C                                                                            A 223
      PHIMT=PHIM(1)+PHIM(2)+PHIM(3)                                          A 224
      DO 28 I=1,3                                                            A 225
      DC=DC+DF(I)*PHIM(I)/PHIMT                                              A 226
      SIGA1=SIGA1+SIGA(I)*PHIM(I)/PHIMT                                      A 227
      NSIGF1=NSIGF1+NSIGF(I)*PHIM(I)/PHIMT                                   A 228
      KSIGF1=KSIGF1+KSIGF(I)*PHIM(I)/PHIMT                                   A 229
28    CONTINUE                                                               A 230
      WRITE (6,55)                                                           A 231
      WRITE (6,56) PHIMT,DC,SIGA1,NSIGF1,KSIGF1                              A 232
C                                                                            A 233
C                    EFFECTIVE MULTIPLICATION FACTOR                         A 234
```

```
C                                                                       A 235
      DO 29 I=1,34                                                      A 236
      EFFNU=EFFNU+ENPHI(I)                                              A 237
      EFFDEN=EFFDEN+DBSQPH(I)+APHI(I)                                   A 238
29    CONTINUE                                                          A 239
      EFFK=EFFNU/EFFDEN                                                 A 240
      WRITE (6,45) BGSQ,EFFK                                            A 241
C                                                                       A 242
C                              BREEDING RATIO                           A 243
C                                                                       A 244
      IF (BGSQ.LT.0.0) GO TO 31                                         A 245
      DO 30 I=1,34                                                      A 246
      ENUBR = ENUBR+(XXA(2,I)-XXF(2,I)+XXA(4,I)-XXF(4,I))*PHI(I)
      EDENBR=EDENBR+(XXA(1,I)+XXA(3,I)+XXA(5,I))*PHI(I)                 A 248
30    CONTINUE                                                          A 249
      BR=ENUBR/EDENBR                                                   A 250
      WRITE (6,44) BR                                                   A 251
31    CONTINUE                                                          A 252
      DO 101  I=1,14
      BTLBD(I) = 0.0
      FRODD(I) = 0.0
101   CONTINUE
      DO 61 J=1,34
      DO 59 I=1,14
      ABS(I,J)= XXA(I,J) *PHI(J)
      FRODD(I) = FRODD(I)+ABS(I,J)
59    CONTINUE
      DO 60 I=1,6
      FIS(I,J) = XXF(I,J) *PHI(J)
      BTLBD(I) = BTLBD(I)+FIS(I,J)
60    CONTINUE
61    CONTINUE
```

```
      WRITE(6,62)
   62 FORMAT(1HO,21X,'ABSORTIONS BY ISOTOPE AND GROUP')
      WRITE(6,63) (NAME(I),NAME(I+1),I=1,19,2)
   63 FORMAT(1H ,'GROUP',4X,10(2A4,4X))
      DO 65 J=1,34
      WRITE(6,64) J,(ABS(I,J),I=1,10)
   64 FORMAT(1H ,I2,5X,10E12.4)
   65 CONTINUE
      J=99
      WRITE(6,64) J,(FRODD(I),I=1,10)
      WRITE(6,102)
  102 FORMAT(1H1)
      WRITE(6,63) (NAME(I),NAME(I+1),I=21,27,2)
      DO 105 J=1,34
      WRITE(6,64) J,(ABS(I,J),I=11,14)
  105 CONTINUE
      J=99
      WRITE(6,64) J,(FRODD(I),I=11,14)
      WRITE(6,66)
   66 FORMAT(1HO,21X,'FISSIONS BY ISOTOPE AND GROUP')
      DO 67 J=1,34
      WRITE(6,64) J,(FIS(I,J),I=1,6)
   67 CONTINUE
      J=99
      WRITE(6,64) J,(BILBO(I),I=1,6)
      IG = 1
      IH = 10
      DO 123 K=1,5
      DO 119 I=1,14
      XA(I,K) = 0.0
      XF(I,K) = 0.0
      XC(I,K) = 0.0
```

```
      DO 120 J=IC,IH
      IF(I.EQ.2)GO TO 127
      XA(I,K) = XA(I,K)+SXA(I,J)*PHI(J)
      GO TO 128
127   CONTINUE
      XA(I,K) = XA(I,K)+XXA(I,J)*PHI(J)/A(2)
128   CONTINUE
      IF(I.GT.6)GO TO 121
      XF(I,K) = XF(I,K)+SXF(I,J)*PHI(J)
      XC(I,K) = XA(I,K)-XF(I,K)
      GO TO 120
121   CONTINUE
      XC(I,K) = XA(I,K)
120   CONTINUE
      XC(I,K) = XC(I,K)/PHIM(K)
      XF(I,K) = XF(I,K)/PHIM(K)
      XA(I,K) = XA(I,K)/PHIM(K)
119   CONTINUE
      IC = IH+1
      IF(K.EQ.1) IH=17
      IF(K.EQ.2) IH=54
123   CONTINUE
      WRITE(6,532)
532   FORMAT(1H0,21X,'THREE GROUP MICROSCOPIC CROSS SECTIONS')
      WRITE (6,533)
533   FORMAT (1H0,11X,'SIG-A-1',5X,'SIG-A-2',5X,'SIG-A-3',5X,'SIG-C-1',
     1 5X,'SIG-C-2',5X,'SIG-C-3',5X,'SIG-F-1',5X,'SIG-F-2',5X,'SIG-F-3')
      DO 125 I=1,14
      IS=2*I-1
      IT=2*I
      IF(I.GT.6)GO TO 126
      WRITE(6,124)NAME(IS),NAME(IT),XA(I,1),XA(I,2),XA(I,3),XC(I,1),
```

```
     1XC(I,2),XC(I,3),XF(I,1),XF(I,2),XF(I,3)
      GO TO 125
  126 CONTINUE
      WRITE(6,124)NAME(IS),NAME(IT),XA(I,1),XA(I,2),XA(I,3)
  124 FORMAT('0',2A4,9E12.4)
  125 CONTINUE
      BOSQ=BGSQ+RGSQI                                                    A 253
      IF (IA.LT.IB) GO TO 12                                             A 254
      DO 112 J =1,24
      XXA(2,J) = XXA(2,J)-BETA(J)*(1.0-P(J))
  112 CONTINUE
      DO 110 J=1,34
      DO 109 I=1,14
      XXA(I,J) = SXA(I,J)
      XSE(I,J) = SSE(I,J)
      XSI(I,J) = SSI(I,J)
  109 CONTINUE
      DO 110 I=1,6
      XXF(I,J) = SXF(I,J)
  110 CONTINUE
      DO 111 I=1,9
      DO 111 J=1,15
      DO 111 K=1,15
      XOS(I,J,K) = SOS(I,J,K)
  111 CONTINUE
      GO TO 116
  117 CONTINUE
      STOP                                                               A 255
C                                                                        A 256
 32   FORMAT (15X,2A4,34X,F9.7)                                          A 257
 33   FORMAT (7F10.0)                                                    A 258
 34   FORMAT (2E12.5,2I2)                                                A 259
```

```
 35    FORMAT (//30X,13HTABLE OF DENSITIES//15X,4HNAME,38X,7HDENSITY,/57X      A 260
      1,9P(1/34-CM))                                                          A 261
 36    FORMAT (5E10.5)                                                         A 262
 37    FORMAT (6E10.0)                                                         A 263
 38    FORMAT (10E8.0)                                                         A 264
 39    FORMAT (2(/),34X,16H16 GROUP RESULTS,//,4X,5HGROUP,11X,4HFLUX,11X,      A 265
      110HSIG-A*FLUX,7X,13HNU*SIG-F*FLUX,6X,7HLEAKAGE,/,14X,16H(NEUT/CM*C     A 266
      2M*SEC),4X,13H(NEUT/CC*SEC),5X,13H(NEUT/CC*SEC),5X,13H(NEUT/CC*SEC)     A 267
      3,/)                                                                    A 268
 40    FORMAT (5X,I2,4(10X,F8.4))                                              A 269
 41    FORMAT (3(/),34X,17H3 GROUP CONSTANTS,//,4X,5HGROUP,4X,5HSIG-A,4X,      A 270
      18HNU*SIG-F,2X,7HSIG-R-F,4X,5HSIG-R,6X,9HSIG-R 1-3,5X,1HD,5X,11HKAP     A 271
      2PA*SIG-F)                                                              A 272
 42    FORMAT (5X,I2,2X,5(3X,F7.5),4X,F4.2,4X,F10.3)                           A 273
 43    FORMAT (//,5X,11HBUCKLING IS,F8.5,9X,3HK-EFF IS,F8.5)                   A 274
 44    FORMAT (1H+,54X,17HBREEDING RATIO IS,F6.3)                              A 275
 45    FORMAT (7((2A4),2X))                                                    A 276
 46    FORMAT (///,33X,27HDOWN SCATTERING MATRIX FOR ,2A4,/)                   A 277
 47    FORMAT (5X,15(F5.3,1X))                                                 A 278
 48    FORMAT (1H1,19X,37H********  INPUT INFORMATION  ********,6(/))          A 279
 49    FORMAT (5X,I2,7(2X,F8.4))                                               A 280
 50    FORMAT (6(/),30X,13HINPUT DATA FOR ,2A4,///,4X,5HGROUP,4X,3HXXA         A 281
      1,7X,3HXXF,7X,3HXSF,7X,3HXSI,7X,2HNU,8X,2HMU,8X,3HZYF,/,7X,4(6X,4H(     A 282
      28N))/)                                                                 A 283
 51    FORMAT (6(/),30X,13HINPUT DATA FOR ,2A4,///,4X,5HGROUP,8X,3HXXA         A 284
      1,11X,3HXSF,11X,3HXSI,11X,2HMU,12X,3HZYF,/,7X,3(10X,4H(8N))/)           A 285
 52    FORMAT (5X,I2,5(6X,F8.4))                                               A 286
 53    FORMAT (8(/),22X,33HNORMALIZED FISSION NEUTRON SOURCE///,15X,5HGRO      A 287
      1UP,37X,8HERACTION,/)                                                   A 288
 54    FORMAT (16X,I2,39X,F6.4)                                                A 289
 55    FORMAT (3(/),35X,15H1 GROUP RESULTS,//,5X,4HFLUX,14X,1HD,12X,5HSIG      A 290
      1-A,9X,3HNU*SIG-F,9X,11HKAPPA*SIG-F)                                    A 291
```

```
56    FORMAT (3X,2(F8.5,8X),2(F7.5,9X),F10.3)                                  A 292
57    FORMAT (1H1,17X,40H********  OUTPUT INFORMATION:  CASE NO. ,I2,10H      A 293
     1  ********,2(/))                                                         A 294
58    FORMAT (4(/),35X,15H3 GROUP RESULTS,//,4X,5HGROUP,11X,4HFLUX,11X,1     A 295
     10HSIG-A*FLUX,7X,13HNU*SIG-F*FLUX,8X,7HLEAKAGE,/,14X,16H(NEUT/CM*CM     A 296
     2*SEC),4X,15H(NEUT/CC*SEC),5X,15H(NEUT/CC*SEC),5X,15H(NEUT/CC*SEC),     A 297
     3/)                                                                     A 298
      END                                                                    A 299
```

2. Listing of FUELBURN

```
C                                                                       A    1
C                              MODULE FUEL BURN                         A    2
C                                                                       A    3
      IMPLICIT REAL*4(A-H,L-Z)                                          A    4
      REAL KI                                                           A    5
      DIMENSION XF5(3),XF6(3),XF8(3),XF9(3),XF0(3),XF1(3),XF2(3)        A    6
      DIMENSION XA5(3),XA6(3),XA8(3),XA9(3),XA0(3),XA1(3),XA2(3)        A    7
      DIMENSION XC5(3),XC6(3),XC8(3),XC9(3),XC0(3),XC1(3),XC2(3)        A    8
      DIMENSION SIGF5(3),SIGF6(3),SIGF8(3),SIGF9(3),SIGF0(3)            A    9
      DIMENSION SIGF1(3),SIGF2(3),SIGA5(3),SIGA6(3),SIGA8(3)            A   10
      DIMENSION SIGA9(3),SIGA0(3),SIGA1(3),SIGA2(3),SIGC5(3)            A   11
      DIMENSION SIGC6(3),SIGC8(3),SIGC9(3),SIGC0(3),SIGC1(3)            A   12
      DIMENSION M5(40),M6(40),M8(40),M9(40),M0(40),M1(40),M2(40)        A   13
      DIMENSION SIGFU(3),SIGFPU(3),NEUT(3),DF(3),SIGAT(3),SIGA3(3)      A   14
      DIMENSION TF(40),ET(40),SIGP(40),SIGR(3),SIGC2(3),BURN(40)        A   15
C                                                                       A   16
C                    READ AND WRITE INPUT INFORMATION                   A   17
C                                                                       A   18
      READ (5,32) M5(1),M6(1),M8(1),M9(1),M0(1),M1(1),M2(1)             A   19
      READ (5,34) SIGR(1),SIGR(2),DF(1),DF(2),DF(3),BG,JJ               A   20
      READ (5,33) P,FY13,FY23,TC,SIGA3(1),SIGA3(2),SIGA3(3),XAX         A   21
      READ (5,37) XASU2,XASU3,XANU2,XANU3,XASP2,XASP3,XANP2,XANP3       A   22
      WRITE (6,35)                                                      A   23
      WRITE (6,6)                                                       A   24
      WRITE (6,31) BG                                                   A   25
      WRITE (6,22) P                                                    A   26
      WRITE (6,20) FY13                                                 A   27
      WRITE (6,21) FY23                                                 A   28
      WRITE (6,30) SIGR(1),SIGR(2)                                      A   29
      WRITE (6,38) SIGA3(1),SIGA3(2),SIGA3(3)                           A   30
      WRITE (6,29) DF(1),DF(2),DF(3)                                    A   31
      WRITE (6,17)                                                      A   32
```

```
      WRITE (6,18)                                                          A  33
      WRITE (6,19) M5(1),M6(1),M8(1),M9(1),M0(1),M1(1),M2(1)                A  34
      WRITE (6,16)                                                          A  35
      DO 1 I=1,3                                                            A  36
      READ (5,32) XF5(I),XF6(I),XF8(I),XF9(I),XF0(I),XF1(I),XF2(I)          A  37
      READ (5,32) XC5(I),XC6(I),XC8(I),XC9(I),XC0(I),XC1(I),XC2(I)          A  38
      READ (5,32) XA5(I),XA6(I),XA8(I),XA9(I),XA0(I),XA1(I),XA2(I)          A  39
      WRITE (6,25) I                                                        A  40
      WRITE (6,26) XF5(I),XF6(I),XF8(I),XF9(I),XF0(I),XF1(I),XF2(I)         A  41
      WRITE (6,27) XC5(I),XC6(I),XC8(I),XC9(I),XC0(I),XC1(I),XC2(I)         A  42
      WRITE (6,28) XA5(I),XA6(I),XA8(I),XA9(I),XA0(I),XA1(I),XA2(I)         A  43
1     CONTINUE                                                              A  44
      WRITE (6,36) XASU2,XASU3,XANU2,XANU3,XASP2,XASP3,XANP2,XANP3,XAX      A  45
      WRITE (6,23)                                                          A  46
      AVO=0.6025E24                                                         A  47
      NSU=0.0                                                               A  48
      NNU=0.0                                                               A  49
      NSPU=0.0                                                              A  50
      NNPU=0.0                                                              A  51
      PHIS=M5(1)                                                            A  52
      BURNT=0.0                                                             A  53
      LAMDI=1.66E-09                                                        A  54
C                                                                           A  55
C                  FLUX-WEIGHTED MICROSCOPIC CROSS SECTIONS                 A  56
C                                                                           A  57
      BETA5=(XF5(1)*FY13+XF5(2)*FY23+XF5(3))*8.0E10                         A  58
      BETA8=(XF8(1)*FY13+XF8(2)*FY23+XF8(3))*7.8E10                         A  59
      BETA9=(XF9(1)*FY13+XF9(2)*FY23+XF9(3))*8.2E10                         A  60
      BETA1=(XF1(1)*FY13+XF1(2)*FY23+XF1(3))*8.2E10                         A  61
      FY5=P/(BETA5*M5(1)+BETA8*M8(1)+BETA9*M9(1)+BETA1*M1(1))               A  62
      MU5=XA5(1)*FY13+XA5(2)*FY23+XA5(3)                                    A  63
      MU6=XA6(1)*FY13+XA6(2)*FY23+XA6(3)                                    A  64
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```
      MU6=XA6(1)*FY12+XA6(2)*FY23+XA6(3)                                    A  65
      MU9=XA9(1)*FY13+XA9(2)*FY23+XA9(3)                                    A  66
      MU0=XA0(1)*FY13+XA0(2)*FY23+XA0(3)                                    A  67
      MU1=XA1(1)*FY13+XA1(2)*FY23+XA1(3)+LAMD1/FY3                          A  68
      MU2=XA2(1)*FY13+XA2(2)*FY23+XA2(3)                                    A  69
      GAM5=XC5(1)*FY13+XC5(2)*FY23+XC5(3)                                   A  70
      GAM8=XC8(1)*FY13+XC8(2)*FY23+XC8(3)                                   A  71
      GAM9=XC9(1)*FY13+XC9(2)*FY23+XC9(3)                                   A  72
      GAM1=XC1(1)*FY13+XC1(2)*FY23+XC1(3)                                   A  73
      JT=JJ+1                                                               A  74
C                                                                           A  75
C                  FUEL BURNUP CALCULATIONS                                 A  76
C                                                                           A  77
      DO 5 J=2,JT                                                           A  78
      K=J-1                                                                 A  79
      FY3=P/(BETA5*M5(K)+BETA8*M8(K)+BETA9*M9(K)+BETA1*M1(K))               A  80
      THETA=FY3*T0*3600.                                                    A  81
      EX5=EXP(-MU5*THETA)                                                   A  82
      EX6=EXP(-MU6*THETA)                                                   A  83
      EX8=EXP(-MU8*THETA)                                                   A  84
      EX9=EXP(-MU9*THETA)                                                   A  85
      EX0=EXP(-MU0*THETA)                                                   A  86
      EX1=EXP(-MU1*THETA)                                                   A  87
      EX2=EXP(-MU2*THETA)                                                   A  88
      A1=(GAM5*M5(K))/(MU6-MU5)                                             A  89
      A2=(GAM8*M8(K))/(MU9-MU8)                                             A  90
      A3=M0(K)+(GAM9*GAM8*M8(K))/((MU0-MU9)*(MU9-MU8))+(GAM9*M9(K))/(MU9    A  91
     1-MU0)+(GAM8*GAM9*M8(K))/((MU8-MU0)*(MU9-MU8))                         A  92
      A4=(GAM9/(MU0-MU9))*(M9(K)+(GAM8*M8(K))/(MU8-MU9))                    A  93
      A5=GAM9*GAM8*M8(K)/((MU0-MU8)*(MU9-MU8))                              A  94
      A6=M1(K)+(MU0/(MU0-MU1))*A3+(MU0/(MU9-MU1))*A4+(MU0/(MU8-MU1))*A5     A  95
      A7=(MU0/(MU1-MU0))*A3                                                 A  96
```

```
      A8=(MU0/(MU1-MU9))*A4                                                A  97
      A9=(MU0/(MU1-MU8))*A5                                                A  98
      A10=M2(K)+((GAM1*A6)/(MU1-MU2))+((GAM1*A7)/(MU0-MU2))+((GAM1*A8)/(   A  99
     1MU9-MU2))+((GAM1*A9)/(MU8-MU2))                                      A 100
      A11=(GAM1*A6)/(MU2-MU1)                                              A 101
      A12=(GAM1*A7)/(MU2-MU0)                                              A 102
      A13=(GAM1*A8)/(MU2-MU9)                                              A 103
      A14=(GAM1*A9)/(MU2-MU8)                                              A 104
      M5(J)=M5(K)*EX5                                                      A 105
      M6(J)=(M6(K)-A1)*EX6+A1*EX5                                          A 106
      M8(J)=M8(K)*EX8                                                      A 107
      M9(J)=(M9(K)-A2)*EX9+A2*EX8                                          A 108
      M0(J)=A3*EX0+A4*EX9+A5*EX8                                           A 109
      M1(J)=A6*EX1+A7*EX0+A8*EX9+A9*EX8                                    A 110
      M2(J)=A10*EX2+A11*EX1+A12*EX0+A13*EX9+A14*EX8                        A 111
      Y5=(BETA5*M5(K))/MU5                                                 A 112
      Y8=BETA8*M8(K)/MU8-GAM8*M8(K)*BETA9/((MU8-MU9)*MU8)+BETA1*A9/MU8     A 113
      Y9=(M9(K)+(GAM8*M8(K))/(MU8-MU9))*(BETA9/MU9)+A8*BETA1/MU9           A 114
      Y0=A7*BETA1/MU0                                                      A 115
      Y1=A6*BETA1/MU1                                                      A 116
      BT(J)=(Y5*(1.-EX5)+Y8*(1.-EX8)+Y9*(1.-EX9)+Y0*(1.-EX0)+Y1*(1.-EX1)   A 117
     1)/3600.                                                              A 118
      BURN(J)=BT(J)/(24.*(M5(1)+M6(1)+M8(1)+M9(1)+M0(1)+M1(1)+M2(1)))      A 119
      TF(J)=TO*(J-1)                                                       A 120
      BURNT=BURNT+BURN(J)                                                  A 121
      XICR=(GAM8*M8(J)+MU0*M0(J))/(MU5*M5(J)+MU9*M9(J)+MU1*M1(J))          A 122
C                                                                          A 123
C                          MACROSCOPIC CROSS SECTIONS                      A 124
C                                                                          A 125
      DO 4 I=1,5                                                           A 126
      SIGF5(I)=XF5(I)*M5(J)*AVO/235.                                       A 127
      SIGA5(I)=XA5(I)*M5(J)*AVO/235.                                       A 128
```

```
      SIGC5(I)=XC5(I)*M5(J)*AVO/235.                                    A 129
      SIGF6(I)=XF6(I)*M6(J)*AVO/236.                                    A 130
      SIGA6(I)=XA6(I)*M6(J)*AVO/236.                                    A 131
      SIGC6(I)=XC6(I)*M6(J)*AVO/236.                                    A 132
      SIGF8(I)=XF8(I)*M8(J)*AVO/238.                                    A 133
      SIGA8(I)=XA8(I)*M8(J)*AVO/238.                                    A 134
      SIGC8(I)=XC8(I)*M8(J)*AVO/238.                                    A 135
      SIGF9(I)=XF9(I)*M9(J)*AVO/239.                                    A 136
      SIGA9(I)=XA9(I)*M9(J)*AVO/239.                                    A 137
      SIGC9(I)=XC9(I)*M9(J)*AVO/239.                                    A 138
      SIGF0(I)=XF0(I)*M0(J)*AVO/240.                                    A 139
      SIGA0(I)=XA0(I)*M0(J)*AVO/240.                                    A 140
      SIGC0(I)=XC0(I)*M0(J)*AVO/240.                                    A 141
      SIGF1(I)=XF1(I)*M1(J)*AVO/241.                                    A 142
      SIGA1(I)=XA1(I)*M1(J)*AVO/241.                                    A 143
      SIGC1(I)=XC1(I)*M1(J)*AVO/241.                                    A 144
      SIGF2(I)=XF2(I)*M2(J)*AVO/242.                                    A 145
      SIGA2(I)=XA2(I)*M2(J)*AVO/242.                                    A 146
      SIGC2(I)=XC2(I)*M2(J)*AVO/242.                                    A 147
      IF (J.GT.2) GO TO 3                                               A 148
      IF (I.GT.1) GO TO 2                                               A 149
      WRITE (6,24)                                                      A 150
2     CONTINUE                                                          A 151
      WRITE (6,25) I                                                    A 152
      WRITE (6,26) SIGF5(I),SIGF6(I),SIGF8(I),SIGF9(I),SIGF0(I),SIGF1(I)  A 153
     1,SIGF2(I)                                                         A 154
      WRITE (6,27) SIGC5(I),SIGC6(I),SIGC8(I),SIGC9(I),SIGC0(I),SIGC1(I)  A 155
     1,SIGC2(I)                                                         A 156
      WRITE (6,28) SIGA5(I),SIGA6(I),SIGA8(I),SIGA9(I),SIGA0(I),SIGA1(I)  A 157
     1,SIGA2(I)                                                         A 158
3     CONTINUE                                                          A 159
      SIGF0(I)=SIGF5(I)+SIGF8(I)                                        A 160
```

```
      SIGFPU(I)=SIGF9(I)+SIGF1(I)                                       A 161
      SIGAT(I)=SIGA5(I)+SIGA6(I)+SIGA8(I)+SIGA9(I)+SIGA0(I)+SIGA1(I)+SIG A 162
     1A2(I)+SIGA3(I)                                                    A 163
4     CONTINUE                                                          A 164
C                                                                       A 165
C                          FISSION PRODUCTS                             A 166
C                                                                       A 167
      FU=(SIGFU(1)*FY13+SIGFU(2)*FY23+SIGFU(3))*FY3                     A 168
      FPU=(SIGFPU(1)*FY13+SIGFPU(2)*FY23+SIGFPU(3))*FY3                 A 169
      SIGXE=XAX*(0.065*FU+0.072*FPU)/(2.11E-05+XAX*FY3)                 A 170
      SIGSM=(0.011*FU+0.013*FPU)/FY3                                    A 171
      SIGSM = 0.0
      MUSU=XASU2*FY23+XASU3                                             A 172
      MUNU=XANU2*FY23+XANU3                                             A 173
      MUSP=XASP2*FY23+XASP3                                             A 174
      MUNP=XANP2*FY23+XANP3                                             A 175
      NSU=(0.576*FU/(MUSU*FY3))*(1.-EXP(-MUSU*FY3*TO*3600.))+NSU        A 177
      NNU=1.543*FU*TO*3600.+NNU                                         A 178
      NSPU=(0.401*FPU/(MUSP*FY3))*(1.-EXP(-MUSP*FY3*TO*3600.))+NSPU     A 179
      NNPU=1.501*FPU*TO*3600.+NNPU                                      A 180
      SIGFP2=NSU*XASU2+NNU*XANU2+NSPU*XASP2+NNPU*XANP2                  A 181
      SIGFP3=NSU*XASU3+NNU*XANU3+NSPU*XASP3+NNPU*XANP3                  A 182
C                                                                       A 183
C                          CONTROL  POISON                              A 184
C                                                                       A 185
      LOSS1=DF(1)*BG+SIGAT(1)+SIGR(1)                                   A 186
      LOSS2=DF(2)*BG+SIGAT(2)+SIGR(2)+SIGFP2                            A 187
      LOSS3=DF(3)*BG+SIGAT(3)+SIGXE+SIGSM+SIGFP3                        A 188
      NEUT(1)=2.58*SIGF5(1)+2.60*SIGF8(1)+3.05*SIGF9(1)+3.18*SIGF1(1)   A 189
     1 +2.97*SIGF0(1)+3.23*SIGF2(1)
      NEUT(2)=2.44*SIGF5(2)+2.89*SIGF9(2)+3.02*SIGF1(2)                 A 190
     1 +2.87*SIGF0(2)+3.12*SIGF2(2)
```

```
      NEUT(3)=2.44*SIGF5(3)+2.89*SIGF9(3)+3.02*SIGF1(3)+2.87*SIGF0(3)      A 191
      SIGP(J)=(NEUT(3)*SIGP(1)*SIGR(2)/(1.0040*LOSS1*LOSS2-NEUT(1)*LOSS2   A 192
     1-NEUT(2)*SIGR(1)))-LOSS3                                             A 193
C                                                                          A 194
C                          CALCULATION OF K-INFINITE (KI)                  A 195
C                                                                          A 196
      KI=(NEUT(1)*(SIGAT(2)+SIGFP2+SIGR(2))*(SIGAT(3)+SIGFP3+SIGXE+SIGSM   A 197
     1)+NEUT(2)*SIGR(1)*(SIGAT(3)+SIGFP3+SIGXE+SIGSM)+NEUT(3)*SIGR(1)*SI  A 198
     2GR(2))/((SIGAT(1)+SIGR(1))*(SIGAT(2)+SIGFP2+SIGR(2))*(SIGAT(3)+SIG  A 199
     3FP3+SIGXE+SIGSM))                                                    A 200
C                                                                          A 201
C                             OUTPUT INFORMATION                           A 202
C                                                                          A 203
      WRITE (6,7) K,KI,SIGP(J)                                             A 204
      WRITE (6,8) FY3                                                      A 205
      WRITE (6,9) M5(J),THETA                                              A 206
      WRITE (6,10) M6(J),XTCR                                              A 207
      WRITE (6,11) M8(J),BURN(J)                                           A 208
      WRITE (6,12) M9(J),BURNT                                             A 209
      WRITE (6,13) M0(J),FT(J)                                             A 210
      WRITE (6,14) M1(J),TF(J)                                             A 211
      WRITE (6,15) M2(J),TO                                                A 212
5     CONTINUE                                                             A 213
6     FORMAT (44H  ********** INPUT INFORMATION **********)                A 215
7     FORMAT (//28H DATA AT END OF TIME STEP  #,I3,8X,4HK = ,F5.3,11X,6H   A 216
     1SIGP =,F8.5)                                                         A 217
8     FORMAT (10HO ISOTOPES,7X,13HDENSITY(KG/L),6X,14HTHERMAL FLUX =,E11   A 218
     1.3,3X,11H1/SEC*CM**2)                                                A 219
9     FORMAT (3X,5HU-235,10X,E10.3,8X,17HTHERMAL FLUENCE =,E12.3,3X,7H1/   A 220
     1CM**2)                                                               A 221
10    FORMAT (3X,5HU-236,10X,E10.3,8X,32HINSTANTANEOUS CONVERSION RATIO    A 222
     1=,F6.3)                                                              A 223
```

```
11    FORMAT (3X,5HU-238,10X,F10.3,8X,18HBURNUP THIS STEP =,F7.0,3X,6HMW      A 224
     1D/MT)                                                                  A 225
12    FORMAT (3X,6HPU-239,9X,F10.3,8X,14HTOTAL BURNUP =,F8.0,3X,6HMWD/MT      A 226
     1)                                                                      A 227
13    FORMAT (3X,6HPU-240,9X,F10.3,8X,17HENERGY DENSITY IS,F8.0,3X,7HKW-      A 228
     1HR/L)                                                                  A 229
14    FORMAT (3X,6HPU-241,9X,F10.3,8X,17HTIME STEP ENDS AT,F9.0,3X,5HHOU      A 230
     1RS)                                                                    A 231
15    FORMAT (3X,6HPU-242,9X,F10.3,8X,16HTIME STEP LENGTH,F7.0,3X,5HHOUR      A 232
     1S)                                                                     A 233
16    FORMAT (/22X,34HMICROSCOPIC CROSS SECTIONS (CM**2))                     A 234
17    FORMAT (34HO INITIAL ISOTOPE DENSITIES (KG/L))                          A 235
18    FORMAT (3X,6H U-235,7X,5HU-236,7X,5HU-238,7X,6HPU-239,6X,6HPU-240,      A 236
     16X,6HPU-241,6X,6HPU-242)                                               A 237
19    FORMAT (3X,7(F7.5,5X))                                                  A 238
20    FORMAT (41H  RATIO OF GROUP 1 FLUX TO THERMAL FLUX =,F5.2)              A 239
21    FORMAT (41H  RATIO OF GROUP 2 FLUX TO THERMAL FLUX =,F5.2)              A 240
22    FORMAT (24H  POWER DENSITY (KW/L) =,F7.2)                               A 241
23    FORMAT (//40H  ****** END OF INPUT INFORMATION ******/)                 A 242
24    FORMAT (/22X,33HMACROSCOPIC CROSS SECTIONS (1/CM),/)                    A 243
25    FORMAT (2X,5HGROUP,I2,7X,5HU-235,5X,5HU-236,5X,5HU-238,5X,6HPU-239      A 244
     1,4X,6HPU-240,4X,6HPU-241,4X,6HPU-242)                                  A 245
26    FORMAT (2X,7HFISSION,5X,7(F8.2,2X))                                     A 246
27    FORMAT (2X,7HCAPTURE,5X,7(F8.2,2X))                                     A 247
28    FORMAT (2X,10HABSORPTION,2X,7(F8.2,2X),/)                               A 248
29    FORMAT (29H  DIFFUSION COEFFICIENTS (CM),4X,7HDF(1) =,F6.3,5X,7HDF      A 249
     1(2) =,F6.3,5X,7HDF(3) =,F6.3)                                          A 250
30    FORMAT (31H  REMOVAL CROSS SECTIONS (1/CM),6X,10HSIGR(1) = ,F5.3,8      A 251
     1X,10HSIGR(2) = ,F5.3)                                                  A 252
31    FORMAT (13HO BUCKLING = ,F10.4,2X,7H1/CM**2)                            A 253
32    FORMAT (7F10.3)                                                         A 254
33    FORMAT (7F7.0,E12.5)                                                    A 255
```

```
34     FORMAT (6F10.3,I2)                                                    A 256
35     FORMAT (1H1)                                                          A 257
36     FORMAT (52H0 FISSION PRODUCT MICROSCOPIC CROSS SECTIONS (CM**2),/,    A 258
      12X,7HXASU2 =,E10.3,8X,7HXASU3 =,E10.3,/,2X,7HXANU2 =,E10.3,8X,7HXA    A 259
      2NU3 =,E10.3,/,2X,7HXASP2 =,E10.3,8X,7HXASP3 =,E10.3,/,2X,7HXANP2 =   A 260
      3,E10.3,8X,7HXANP3 =,E10.3,/,2X,5HXAX =,E10.3)                        A 261
37     FORMAT (8E10.3)                                                       A 262
38     FORMAT (34H  CLAD & COOLANT ABSORPTION (1/CM),1X,9HSIGA3(1)=,F6.4,    A 263
      11X,9HSIGA3(2)=,F6.4,1X,9HSIGA3(3)=,F6.4)                             A 264
       STOP                                                                 A 265
       END                                                                  A 266
```

3. Listing of FUELBURN-FASCON Linkage

```
C                                                                       A    1
C                       FUELBURN-FASCON LINKAGE
C                                                                       A    3
      IMPLICIT REAL*4(A-H,L-Z)                                          A    4
      COMMON I5(200),M8(200),M9(200),M0(200),M1(200),M2(200),SIGR(3),
     1DF(3),
     1FY13,FY23,SIGA3(3),XF5(3),XF8(3),XF9(3),XF0(3),XF1(3),XF2(3),
     2XC5(3),XC8(3),XC9(3),XC0(3),XC1(3),XC2(3),XA5(3),XA8(3),XA9(3),
     3XA0(3),XA1(3),XA2(3),KI,SIGFP2,SIGFP3,A(14),XICR
      REAL KI                                                           A    5
      DIMENSION SIGF5(3),SIGF6(3),SIGF8(3),SIGF9(3),SIGF0(3)            A    9
      DIMENSION SIGF1(3),SIGF2(3),SIGA5(3),SIGA6(3),SIGA8(3)            A   10
      DIMENSION SIGA9(3),SIGA0(3),SIGA1(3),SIGA2(3),SIGC5(3)            A   11
      DIMENSION SIGC6(3),SIGC8(3),SIGC9(3),SIGC0(3),SIGC1(3),M6(200)    A   12
      DIMENSION SIGFU(3),SIGFPU(3),NEUT(3)       ,SIGAT(3)
      DIMENSION  XF6(3),XC6(3),XA6(3)
      DIMENSION TF(200),ET(200),SIGP(200),SIGC2(3),BURN(200)
C                                                                       A   16
C                    READ AND WRITE INPUT INFORMATION                   A   17
C                                                                       A   18
      READ (5,32) M5(1),M6(1),M8(1),M9(1),M0(1),M1(1),M2(1)             A   19
      READ (5,34) SIGR(1),SIGR(2),DF(1),DF(2),DF(3),BG,JJ               A   20
      READ (5,33) P,FY13,FY23,T0,SIGA3(1),SIGA3(2),SIGA3(3),XAX         A   21
      READ (5,37) XASU2,XASU3,XANU2,XANU3,XASP2,XASP3,XANP2,XANP3        A   22
      WRITE (6,35)                                                      A   23
      WRITE (6,6)                                                       A   24
      WRITE (6,21) BG                                                   A   25
      WRITE (6,22) P                                                    A   26
      WRITE (6,20) FY13                                                 A   27
      WRITE (6,21) FY23                                                 A   28
      WRITE (6,30) SIGR(1),SIGR(2)                                      A   29
      WRITE (6,38) SIGA3(1),SIGA3(2),SIGA3(3)                           A   30
```

```
      WRITE (6,29) DF(1),DF(2),DF(3)                                    A  31
      WRITE (6,17)                                                      A  32
      WRITE (6,18)                                                      A  33
      WRITE (6,19) M5(1),M6(1),M8(1),M9(1),M0(1),M1(1),M2(1)            A  34
      WRITE (6,16)                                                      A  35
      DO 1 I=1,3                                                        A  36
      READ (5,32) XF5(I),XF6(I),XF8(I),XF9(I),XF0(I),XF1(I),XF2(I)      A  37
      READ (5,32) XC5(I),XC6(I),XC8(I),XC9(I),XC0(I),XC1(I),XC2(I)      A  38
      READ (5,32) XA5(I),XA6(I),XA8(I),XA9(I),XA0(I),XA1(I),XA2(I)      A  39
      WRITE (6,25) I                                                    A  40
      WRITE (6,26) XF5(I),XF6(I),XF8(I),XF9(I),XF0(I),XF1(I),XF2(I)     A  41
      WRITE (6,27) XC5(I),XC6(I),XC8(I),XC9(I),XC0(I),XC1(I),XC2(I)     A  42
      WRITE (6,28) XA5(I),XA6(I),XA8(I),XA9(I),XA0(I),XA1(I),XA2(I)     A  43
1     CONTINUE                                                          A  44
      WRITE (6,36) XASU2,XASU3,XANU2,XANU3,XASP2,XASP3,XANP2,XANP3,XAX  A  45
      WRITE (6,23)                                                      A  46
      A(9) = 0.03493
      A(10) = 0.001275
      A(11) = 0.005071
      AVO=0.6025E24                                                     A  47
      NSU=0.0                                                           A  48
      NNU=0.0                                                           A  49
      NSPU=0.0                                                          A  50
      NNPU=0.0                                                          A  51
      PHI5=M5(1)                                                        A  52
      BURNT=0.0                                                         A  53
      LAMD1=1.66E-09                                                    A  54
C                                                                       A  55
C                  FLUX-WEIGHTED MICROSCOPIC CROSS SECTIONS             A  56
C                                                                       A  57
      SFTA5=(XF5(1)*FY13+XF5(2)*FY23+XF5(3))*8.0E10                     A  58
      SFTA8=(XF8(1)*FY13+XF8(2)*FY23+XF8(3))*7.8E10                     A  59
```

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      BETA9=(XF9(1)*FY13+XF9(2)*FY23+XF9(3))*8.2E10                    A  60
      BETA1=(XF1(1)*FY13+XF1(2)*FY23+XF1(3))*8.2E10                    A  61
      FY3=P/(BETA5*M5(1)+BETA8*M8(1)+BETA9*M9(1)+BETA1*M1(1))          A  62
      MU5=XA5(1)*FY13+XA5(2)*FY23+XA5(3)                               A  63
      MU6=XA6(1)*FY13+XA6(2)*FY23+XA6(3)                               A  64
      MU8=XA8(1)*FY13+XA8(2)*FY23+XA8(3)                               A  65
      MU9=XA9(1)*FY13+XA9(2)*FY23+XA9(3)                               A  66
      MU0=XA0(1)*FY13+XA0(2)*FY23+XA0(3)                               A  67
      MU1=XA1(1)*FY13+XA1(2)*FY23+XA1(3)+LAMD1/FY3                     A  68
      MU2=XA2(1)*FY13+XA2(2)*FY23+XA2(3)                               A  69
      GAM5=XC5(1)*FY13+XC5(2)*FY23+XC5(3)                              A  70
      GAM8=XC8(1)*FY13+XC8(2)*FY23+XC8(3)                              A  71
      GAM9=XC9(1)*FY13+XC9(2)*FY23+XC9(3)                              A  72
      GAM1=XC1(1)*FY13+XC1(2)*FY23+XC1(3)                              A  73
      JT=JJ+1                                                          A  74
C                                                                      A  75
C                    FUEL BURNUP CALCULATIONS                          A  76
C                                                                      A  77
      KT = 1
      KJT = 0
      DO 5 J=2,JT                                                      A  78
      K=J-1                                                            A  79
      FY3=P/(BETA5*M5(K)+BETA8*M8(K)+BETA9*M9(K)+BETA1*M1(K))          A  80
      THETA=FY3*T0*3600.                                               A  81
      EX5=EXP(-MU5*THETA)                                              A  82
      EX6=EXP(-MU6*THETA)                                              A  83
      EX8=EXP(-MU8*THETA)                                              A  84
      EX9=EXP(-MU9*THETA)                                              A  85
      EX0=EXP(-MU0*THETA)                                              A  86
      EX1=EXP(-MU1*THETA)                                              A  87
      EX2=EXP(-MU2*THETA)                                              A  88
      A1=(GA15*M5(K))/(MU6-MU5)                                        A  89
```

```
      A2=(GAM3*M8(K))/(MU9-MU8)                                          A  90
      A3=M0(K)+(GAM9*GAM8*M8(K))/((MU0-MU9)*(MU9-MU8))+(GAM9*M9(K))/(MU9  A  91
     1-MU0)+(GAM8*GAM9*M8(K))/((MU8-MU0)*(MU9-MU8))                      A  92
      A4=(GAM9/(MU0-MU9))*(M9(K)+(GAM8*M8(K))/(MU8-MU9))                 A  93
      A5=GAM9*GAM8*M8(K)/((MU0-MU8)*(MU9-MU8))                           A  94
      A6=M1(K)+(MU0/(MU0-MU1))*A3+(MU0/(MU9-MU1))*A4+(MU0/(MU8-MU1))*A5  A  95
      A7=(MU0/(MU1-MU0))*A3                                              A  96
      A8=(MU0/(MU1-MU9))*A4                                              A  97
      A9=(MU0/(MU1-MU8))*A5                                              A  98
      A10=M2(K)+((GAM1*A6)/(MU1-MU2))+((GAM1*A7)/(MU0-MU2))+((GAM1*A8)/(  A  99
     1MU9-MU2))+((GAM1*A9)/(MU8-MU2))                                    A 100
      A11=(GAM1*A6)/(MU2-MU1)                                            A 101
      A12=(GAM1*A7)/(MU2-MU0)                                            A 102
      A13=(GAM1*A8)/(MU2-MU9)                                            A 103
      A14=(GAM1*A9)/(MU2-MU8)                                            A 104
C                          MACROSCOPIC CROSS SECTIONS                   A 124
C                                                                       A 125
      DO 4 I=1,3                                                         A 126
      SIGF5(I)=XF5(I)*M5(K)*AV0/235.                                     A 127
      SIGA5(I)=XA5(I)*M5(K)*AV0/235.                                     A 128
      SIGC5(I)=XC5(I)*M5(K)*AV0/235.                                     A 129
      SIGF6(I)=XF6(I)*M6(K)*AV0/236.                                     A 130
      SIGA6(I)=XA6(I)*M6(K)*AV0/236.                                     A 131
      SIGC6(I)=XC6(I)*M6(K)*AV0/236.                                     A 132
      SIGF8(I)=XF8(I)*M8(K)*AV0/238.                                     A 133
      SIGA8(I)=XA8(I)*M8(K)*AV0/238.                                     A 134
      SIGC8(I)=XC8(I)*M8(K)*AV0/238.                                     A 135
      SIGF9(I)=XF9(I)*M9(K)*AV0/239.                                     A 136
      SIGA9(I)=XA9(I)*M9(K)*AV0/239.                                     A 137
      SIGC9(I)=XC9(I)*M9(K)*AV0/239.                                     A 138
      SIGF0(I)=XF0(I)*M0(K)*AV0/240.                                     A 139
      SIGA0(I)=XA0(I)*M0(K)*AV0/240.                                     A 140
```

```
      SIGC0(I)=XC0(I)*M0(K)*AV0/240.                                    A 141
      SIGF1(I)=XF1(I)*M1(K)*AV0/241.                                    A 142
      SIGA1(I)=XA1(I)*M1(K)*AV0/241.                                    A 143
      SIGC1(I)=XC1(I)*M1(K)*AV0/241.                                    A 144
      SIGF2(I)=XF2(I)*M2(K)*AV0/242.                                    A 145
      SIGA2(I)=XA2(I)*M2(K)*AV0/242.                                    A 146
      SIGC2(I)=XC2(I)*M2(K)*AV0/242.                                    A 147
      IF (J.GT.2) GO TO 3                                               A 148
      IF (I.GT.1) GO TO 2                                               A 149
      WRITE (6,24)                                                      A 150
2     CONTINUE                                                          A 151
      WRITE (6,25) I                                                    A 152
      WRITE (6,26) SIGF5(I),SIGF6(I),SIGF8(I),SIGF9(I),SIGF0(I),SIGF1(I)  A 153
     1,SIGF2(I)                                                         A 154
      WRITE (6,27) SIGC5(I),SIGC6(I),SIGC8(I),SIGC9(I),SIGC0(I),SIGC1(I)  A 155
     1,SIGC2(I)                                                         A 156
      WRITE (6,28) SIGA5(I),SIGA6(I),SIGA8(I),SIGA9(I),SIGA0(I),SIGA1(I)  A 157
     1,SIGA2(I)                                                         A 158
3     CONTINUE                                                          A 159
      SIGFU(I)=SIGF5(I)+SIGF8(I)                                        A 160
      SIGFPU(I)=SIGF9(I)+SIGF1(I)                                       A 161
      SIGAT(I)=SIGA5(I)+SIGA6(I)+SIGA8(I)+SIGA9(I)+SIGA0(I)+SIGA1(I)+SIG  A 162
     1A2(I)+SIGA3(I)                                                    A 163
4     CONTINUE                                                          A 164
C                                                                       A 165
C                          FISSION PRODUCTS                             A 166
C                                                                       A 167
      FU=(SIGFU(1)*FY13+SIGFU(2)*FY23+SIGFU(3))*FY3                     A 168
      FPU=(SIGFPU(1)*FY13+SIGFPU(2)*FY23+SIGFPU(3))*FY3                 A 169
      SIGXE=XAX*(0.065*FU+0.072*FPU)/(2.11E-05+XAX*FY3)                 A 170
      SIGSM=(0.011*FU+0.013*FPU)/FY3                                    A 171
      SIGSM = 0.0
```

```
      MUSU=XASU2*FY23+XASU3                                                    A 172
      MUNU=XANU2*FY23+XANU3                                                    A 173
      MUSP=XASP2*FY23+XASP3                                                    A 174
      MUNP=XANP2*FY23+XANP3                                                    A 175
      NSU=(0.376*FU/(MUSU*FY3))*(1.-EXP(-MUSU*FY3*T0*3600.))+NSU               A 176
      NNU=1.543*FU*T0*3600.+NNU                                                A 178
      NSPU=(0.401*FPU/(MUSP*FY3))*(1.-EXP(-MUSP*FY3*T0*3600.))+NSPU            A 179
      NNPU=1.501*FPU*T0*3600.+NNPU                                             A 180
C                                                                              A 183
      A(13) = (NSU+NNU)*1.0E-24
      A(14) = (NSPU+NNPU)*1.0E-24
      M5(J)=M5(K)*EX5                                                          A 105
      M6(J)=(M6(K)-A1)*EX6+A1*EX5                                              A 106
      M8(J)=M8(K)*EX8                                                          A 107
      M9(J)=(M9(K)-A2)*EX9+A2*EX8                                              A 108
      M0(J)=A3*EX0+A4*EX9+A5*EX8                                               A 109
      M1(J)=A6*EX1+A7*EX0+A8*EX9+A9*EX8                                        A 110
      M2(J)=A10*EX2+A11*EX1+A12*EX0+A13*EX9+A14*EX8                            A 111
      CALL FASCON(J,0)
1000  CONTINUE
      BETA5=(XF5(1)*FY13+XF5(2)*FY23+XF5(3))*8.0E10                            A  58
      BETA8=(XF8(1)*FY13+XF8(2)*FY23+XF8(3))*7.8E10                            A  59
      BETA9=(XF9(1)*FY13+XF9(2)*FY23+XF9(3))*8.2E10                            A  60
      BETA1=(XF1(1)*FY13+XF1(2)*FY23+XF1(3))*8.2E10                            A  61
      FY3=P/(BETA5*M5(1)+BETA8*M8(1)+BETA9*M9(1)+BETA1*M1(1))                  A  62
      MU5=XA5(1)*FY13+XA5(2)*FY23+XA5(3)                                       A  63
      MU6=XA6(1)*FY13+XA6(2)*FY23+XA6(3)                                       A  64
      MU8=XA8(1)*FY13+XA8(2)*FY23+XA8(3)                                       A  65
      MU9=XA9(1)*FY13+XA9(2)*FY23+XA9(3)                                       A  66
      MU0=XA0(1)*FY13+XA0(2)*FY23+XA0(3)                                       A  67
      MU1=XA1(1)*FY13+XA1(2)*FY23+XA1(3)+LAMD1/FY3                             A  68
      MU2=XA2(1)*FY13+XA2(2)*FY23+XA2(3)                                       A  69
```

```
      GAM5=XC5(1)*FY13+XC5(2)*FY23+XC5(3)                                A  70
      GAM8=XC8(1)*FY13+XC8(2)*FY23+XC8(3)                                A  71
      GAM9=XC9(1)*FY13+XC9(2)*FY23+XC9(3)                                A  72
      GAM1=XC1(1)*FY13+XC1(2)*FY23+XC1(3)                                A  73
      IF(KRI.EQ.1) GO TO 1001
      Y5=(BETA5*M5(K))/MU5                                               A 112
      Y8=BETA8*M8(K)/MU8-GAM8*M8(K)*BETA9/((MU8-MU9)*MU8)+BETA1*A9/MU8   A 113
      Y9=(M9(K)+(GAM8*M8(K))/(MU8-MU9))*(BETA9/MU9)+A8*BETA1/MU9         A 114
      Y0=A7*BETA1/MU0                                                    A 115
      Y1=A6*BETA1/MU1                                                    A 116
      FT(J)=(Y5*(1.-EX5)+Y8*(1.-EX8)+Y9*(1.-EX9)+Y0*(1.-EX0)+Y1*(1.-EX1) A 117
     1)/3600.                                                            A 118
      BURN(J)=FT(J)/(24.*(M5(1)+M6(1)+M8(1)+M9(1)+M0(1)+M1(1)+M2(1)))    A 119
      TE(J)=T0*(J-1)                                                     A 120
      BURNT=BURNT+BURN(J)                                                A 121
C                                                                        A 123
C                        CONTROL  POISON                                 A 184
C                                                                        A 185
      LOSS1=DF(1)*BG+SIGAT(1)+SIGR(1)                                    A 186
      LOSS2=DF(2)*BG+SIGAT(2)+SIGR(2)+SIGFP2                             A 187
      LOSS3=DF(3)*BG+SIGAT(3)+SIGXE+SIGSM+SIGFP3                         A 188
      NEUT(1)=2.58*SIGF5(1)+2.60*SIGF8(1)+3.05*SIGF9(1)+3.13*SIGF1(1)    A 189
     1+2.97*SIGF0(1)+3.23*SIGF2(1)
      NEUT(2)=2.44*SIGF5(2)+2.89*SIGF9(2)+3.02*SIGF1(2)                  A 190
     1+2.87*SIGF0(2)+3.12*SIGF2(2)
      NEUT(3)=2.44*SIGF5(3)+2.89*SIGF9(3)+3.02*SIGF1(3)+2.87*SIGF0(3)    A 191
      SIGP(J)=(NEUT(3)*SIGR(1)*SIGR(2)/(1.0040*LOSS1*LOSS2-NEUT(1)*LOSS2 A 192
     1-NEUT(2)*SIGR(1)))-LOSS3                                           A 193
C                                                                        A 194
C                        CALCULATION OF K-INFINITE (KI)                  A 195
C                                                                        A 196
C                                                                        A 201
```

```
C                                  OUTPUT INFORMATION                    A 202
C                                                                        A 203
      WRITE (6,7) K,KI,SIGP(J)                                           A 204
      WRITE (6,8) FYS                                                    A 205
      WRITE (6,9) M5(J),THETA                                            A 206
      WRITE (6,10) M6(J),XICR                                            A 207
      WRITE (6,11) M8(J),BURN(J)                                         A 208
      WRITE (6,12) M9(J),BURNT                                           A 209
      WRITE (6,13) M0(J),FT(J)                                           A 210
      WRITE (6,14) M1(J),TF(J)                                           A 211
      WRITE (6,15) M2(J),TO                                              A 212
      WRITE(6,39) NSU
   39 FORMAT(3X,3HNSU,12X,F10.3)
      WRITE(6,40) NNU
   40 FORMAT(3X,3HNNU,12X,F10.3)
      WRITE(6,41) NSPU
   41 FORMAT(3X,4HNSPU,11X,F10.3)
      WRITE(6,42) NNPU
   42 FORMAT(3X,4HNNPU,11X,F10.3)
      QUEST = KT
      QUEST = QUEST*20000.
      IF(BURNT.GT.QUEST) CALL FASCON(J,KT)
      IF(BURNT.GT.QUEST) KRT = 1
      IF(BURNT.GT.QUEST) NSU = 0.0
      IF(BURNT.GT.QUEST) NNU = 0.0
      IF(BURNT.GT.QUEST) NSPU = 0.0
      IF(BURNT.GT.QUEST) NNPU = 0.0
      IF(BURNT.GT.QUEST) GO TO 1000
 1001 CONTINUE
      KRT = 0
    5 CONTINUE                                                           A 213
    6 FORMAT (44H  ********** INPUT INFORMATION **********)              A 215
```

```
7     FORMAT (//28H DATA AT END OF TIME STEP  #,I3,8X,4HK = ,F5.3,11X,6H   A 216
     1SIGP =,F8.5)                                                        A 217
8     FORMAT (10HO ISOTOPES,7X,13HDENSITY(KG/L),6X,14HTHERMAL FLUX =,E11   A 218
     1.3,3X,11H1/SEC*CM**2)                                               A 219
9     FORMAT (3X,5HU-235,10X,E11.4,8X,17HTHERMAL FLUENCE =,E12.3,3X,7H1/   A 220
     1CM**2)                                                              A 221
10    FORMAT (3X,5HU-236,10X,E11.4,8X,32HINSTANTANEOUS CONVERSION RATIO    A 222
     1=,F6.3)                                                             A 223
11    FORMAT (3X,5HU-238,10X,E11.4,8X,18HBURNUP THIS STEP =,F7.0,3X,6HMW   A 224
     1D/MT)                                                               A 225
12    FORMAT (3X,6HPU-239,9X,E11.4,8X,14HTOTAL BURNUP =,F8.0,3X,6HMWD/MT   A 226
     1)                                                                   A 227
13    FORMAT (3X,6HPU-240,9X,E11.4,8X,17HENERGY DENSITY IS,F8.0,3X,7HKW-   A 228
     1HR/L)                                                               A 229
14    FORMAT (3X,6HPU-241,9X,E11.4,8X,17HTIME STEP ENDS AT,F9.0,3X,5HHOU   A 230
     1RS)                                                                 A 231
15    FORMAT (3X,6HPU-242,9X,E11.4,8X,16HTIME STEP LENGTH,F7.0,3X,5HHOUR   A 232
     1S)                                                                  A 233
16    FORMAT (/22X,34HMICROSCOPIC CROSS SECTIONS (CM**2))                  A 234
17    FORMAT (34HO INITIAL ISOTOPE DENSITIES (KG/L))                       A 235
18    FORMAT (3X,6H U-235,7X,5HU-236,7X,5HU-238,7X,6HPU-239,6X,6HPU-240,   A 236
     16X,6HPU-241,6X,6HPU-242)                                            A 237
19    FORMAT (3X,7(F7.5,5X))                                               A 238
20    FORMAT (41H  RATIO OF GROUP 1 FLUX TO THERMAL FLUX =,F5.2)           A 239
21    FORMAT (41H  RATIO OF GROUP 2 FLUX TO THERMAL FLUX =,F5.2)           A 240
22    FORMAT (24H  POWER DENSITY (KW/L) =,F7.2)                            A 241
23    FORMAT (//40H  ****** END OF INPUT INFORMATION ******/)              A 242
24    FORMAT (/22X,33HMACROSCOPIC CROSS SECTIONS (1/CM),/)                 A 243
25    FORMAT (2X,5HGROUP,I2,7X,5HU-235,5X,5HU-236,5X,5HU-238,5X,6HPU-239   A 244
     1,4X,6HPU-240,4X,6HPU-241,4X,6HPU-242)                               A 245
26    FORMAT (2X,7HFISSION,5X,7(F8.2,2X))                                  A 246
27    FORMAT (2X,7HCAPTURE,5X,7(F8.2,2X))                                  A 247
```

```
28    FORMAT (2X,10HABSORPTION,2X,7(F8.2,2X),/)                          A 248
29    FORMAT (29H  DIFFUSION COEFFICIENTS (CM),4X,7HDF(1) =,F6.3,5X,7HDF  A 249
     1(2) =,F6.3,5X,7HDF(3) =,F6.3)                                      A 250
30    FORMAT (31H  REMOVAL CROSS SECTIONS (1/CM),6X,10HSIGR(1) = ,F5.3,8  A 251
     1X,10HSIGR(2) = ,F5.3)                                              A 252
31    FORMAT (13HO BUCKLING = ,F10.4,2X,7H1/CM**2)                       A 253
32    FORMAT (7E10.3)                                                    A 254
33    FORMAT (7F7.0,E12.5)                                               A 255
34    FORMAT (6E10.3,I3)                                                 A 256
35    FORMAT (1H1)                                                       A 257
36    FORMAT (52HO FISSION PRODUCT MICROSCOPIC CROSS SECTIONS (CM**2),/,  A 258
     12X,7HXASU2 =,F10.3,8X,7HXASU3 =,E10.3,/,2X,7HXANU2 =,E10.3,8X,7HXA  A 259
     2NU3 =,E10.3,/,2X,7HXASP2 =,F10.3,8X,7HXASP3 =,F10.3,/,2X,7HXANP2 =  A 260
     3,E10.3,8X,7HXANP3 =,F10.3,/,2X,5HXAX =,F10.3)                      A 261
37    FORMAT (8E10.3)                                                    A 262
38    FORMAT (34H  CLAD & COOLANT ABSORPTION (1/CM),1X,9HSIGA3(1)=,F6.4,  A 263
     11X,9HSIGA3(2)=,F6.4,1X,9HSIGA3(3)=,F6.4)                           A 264
      STOP                                                              A 265
      END                                                               A 266
```

```
      SUBROUTINE FASCON(L,KT)
C                                                                       A    4
      IMPLICIT REAL*4(A-H,M-Z)                                          A    5
      COMMON M5(200),M8(200),M9(200),M0(200),M1(200),M2(200),SIGR(3),
     1DF(3),
     1FY13,FY23,SIGA3(3),XF5(3),XF8(3),XF9(3),XF0(3),XF1(3),XF2(3),
     2XC5(3),XC8(3),XC9(3),XC0(3),XC1(3),XC2(3),XA5(3),XA8(3),XA9(3),
     3XA0(3),XA1(3),XA2(3),EFFK,SIGFP2,SIGFP3,A(14),BR
      REAL KAPPA(6),KSIGF(3),KSIGF1                                     A    6
      DIMENSION XSF(14,34), XSI(14,34), XXF(14,34), XXA(14,34), XDS(9,34  A    7
     1,34)                                                              A    8
      DIMENSION NU(14,34), ZYF(14,34), NU(6,34), SO(34),          NAME(28)  A    9
      DIMENSION SUMA(34), SUMFS(34), SUMIS(34), SUMNF(34), SUMKF(34)    A   10
      DIMENSION D(34), BETA(34), GAMMA(34), TERM3(34), TOTAL(34), FLETH(  A   11
     134)                                                               A   12
      DIMENSION PHI(34), PHIU(34), QE(34), APHI(34), DBSQPH(34), DBSQFI(  A   13
     13)                                                                A   14
      DIMENSION FNPHI(34), FKPHI(34), SIGRF(3),          SIGR2(3), NSIGF  A   15
     1(3)                                                               A   16
      DIMENSION PHIM(5), APHIM(5), FNPHIM(5), FKPHIM(3), DM(3),       S  A   17
     1IGA(3)                                                            A   18
      DIMENSION FFLDF(14),BILBO(14),P(34),BBS(14,34),FIS(14,34)
      DIMENSION XDSI(34,34),SXA(14,34),SXF(14,34),SSF(14,34),SSI(14,34)
      DIMENSION XA(14,3),XF(14,3),XC(14,3),SDS(9,15,15)
C                                                                       A   19
C           SECTION FOR INPUT AND INITIALIZATION OF DATA                A   20
C                                                                       A   21
      IF(L.GT.2) GO TO 1003
      DATA KAPPA/3.12E-11,3.09E-11,2*3.24E-11,3.27E-11,0.0/             A   22
      DATA XXF/476*0.0/,NU/204*0.0/,XDS/10404*0.0/                      B   22
      DATA SO/34*0.0/
      DATA P/18*1.0,0.989,0.905,0.993,0.984,0.952,0.956,1.0,0.891,0.895,
```

```
     11.0,0.675,5*1.0/
      DO 1 I=1,14                                                        A  25
      DO 1 J=1,34                                                        A  26
      READ (5,36) XXA(I,J),XSF(I,J),XSI(I,J),MU(I,J),ZYE(I,J)            A  27
1     CONTINUE                                                           A  28
      DO 2 I=1,6                                                         A  29
      DO 80 J=1,31,3
      READ (5,37) XXF(I,J),NU(I,J),XXF(I,J+1),NU(I,J+1),XXF(I,J+2),NU(I,  A  31
     1J+2)                                                               A  32
   80 CONTINUE
      READ(5,37) XXF(1,34),NU(I,34)
2     CONTINUE                                                           A  33
      READ (5,38) (SO(I),I=1,18)                                         A  34
      READ (5,58) (((XDS(I,J,K),K=2,15),J=1,15),I=1,9)                   A  35
      READ (5,45) (NAME(I),I=1,28)                                       A  36
1003  CONTINUE
      LTFF = 0
      IF(KT.NE.0) GO TO 1004
      A(1) = M5(L)*0.6024/235.
      A(2) = M8(L)*0.6024/238.
      A(3) = M9(L)*0.6024/239.
      A(4) = M0(L)*0.6024/240.
      A(5) = M1(L)*0.6024/241.
      A(6) = M2(L)*0.6024/242.
      A(7) = 0.01226
      A(8) = 0.0
      A(12) = 0.0
      GO TO 1007
1004  CONTINUE
      A(13) = 0.0
      A(14) = 0.0
      DELK = 1.3868-FFFK
```

```
      IF(DELK.GT.0.0) GO TO 1005
      A(3) = A(3)*0.995
      A(4) = A(4)*0.995
      A(5) = A(5)*0.995
      A(6) = A(6)*0.995
      A(10) = 0.001275
      A(11) = 0.005071
      M9(L) = A(3)*239./.6024
      M0(L) = A(4) *240./.6024
      M1(L) = A(5)*241./.6024
      M2(L) = A(6) * 242./.6024
      M8(L) = 6.256-M5(L)-M9(L)-M0(L)-M1(L)-M2(L)
      A(2) = M8(L)*.6024/238.
      GO TO 1007
1005  CONTINUE
      A(3) = A(3)*1.005
      A(4) = A(4)*1.005
      A(5) = A(5)*1.005
      A(6) = A(6)*1.005
      A(10) = 0.001275
      A(11) = 0.005071
      M9(L) = A(3)*239./.6024
      M0(L) = A(4) *240./.6024
      M1(L) = A(5)*241./.6024
      M2(L) = A(6) * 242./.6024
      M8(L) = 6.256-M5(L)-M9(L)-M0(L)-M1(L)-M2(L)
      A(2) = M8(L)*.6024/238.
1007  CONTINUE
      DO 3 I=1,14                                                    A  41
      IS=2*I-1                                                       A  42
      IT=2*I                                                         A  43
      WRITE (6,32) NAME(IS),NAME(IT),A(I)                            A  44
```

```
3       CONTINUE
 116    CONTINUE
        TA = 0
        LIFE = LIFE+1
        IF(KT.NE.0) GO TO 1000
        IF(LIFE.EQ.1) GO TO 1000
        DELK = 1.0868-EFFK
        IF(DELK.LT.0.0) GO TO 1010
        IF(DELK.LT.0.001) GO TO 117
        D20F = A(11)/(A(10)+A(11))
        D20F = D20F-0.003
        A(11) = D20F*0.006338
        A(10) = (1.-D20F)*0.006373
        A(9) = 0.03176+(A(10)/2.+A(11)/2.)
        GO TO 1011
1010    CONTINUE
        DELK = 0.0-DELK
        IF(DELK.LT.0.001) GO TO 117
        D20F = A(11)/(A(10)+A(11))
        D20F = D20F+0.003
        A(11) = D20F*0.006338
        A(10) = (1.-D20F)*0.006373
        A(9) = 0.03176+(A(10)/2.+A(11)/2.)
1011    CONTINUE
1000    CONTINUE
        DO 105 J=1,34
        SUMKE(J) = 0.0
        SUMNE(J) = 0.0
 105    CONTINUE
        DO 106  K=1,5
        SIGRE(K) = 0.0
        SIGR(K) = 0.0
```

```
      SIGR2(K) = 0.0
  105 CONTINUE
      BGSQ = 0.0
      BGSQI = 0.0
      IB = 1
      IC = 1
      GO TO 3
  755 CONTINUE
      IF (IC.GT.0) GO TO 8                                              A  46
      IMP = IMP+1
      IF(IMP.GT.40) RETURN
      WRITE (6,53)                                                      A  47
      DO 4 I=1,18                                                       A  48
      WRITE (6,54) I,SO(I)                                              A  49
    4 CONTINUE                                                          A  50
      DO 5 I=1,9                                                        A  51
      IS=2*I-1                                                          A  52
      IT=2*I                                                            A  53
      WRITE (6,46) NAME(IS),NAME(IT)                                    A  54
      DO 5 J=1,15                                                       A  55
      WRITE (6,47) (XDS(I,J,K),K=1,15)                                  A  56
    5 CONTINUE                                                          A  57
      DO 6 I=1,6                                                        A  58
      IS=2*I-1                                                          A  59
      IT=2*I                                                            A  60
      WRITE (6,50) NAME(IS),NAME(IT)                                    A  61
      DO 6 J=1,18                                                       A  62
      WRITE (6,49) J,XXA(I,J),XXF(I,J),XSF(I,J),XSI(I,J),NU(I,J),MU(I,J)  A  63
     1,ZYF(I,J)                                                         A  64
    6 CONTINUE                                                          A  65
      DO 7 I=7,14                                                       A  66
      IS=2*I-1                                                          A  67
```

```
      IT=2*I                                                            A  68
      WRITE (6,51) NAME(IS),NAME(IT)                                    A  69
      DO 7 J=1,18                                                       A  70
      WRITE (6,52) J,XXA(I,J),XSF(I,J),XSI(I,J),MU(I,J),ZYE(I,J)        A  71
7     CONTINUE                                                          A  72
      GO TO 755
8     CONTINUE                                                          A  73
C                                                                       A  74
C                   OBTAIN MACROSCOPIC CROSS SECTIONS                 A  75
C                                                                       A  76
      DO 10 J=1,34                                                      A  77
      DO 9 I=1,14                                                       A  78
      SXA(I,J) = XXA(I,J)
      SXF(I,J) = XXF(I,J)
      SSE(I,J) = XSE(I,J)
      SSI(I,J) = XSI(I,J)
      XXA(I,J)=XXA(I,J)*A(I)                                            A  79
      XSF(I,J)=XSF(I,J)*A(I)                                            A  80
      XSI(I,J)=XSI(I,J)*A(I)                                            A  81
9     CONTINUE                                                          A  82
      DO 10 I=1,6                                                       A  83
      XXF(I,J)=XXF(I,J)*A(I)                                            A  84
10    CONTINUE                                                          A  85
      DO 11 I=1,9                                                       A  86
      DO 11 J=1,15                                                      A  87
      DO 11 K=1,15                                                      A  88
      SDS(I,J,K) = XDS(I,J,K)
      XDS(I,J,K)=XDS(I,J,K)*A(I)                                        A  89
11    CONTINUE                                                          A  90
C                                                                       A  91
C                SUM MACROSCOPIC CROSS SECTIONS                         A  92
C                OF ALL ELEMENTS FOR EACH MICRO-GROUP                   A  93
```

```
C                                                                       A  94
12    CONTINUE                                                          A  95
      IA=IA+1                                                           A  96
      IF (IA.NE.1) GO TO 15                                             A  99
      DO 13 J=1,34                                                      A 100
      DO 13 I=1,6                                                       A 101
      SUMKF(J)=SUMKF(J)+XXF(I,J)*KAPPA(I)                               A 102
      SUMNF(J)=SUMNF(J)+XXF(I,J)*NU(I,J)                                A 103
13    CONTINUE                                                          A 104
      DO 14 J=1,34
      DO 14 K=1,34
      XDS1(K,J) =0.0
      DO 14 I=1,9
      XDS1(K,J) = XDS1(K,J)+XDS(I,K,J)
14    CONTINUE                                                          A 110
      DO 21 J=1,34                                                      A 112
      SUMA(J)=0.0                                                       A 113
      SUMFS(J)=0.0                                                      A 114
      SUMIS(J)=0.0                                                      A 115
      TERM3(J)=0.0                                                      A 116
      BETA(J)=0.0                                                       A 117
      DO 16 I=1,14                                                      A 119
      SUMA(J)=SUMA(J)+XXA(I,J)                                          A 120
      SUMFS(J)=SUMFS(J)+XSE(I,J)                                        A 121
      SUMIS(J)=SUMIS(J)+XSI(I,J)                                        A 122
      TERM3(J)=TERM3(J)+(1.0-MU(I,J))*XSE(I,J)                          A 123
      BETA(J)=BETA(J)+ZYE(I,J)*XSE(I,J)                                 A 124
16    CONTINUE                                                          A 125
      SUMA(J) = SUMA(J)+BETA(J)*(1.0-P(J))
      XXA(2,J) = XXA(2,J)+BETA(J)*(1.0-P(J))
21    CONTINUE                                                          A 156
15    CONTINUE                                                          A 111
```

```
C                                                                       A 126
C              CALCULATE DIFFUSION COEFFICIENT, MICRO-GROUP FLUX,       A 127
C              NEUTRON DENSITY AND SLOWING DOWN DENSITY                 A 128
C                                                                       A 129
      DO 200 J=1,34
      TOTAL(J)=0.0                                                      A 118
      D(J)=1.0/(3.0*(SUMA(J)+SUMTS(J)+TERM3(J)))                        A 130
      GAMMA(J)=D(J)*BGSQ+SUMA(J)+SUMIS(J)                               A 131
      IF (J.GT.1) GO TO 17                                              A 133
      PHI(J)=SO(J)/(GAMMA(J)+4.0*BETA(J))                               A 134
      PHIU(1)=4.0*PHI(1)                                                A 135
      QE(1)=BETA(1)*PHIU(1)                                             A 136
      GO TO 20                                                          A 137
17    CONTINUE                                                          A 138
      JJ=J-1                                                            A 140
      DO 18 K=1,JJ                                                      A 142
      TOTAL(J)=TOTAL(J)+XDS1(K,J) *PHI(K)                               A 143
18    CONTINUE                                                          A 144
19    CONTINUE                                                          A 145
      PHI(J)=(SO(J)+TOTAL(J)+(BETA(J)+BETA(JJ))*PHIU(JJ))/(GAMMA(J)+(4.0 A 146
     1*BETA(J)))                                                        A 147
      PHIU(J)=(4.0*PHI(J))-PHIU(JJ)                                     A 148
      QE(J)=BETA(J)*PHIU(J)                                             A 149
20    CONTINUE                                                          A 150
      APHI(J)=SUMA(J)*PHI(J)                                            A 151
      ENPHI(J)=SUMNF(J)*PHI(J)                                          A 152
      EKPHI(J)=SUMKF(J)*PHI(J)                                          A 153
      DRSQPH(J)=D(J)*BGSQ*PHI(J)                                        A 154
 200  CONTINUE
C                                                                       A 157
C                          THREE GROUP CALCULATIONS                     A 158
C                                                                       A 159
```

```
      IG=1                                                              A 161
      IH=10
      DO 23 I=1,3                                                       A 163
      PHIM(I)=0.0                                                       A 164
      APHIM(I)=0.0                                                      A 165
      DM(I)=0.0                                                         A 166
      FNPHIM(I)=0.0                                                     A 167
      FKPHIM(I)=0.0                                                     A 168
      DO 22 J=IG,IH                                                     A 169
      PHIM(I)=PHIM(I)+PHI(J)                                            A 170
      APHIM(I)=APHIM(I)+APHI(J)                                         A 171
      DM(I)=DM(I)+D(J)*PHI(J)                                           A 172
      FNPHIM(I)=FNPHIM(I)+FNPHI(J)                                      A 173
      FKPHIM(I)=FKPHIM(I)+FKPHI(J)                                      A 174
22    CONTINUE                                                          A 175
      IG=IH+1                                                           A 176
      IF (I.EQ.1) IH=17                                                 83
      IF (I.EQ.2) IH=54                                                 A 178
      SIGA(I)=APHIM(I)/PHIM(I)                                          A 179
      DF(I)=DM(I)/PHIM(I)                                               A 180
      NSIGF(I)=FNPHIM(I)/PHIM(I)                                        A 181
      KSIGF(I)=FKPHIM(I)/PHIM(I)                                        A 182
      DBSQFI(I)=DM(I)*BGSQ                                              A 183
23    CONTINUE                                                          A 185
C                                                                       A 186
C                          REMOVAL CROSS SECTIONS                       A 187
      SUM12=0.0                                                         A 188
      SUM13=0.0                                                         A 189
      SUM23=0.0                                                         A 190
      DC=0.0                                                            A 191
      SIGA1=0.0                                                         A 192
      NSIGF1=0.0                                                        A 193
```

```
      KSIGF1=0.0                                                        A 194
      ENUBR=0.0                                                         A 195
      EDENBR=0.0                                                        A 196
      EFFNU=0.0                                                         A 197
      EFDEN=0.0                                                         A 198
C                                                                       A 199
      DO 100 J=1,10
      DO 24 K=11,17
      SUM12=SUM12+XDS1(J,K) *PHI(J)                                     A 202
24    CONTINUE                                                          A 203
      DO 100 K=18,34
100   SUM13 = SUM13+XDS1(J,K) *PHI(J)
      DO 26 K=18,34
      DO 26 J=11,17
      SUM23=SUM23+XDS1(J,K) *PHI(J)                                     A 209
26    CONTINUE                                                          A 210
      SIGRE(1)=QF(10)/PHIM(1)
      SIGRE(2)=QF(17)/PHIM(2)
      SIGR(1)=SIGRE(1)+SUM12/PHIM(1)                                    A 213
      SIGR(2)=SIGRE(2)+SUM23/PHIM(2)                                    A 214
      SIGR2(1)=SUM13/PHIM(1)                                            A 215
27    CONTINUE                                                          A 220
C                                                                       A 221
C                              ONE GROUP CALCULATIONS                   A 222
C                                                                       A 223
      PHIMT=PHIM(1)+PHIM(2)+PHIM(3)                                     A 224
      DO 28 I=1,3                                                       A 225
      DC=DC+DF(I)*PHIM(I)/PHIMT                                         A 226
      SIGA1=SIGA1+SIGA(I)*PHIM(I)/PHIMT                                 A 227
      NSIGF1=NSIGF1+NSIGF(I)*PHIM(I)/PHIMT                              A 228
      KSIGF1=KSIGF1+KSIGF(I)*PHIM(I)/PHIMT                              A 229
28    CONTINUE                                                          A 230
```

```
C                                                                       A 233
C                    EFFECTIVE MULTIPLICATION FACTOR                    A 234
C                                                                       A 235
      DO 29 I=1,34                                                      A 236
      EFFNU=EFFNU+FNPHI(I)                                              A 237
      EFDEN=EFDEN+ABSQPH(I)+APHI(I)                                     A 238
29    CONTINUE                                                          A 239
      EFFK=EFFNU/EFDEN                                                  A 240
      WRITE (6,43) LIFE,EFFK
43    FORMAT (//,5X,'ITERATION= ',I3,9X,8HK-EFF IS,F8.5)
C                                                                       A 242
C                          BREEDING RATIO                               A 243
C                                                                       A 244
      IF (BGSQ.LT.0.0) GO TO 31                                         A 245
      DO 30 I=1,34                                                      A 246
      FNUBR = FNUBR+(XXA(2,I)-XXF(2,I)+XXA(4,I)-XXF(4,I))*PHI(I)
      FDENBR=FDENBR+(XXA(1,I)+XXA(3,I)+XXA(5,I))*PHI(I)                 A 248
30    CONTINUE                                                          A 249
      BR=FNUBR/FDENBR                                                   A 250
31    CONTINUE                                                          A 252
      DO 101  I=1,14
      BILBO(I) = 0.0
      FRODO(I) = 0.0
 101  CONTINUE
      DO 61 J=1,34
      DO 59 I=1,14
      BBS(I,J)= XXA(I,J) *PHI(J)
      FRODO(I) = FRODO(I)+BBS(I,J)
 59   CONTINUE
      DO 60 I=1,6
      FIS(I,J) = XXF(I,J) *PHI(J)
      BILBO(I) = BILBO(I)+FIS(I,J)
```

```
 60   CONTINUE
 61   CONTINUE
      IG = 1
      IH = 10
      DO 123 K=1,3
      DO 119 I=1,14
      XA(I,K) = 0.0
      XF(I,K) = 0.0
      XC(I,K) = 0.0
      DO 120 J=IG,IH
      IF(I.EQ.2)GO TO 127
      XA(I,K) = XA(I,K)+SXA(I,J)*PHI(J)
      GO TO 128
127   CONTINUE
      XA(I,K) = XA(I,K)+XXA(I,J)*PHI(J)/A(2)
128   CONTINUE
      IF(I.GT.6)GO TO 121
      XF(I,K) = XF(I,K)+SXF(I,J)*PHI(J)
      XC(I,K) = XA(I,K)-XF(I,K)
      GO TO 120
121   CONTINUE
      XC(I,K) = XA(I,K)
120   CONTINUE
      XC(I,K) = XC(I,K)/PHIM(K)
      XF(I,K) = XF(I,K)/PHIM(K)
      XA(I,K) = XA(I,K)/PHIM(K)
119   CONTINUE
      IG = IH+1
      IF(K.EQ.1) IH=17
      IF(K.EQ.2) IH=34
123   CONTINUE
      BGSQ=BGSQ+BGSQI
```

```
      IF (IA.LT.IB) GO TO 12
      DO 112 J =1,34
      XXA(2,J) = XXA(2,J)-BETA(J)*(1.0-P(J))
112   CONTINUE
      DO 110 J=1,34
      DO 109 I=1,14
      XXA(I,J) = SXA(I,J)
      XSE(I,J) = SSE(I,J)
      XSI(I,J) = SSI(I,J)
109   CONTINUE
      DO 110 I=1,6
      XXF(I,J) = SXF(I,J)
110   CONTINUE
      DO 111 I=1,9
      DO 111 J=1,15
      DO 111 K=1,15
      XDS(I,J,K) = SDS(I,J,K)
111   CONTINUE
      IF(KT.EQ.0) GO TO 116
      DELK = ABS(1.0868-EFFK)
      IF(DELK.LT.0.001) KT = KT+1
      IF(DELK.LT.0.001) GO TO 117
      GO TO 1004
117   CONTINUE
      FY13 = PHIM(1)/PHIM(3)
      FY23 = PHIM(2)/PHIM(3)
      DO 1002 KR=1,3
      SIGA3(KR) = A(9)*XA(9,KR)+A(7)*XA(7,KR)
      XF5(KR) = XF(1,KR)*1.0E-24
      XF8(KR) = XF(2,KR)*1.0E-24
      XF9(KR) = XF(3,KR)*1.0E-24
      XF0(KR) = XF(4,KR)*1.0E-24
```

```
      XF1(KR) = XF(5,KR)*1.0E-24
      XF2(KR) = XF(6,KR)*1.0E-24
      XC5(KR) = XC(1,KR)*1.0E-24
      XC8(KR) = XC(2,KR)*1.0E-24
      XC9(KR) = XC(3,KR)*1.0E-24
      XC0(KR) = XC(4,KR)*1.0E-24
      XC1(KR) = XC(5,KR)*1.0E-24
      XC2(KR) = XC(6,KR)*1.0E-24
      XA5(KR) = XF5(KR)+XC5(KR)
      XA8(KR) = XF8(KR)+XC8(KR)
      XA9(KR) = XF9(KR)+XC9(KR)
      XA0(KR) = XF0(KR)+XC0(KR)
      XA1(KR) = XF1(KR)+XC1(KR)
      XA2(KR) = XF2(KR)+XC2(KR)
1002  CONTINUE
      SIGFP2 =A(13)*XA(13,2)+A(14)*XA(14,2)
      SIGFP3 = A(13)*XA(13,3)+A(14)*XA(14,3)
      RETURN
C                                                                              A 256
36    FORMAT (5F10.5)                                                          A 262
37    FORMAT (6F10.0)                                                          A 263
38    FORMAT (10F8.0)                                                          A 264
45    FORMAT (7((2A4),2X))                                                     A 276
46    FORMAT (///,33X,27HDOWN SCATTERING MATRIX FOR ,2A4,/)                    A 277
47    FORMAT (5X,15(F5.3,1X))                                                  A 278
32    FORMAT (15X,2A4,34X,F9.7)                                                A 257
49    FORMAT (5X,I2,7(2X,F8.4))                                                A 280
50    FORMAT (6(/),30X,18HINPUT  DATA  FOR  ,2A4,///,4X,5HGROUP,4X,3HXXA       A 281
     1,7X,3HXXF,7X,3HXSE,7X,3HXSI,7X,2HNU,8X,2HMU,8X,3HZYE,/,7X,4(6X,4H(      A 282
     2BN))//)                                                                  A 283
51    FORMAT (6(/),30X,18HINPUT  DATA  FOR  ,2A4,///,4X,5HGROUP,8X,3HXXA       A 284
     1,11X,3HXSE,11X,3HXSI,11X,2HMU,12X,3HZYE,/,7X,3(10X,4H(BN))/)            A 285
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52     FORMAT (5X,I2,5(6X,F8.4))                                                A 286
53     FORMAT (2(/),22X,33HNORMALIZED FISSION NEUTRON SOURCE///,15X,5HGRO       A 287
      1UP,37X,8HFRACTION,/)                                                     A 288
54     FORMAT (16X,I2,39X,F6.4)                                                 A 289
       END                                                                      A 299
```

4. FASCON-2 Output

10.0 Wt. % PU

H_2O

V.F. Set 1

******** INPUT INFORMATION ********

TABLE OF DENSITIES

NAME	DENSITY (1/BN-CM)
U-235	0.0000327
U-238	0.0130500
PU-239	0.0009273
PU-240	0.0002888
PU-241	0.0001877
PU-242	0.0000500
SS 304	0.0109800
SODIUM	0.0
OXYGEN	0.0340100
HYDROGEN	0.0098680
DEUT.	0.0
BORON	0.0
F.P. U	0.0
F.P. PU	0.0

NORMALIZED FISSION NEUTRON SOURCE

GROUP	FRACTION
1	0.0232
2	0.1087
3	0.2105
4	0.2313
5	0.1803
6	0.1147
7	0.0648
8	0.0340
9	0.0171
10	0.0161
11	0.0
12	0.0
13	0.0
14	0.0
15	0.0
16	0.0
17	0.0
18	0.0

DOWN SCATTERING MATRIX FOR U-235

0.0	0.027	0.177	0.420	0.499	0.380	0.220	0.105	0.044	0.018	0.008	0.002	0.0	0.0	0.0
0.0	0.0	0.076	0.285	0.459	0.423	0.275	0.144	0.065	0.027	0.011	0.004	0.001	0.0	0.0
0.0	0.0	0.0	0.165	0.388	0.457	0.347	0.199	0.096	0.042	0.016	0.007	0.003	0.0	0.0
0.0	0.0	0.0	0.0	0.254	0.408	0.375	0.244	0.128	0.057	0.024	0.009	0.004	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.311	0.368	0.279	0.160	0.078	0.034	0.014	0.005	0.001	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.361	0.334	0.216	0.113	0.052	0.022	0.008	0.003	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.381	0.289	0.166	0.080	0.035	0.014	0.006	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.336	0.218	0.114	0.052	0.021	0.008	0.002
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.239	0.137	0.066	0.029	0.012	0.003
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.114	0.059	0.027	0.011	0.003
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.012	0.005	0.002	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DOWN SCATTERING MATRIX FOR U-238

0.0	0.047	0.288	0.678	0.797	0.604	0.345	0.167	0.072	0.028	0.012	0.003	0.0	0.0	0.0
0.0	0.0	0.105	0.388	0.633	0.587	0.383	0.200	0.091	0.038	0.015	0.006	0.0	0.0	0.0
0.0	0.0	0.0	0.236	0.560	0.665	0.506	0.291	0.141	0.061	0.024	0.010	0.002	0.0	0.0
0.0	0.0	0.0	0.0	0.371	0.600	0.558	0.363	0.190	0.086	0.036	0.014	0.006	0.001	0.0
0.0	0.0	0.0	0.0	0.0	0.457	0.544	0.413	0.236	0.115	0.051	0.021	0.008	0.004	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.467	0.433	0.283	0.147	0.067	0.028	0.011	0.004	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.420	0.319	0.183	0.089	0.038	0.016	0.006	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.317	0.206	0.108	0.049	0.020	0.008	0.002
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.204	0.118	0.057	0.025	0.010	0.002
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.111	0.058	0.027	0.011	0.003
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.048	0.023	0.010	0.003
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.020	0.009	0.002
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.002	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DOWN SCATTERING MATRIX FOR PU-239

0.0	0.016	0.101	0.243	0.292	0.223	0.129	0.062	0.027	0.010	0.005	0.001	0.0	0.0	0.0
0.0	0.0	0.064	0.241	0.394	0.366	0.239	0.125	0.057	0.024	0.009	0.004	0.0	0.0	0.0
0.0	0.0	0.0	0.143	0.338	0.402	0.306	0.176	0.085	0.037	0.014	0.006	0.001	0.0	0.0
0.0	0.0	0.0	0.0	0.214	0.345	0.320	0.209	0.109	0.049	0.021	0.008	0.003	0.001	0.0
0.0	0.0	0.0	0.0	0.0	0.241	0.287	0.217	0.124	0.060	0.027	0.011	0.004	0.002	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.226	0.209	0.137	0.071	0.032	0.014	0.005	0.002	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.187	0.142	0.082	0.039	0.017	0.007	0.003	0.000
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.154	0.100	0.052	0.024	0.010	0.004	0.000
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.126	0.073	0.035	0.015	0.006	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.106	0.055	0.025	0.010	0.003
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.091	0.044	0.019	0.005
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.083	0.038	0.010
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.080	0.021
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.067
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DOWN SCATTERING MATRIX FOR PU-240

0.0	0.023	0.140	0.333	0.394	0.300	0.172	0.083	0.036	0.014	0.006	0.001	0.0	0.0	0.0
0.0	0.0	0.061	0.230	0.377	0.350	0.229	0.120	0.054	0.023	0.009	0.004	0.0	0.0	0.0
0.0	0.0	0.0	0.140	0.331	0.392	0.298	0.172	0.083	0.036	0.014	0.006	0.001	0.0	0.0
0.0	0.0	0.0	0.0	0.184	0.295	0.273	0.177	0.092	0.042	0.017	0.006	0.003	0.001	0.0
0.0	0.0	0.0	0.0	0.0	0.134	0.160	0.121	0.069	0.034	0.015	0.006	0.002	0.001	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.242	0.227	0.149	0.078	0.036	0.015	0.006	0.002	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.377	0.287	0.165	0.080	0.035	0.014	0.006	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.301	0.195	0.102	0.047	0.019	0.007	0.002
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.133	0.077	0.037	0.016	0.006	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.015	0.008	0.004	0.001	0.000
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DOWN SCATTERING MATRIX FOR PU-241

0.0	0.017	0.110	0.269	0.327	0.252	0.146	0.070	0.031	0.012	0.006	0.001	0.0	0.0	0.0
0.0	0.0	0.058	0.218	0.355	0.330	0.215	0.112	0.051	0.021	0.008	0.003	0.0	0.0	0.0
0.0	0.0	0.0	0.126	0.299	0.354	0.269	0.155	0.075	0.033	0.013	0.005	0.001	0.0	0.0
0.0	0.0	0.0	0.0	0.169	0.271	0.251	0.163	0.085	0.038	0.016	0.006	0.002	0.001	0.0
0.0	0.0	0.0	0.0	0.0	0.188	0.225	0.171	0.098	0.048	0.021	0.009	0.003	0.002	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.243	0.226	0.148	0.077	0.035	0.015	0.006	0.002	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.264	0.200	0.115	0.056	0.024	0.010	0.004	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.241	0.139	0.073	0.033	0.014	0.005	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.104	0.060	0.029	0.012	0.005	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DOWN SCATTERING MATRIX FOR PU-242

0.0	0.025	0.154	0.365	0.433	0.329	0.189	0.091	0.039	0.015	0.007	0.002	0.0	0.0	0.0
0.0	0.0	0.069	0.261	0.428	0.399	0.261	0.136	0.062	0.026	0.010	0.004	0.0	0.0	0.0
0.0	0.0	0.0	0.160	0.380	0.451	0.343	0.197	0.095	0.042	0.016	0.007	0.002	0.0	0.0
0.0	0.0	0.0	0.0	0.203	0.325	0.299	0.194	0.101	0.045	0.019	0.007	0.003	0.001	0.0
0.0	0.0	0.0	0.0	0.0	0.105	0.126	0.096	0.055	0.027	0.012	0.005	0.002	0.001	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.304	0.284	0.187	0.097	0.045	0.019	0.007	0.003	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.396	0.301	0.173	0.084	0.036	0.015	0.006	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.301	0.195	0.102	0.047	0.019	0.007	0.002
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.154	0.089	0.043	0.018	0.007	0.002
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.037	0.019	0.009	0.004	0.001
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DOWN SCATTERING MATRIX FOR SS 304

0.0	0.004	0.098	0.262	0.345	0.284	0.233	0.037	0.C	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.164	0.359	C.337	0.186	0.176	0.042	0.C10	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.448	0.109	0.179	0.184	0.C70	0.016	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.476	0.246	0.0	0.005	0.C	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	C.0	0.241	0.048	0.C21	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.C	0.0	C.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	C.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.C	0.C	0.C	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.C	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.C	C.C	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	C.0	0.0	0.C	0.0	0.0	0.C	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C.0	0.0	0.0	0.0	0.0	0.0

DOWN SCATTERING MATRIX FOR SODIUM

0.0	0.179	0.182	C.125	0.C68	C.031	0.013	0.005	0.C02	0.001	0.000	0.000	0.0	0.0	0.0
0.0	0.0	0.200	0.164	0.C99	0.050	0.022	0.009	0.C03	0.C01	0.000	0.000	0.0	0.0	0.0
0.0	0.0	0.0	0.304	0.063	0.056	0.032	0.C15	0.CC7	0.C03	0.001	0.000	0.000	0.000	0.0
0.0	0.0	0.0	0.0	0.339	0.C15	0.C	0.C	0.0	0.C	0.000	0.000	0.000	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.238	0.203	0.CC1	0.C	0.C	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	C.0	0.025	0.C85	0.C41	0.C15	0.003	0.000	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.000	0.000	0.000	0.0
0.0	0.0	0.0	0.0	0.C	C.0	0.0	0.C	0.C	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	C.0	0.0	0.0	0.0	C.C	0.0	0.0	0.C	0.C	0.0	0.0	0.0	0.0	0.0
0.0	C.0	0.0	0.0	0.0	C.C	0.0	0.0	0.C	0.C	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	C.0	0.0	C.C	0.0	0.0	0.0	C.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	C.0	0.0	0.0	0.C	C.C	0.0	0.0	0.0	0.0	0.0
0.0	C.0	0.0	0.0	0.0	0.0	0.C	0.0	0.0	C.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	C.C	0.0	C.C	0.C	0.0	0.0	C.0	0.0	0.0	0.0	0.0	0.0

DOWN SCATTERING MATRIX FOR OXYGEN

0.0	0.010	0.054	0.C44	0.034	0.020	0.012	0.007	0.001	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

INPUT DATA FOR U-235

GROUP	XXA (BN)	XXF (BN)	XSE (BN)	XSI (BN)	NU	MU	ZYF
1	1.6935	1.6900	3.3000	1.3690	3.4890	0.8182	0.0015
2	1.1925	1.1850	4.4500	1.7710	3.0630	0.7752	0.0019
3	1.3080	1.2900	4.6500	1.7220	2.8050	C.6849	0.0027
4	1.3595	1.3150	3.9500	1.5040	2.6480	0.5519	0.0037
5	1.3500	1.2450	3.8500	1.2490	2.5520	C.4649	0.0046
6	1.3700	1.2050	4.4000	1.1110	2.5040	C.3739	0.0050
7	1.5150	1.2850	5.5500	0.9726	2.4750	0.2883	0.0061
8	1.7350	1.4250	7.0000	0.7540	2.4580	0.2143	0.0067
9	2.0350	1.6250	8.2500	0.4891	2.4470	0.1442	0.0073
10	2.4200	1.8700	9.1000	0.2174	2.440C	C.C898	0.0078
11	2.9250	2.1750	9.8500	0.0208	2.4360	0.0549	0.0081
12	3.4850	2.5150	10.3000	0.0	2.4340	C.0350	0.0083
13	4.0500	2.8700	10.4000	0.0	2.433C	C.C160	0.0084
14	4.6800	3.3000	10.3500	0.0	2.4320	C.C044	0.0085
15	5.5650	3.9500	13.1500	0.0	2.4310	0.CC29	0.0086
16	6.6000	4.6500	15.1000	0.0	2.4310	0.0029	0.0086
17	7.6550	5.2750	16.5000	0.0	2.4300	0.C029	0.C086
18	10.0000	7.0000	15.5000	0.0	2.4300	0.0029	0.0086
19	12.8500	9.0000	16.5000	0.0	2.4300	0.0029	0.0086
20	20.7000	13.850C	14.0000	0.0	2.4300	0.CC29	0.C086
21	21.8000	14.5500	14.50C0	0.0	2.4300	C.CC29	0.0086
22	32.6000	22.0000	13.0000	0.0	2.4300	0.0029	0.0086
23	39.0000	27.C000	12.0000	0.0	2.4300	C.CC29	0.0086
24	37.0000	26.5000	11.00C0	0.0	2.4300	C.0029	0.CC86
25	45.5000	26.9000	11.0000	0.0	2.4300	0.0027	0.0086
26	45.5000	26.9000	11.00C0	0.0	2.4300	C.CC27	0.0086
27	59.4000	32.5000	11.0000	0.0	2.4300	0.0027	0.0086
28	59.4000	35.2000	11.00C0	0.0	2.4300	0.0027	0.0086
29	24.1000	12.4000	11.40C0	0.0	2.4300	0.C027	0.0C86
30	24.1000	12.4000	12.00C0	0.0	2.4300	0.0027	0.0C86
31	14.7000	11.3000	12.6000	0.0	2.4300	C.CC27	0.0C86
32	14.7000	11.3000	11.50C0	0.0	2.430C	C.0027	0.0086
33	87.9000	85.0000	11.9400	0.0	2.4300	0.0027	0.0086
34	262.8999	223.0C00	12.C0C0	0.0	2.4300	C.CC27	0.0086

INPUT DATA FOR U-238

GROUP	XXA (BN)	XXF (BN)	XSE (BN)	XST (BN)	NU	MU	ZYF
1	0.9290	0.9340	3.1500	2.1130	3.5000	0.8190	0.0020
2	0.5608	0.5470	4.5000	2.4450	3.0700	0.7760	0.0020
3	0.5730	0.5370	4.5000	2.4970	2.8100	0.6860	0.0030
4	0.4850	0.4150	4.2000	2.2260	2.6520	0.5490	0.0040
5	0.1480	0.0264	4.7500	1.8490	2.5560	0.4640	0.0050
6	0.1270	0.0013	5.7500	1.4420	2.4980	0.3730	0.0050
7	0.1170	0.0	7.2500	1.0730	2.4630	0.2890	0.0060
8	0.1340	0.0	9.0000	0.7100	2.4420	0.2140	0.0070
9	0.1700	0.0	10.6500	0.4170	2.4280	0.1450	0.0070
10	0.2140	0.0	11.8000	0.2090	2.4210	0.0900	0.0080
11	0.3380	0.0	12.6000	0.0850	2.4160	0.0550	0.0080
12	0.4480	0.0	13.0000	0.0313	2.4130	0.0350	0.0080
13	0.5710	0.0	13.3000	0.0030	2.4110	0.0160	0.0080
14	0.7030	0.0	13.5500	0.0	2.4100	0.0040	0.0080
15	0.8620	0.0	14.2500	0.0	2.4100	0.0030	0.0080
16	1.0600	0.0	14.8500	0.0	2.4100	0.0030	0.0080
17	1.3600	0.0	14.8000	0.0	2.4090	0.0030	0.0080
18	1.7400	0.0	12.9500	0.0	2.4090	0.0030	0.0080
19	0.0140	0.0	11.9500	0.0	2.4100	0.0028	0.0084
20	0.0180	0.0	10.4000	0.0	2.4100	0.0028	0.0084
21	0.0225	0.0	10.4000	0.0	2.4100	0.0028	0.0084
22	0.0295	0.0	10.4000	0.0	2.4100	0.0028	0.0084
23	0.0380	0.0	10.4000	0.0	2.4100	0.0028	0.0084
24	0.0490	0.0	10.4000	0.0	2.4100	0.0028	0.0084
25	0.0630	0.0	10.4000	0.0	2.4100	0.0028	0.0084
26	0.0800	0.0	10.4000	0.0	2.4100	0.0028	0.0084
27	0.1030	0.0	10.4000	0.0	2.4100	0.0028	0.0084
28	0.1320	0.0	10.4000	0.0	2.4100	0.0028	0.0084
29	0.1700	0.0	9.7000	0.0	2.4100	0.0028	0.0084
30	0.2180	0.0	9.0000	0.0	2.4100	0.0028	0.0084
31	0.2800	0.0	9.0000	0.0	2.4100	0.0028	0.0084
32	0.4880	0.0	8.0000	0.0	2.4100	0.0028	0.0084
33	0.5530	0.0	8.0000	0.0	2.4100	0.0028	0.0084
34	1.1800	0.0	8.0000	0.0	2.4100	0.0028	0.0084

INPUT DATA FOR PU-239

GROUP	XXA (BN)	XXF (BN)	XSE (BN)	XSI (BN)	NU	PU	ZYE
1	2.1900	2.3700	3.7500	0.7694	3.7350	0.8187	0.0015
2	1.7000	1.7800	4.4500	1.5220	3.3950	C.7753	0.0019
3	1.9400	1.9900	4.4000	1.5090	3.188C	C.6864	0.0026
4	2.0200	2.0400	3.9500	1.2790	3.0630	0.5709	0.0036
5	1.7800	1.7700	4.2500	0.9741	2.9870	0.4635	0.0045
6	1.7100	1.6400	5.5000	0.6964	2.9410	C.3736	0.0053
7	1.7000	1.5700	6.7500	0.4774	2.9130	C.2896	0.0060
8	1.6900	1.5000	7.9500	0.3457	2.8960	C.2145	0.0066
9	1.7700	1.5500	8.9000	0.2564	2.8860	0.1449	0.0072
10	1.9000	1.6400	9.7500	0.1997	2.8790	0.C898	0.0077
11	2.0700	1.7100	10.4500	0.1588	2.8760	0.C550	0.0080
12	2.3000	1.7500	10.7500	0.1304	2.8730	C.C350	0.0081
13	2.5900	1.8300	11.1000	0.1014	2.8720	0.C159	0.0083
14	3.0500	1.9900	11.5000	0.0671	2.8710	C.0044	0.0084
15	3.8500	2.2600	12.4500	0.0	2.8710	0.0028	0.0084
16	4.9000	2.6700	12.9500	0.0	2.8700	0.CC28	0.0084
17	6.3800	3.2700	13.3000	0.0	2.8700	0.CC28	0.0084
18	8.2600	4.7400	11.7000	0.0	2.8700	0.0028	0.0084
19	11.0000	6.3400	11.0000	0.0	2.8700	0.0028	0.0084
20	17.7000	10.4000	11.0000	0.0	2.8700	0.0028	0.0084
21	20.6000	10.8000	11.0000	0.0	2.8700	0.CC28	0.0084
22	31.0000	17.0000	11.0000	0.0	2.8700	C.0028	0.0084
23	39.0000	19.4000	11.0000	0.0	2.8700	C.CC28	0.0084
24	82.3000	53.0000	11.0000	0.0	2.8700	C.CC28	0.CC84
25	98.0000	40.1000	11.0000	0.0	2.8700	0.C028	0.0084
26	22.4000	12.0000	11.0000	0.0	2.8700	C.C028	0.0084
27	158.4000	87.5000	11.0000	0.0	2.8700	C.0028	0.0084
28	147.3000	94.4000	11.0000	0.0	2.8700	0.0028	0.0084
29	91.3000	48.4000	11.0000	0.0	2.8700	C.0028	0.0084
30	9.7300	8.9500	11.0000	0.0	2.8700	0.C028	0.0084
31	15.8000	14.0000	11.0000	0.0	2.8700	0.CC28	0.0084
32	30.6000	23.5000	11.0000	0.0	2.8700	C.0028	0.0084
33	66.9000	48.1000	11.0000	0.0	2.8700	0.0028	0.0084
34	520.0000	369.0000	11.0000	0.0	2.8700	C.0028	0.0084

INPUT DATA FOR PU-240

GROUP	XXA (BN)	XXF (BN)	XSE (BN)	XST (BN)	NU	MU	ZYF
1	1.7900	1.7400	3.1500	1.0240	3.7370	C.8190	0.0015
2	1.4900	1.4600	4.5000	1.4570	3.3950	C.7756	0.0019
3	1.6100	1.5700	4.5000	1.4740	3.1890	C.6856	0.0026
4	1.5700	1.5100	4.2000	1.0910	3.063C	0.5488	0.0036
5	1.2300	1.4100	4.7500	0.5430	2.9870	C.4642	0.0045
6	C.8770	0.7380	5.7500	0.7550	2.9410	C.3730	0.0053
7	0.3770	0.2150	7.2500	0.9650	2.9130	C.2890	0.0060
8	0.2980	0.1130	9.C000	0.6730	2.8960	0.2144	0.0066
9	0.3170	0.0934	10.65C0	0.2700	2.8860	0.1446	0.0072
10	0.3640	0.0802	11.8000	0.0290	2.88CC	C.C898	C.0076
11	0.4580	0.0878	12.6000	0.0	2.8760	0.0550	0.0079
12	0.5820	0.0583	13.C0C0	0.0	2.8730	C.0350	0.0081
13	0.7230	0.0979	13.3000	0.0	2.8720	0.C160	0.0083
14	0.8820	0.0558	13.5500	0.0	2.8710	0.0440	0.0084
15	1.0900	0.1110	14.25C0	0.0	2.8710	0.CC28	0.0084
16	1.3600	0.1290	14.1000	0.0	2.87CC	C.0028	0.0084
17	1.8800	0.1780	12.5000	0.0	2.8700	0.CC28	0.0084
18	2.6700	0.2200	10.50C0	0.0	2.8700	C.C028	0.0084
19	4.3400	0.3620	10.C000	0.0	2.8700	0.0028	0.0084
20	4.2700	0.0697	10.00C0	0.0	2.8700	0.CC28	0.0084
21	7.9500	0.0812	10.0000	0.0	2.87CC	0.CC28	0.0084
22	7.3500	0.C700	10.00C0	0.0	2.8700	0.C028	0.0084
23	25.4000	0.2300	10.0CC0	0.0	2.8700	0.CC28	0.0084
24	56.6000	0.5300	10.00C0	0.0	2.8700	C.CC28	0.0084
25	95.7000	C.6900	10.0000	0.0	2.8700	0.C028	0.0084
26	0.4780	0.0028	10.00C0	0.0	2.8700	C.C028	0.0084
27	42.4000	0.3730	10.0000	0.0	2.87C0	0.0028	0.0084
28	0.2940	C.0CC7	10.00C0	0.0	2.8700	C.0028	0.0084
29	0.8860	0.0008	10.0000	0.0	2.8700	C.CC28	0.0084
30	3.5900	0.0014	10.00C0	0.0	2.8700	C.0028	0.0084
31	21.8000	0.0050	10.0CC0	0.0	2.8700	0.CC28	0.0084
32	********	0.1710	10.0000	0.0	2.870C	0.CC28	0.0084
33	********	2.9800	10.00C0	0.0	2.87CC	0.0028	0.0084
34	106.2000	0.0500	10.0000	0.0	2.8700	C.C028	0.0084

INPUT DATA FOR PU-241

GROUP	XXA (BN)	XXF (BN)	XSE (BN)	XSI (BN)	NU	PU	ZYE
1	2.2030	2.2000	3.7500	0.8744	4.0430	C.8187	0.0015
2	1.6050	1.6000	4.4500	1.3720	3.6210	C.7753	0.0019
3	1.6620	1.6500	4.4000	1.3300	3.3640	C.6864	0.0026
4	1.8300	1.8000	3.5500	1.0030	3.2090	C.5506	0.0036
5	1.7710	1.7000	4.2500	0.7654	3.1140	C.4635	0.0045
6	1.8100	1.7000	5.5000	0.7514	3.0570	0.3736	0.0052
7	1.9050	1.7500	6.7500	0.6740	3.0220	C.2896	0.0059
8	2.1550	1.9500	7.9500	0.4806	3.0010	C.2145	0.0066
9	2.6700	2.4000	8.9000	0.2114	2.9890	0.1449	0.0072
10	3.4200	3.0500	9.7500	0.0	2.9810	C.0898	0.0076
11	4.2500	3.7500	10.4500	0.0	2.9760	C.0550	0.0079
12	5.1500	4.5000	10.7500	0.0	2.9730	C.0350	0.0081
13	5.6400	4.8500	11.1000	0.0	2.9710	C.0159	0.0082
14	6.4750	5.5500	11.5000	0.0	2.9700	C.0044	0.0083
15	7.3850	6.3000	12.6000	0.0	2.9700	C.0028	0.0083
16	8.3100	7.0000	12.3000	0.0	2.9700	C.0028	0.0083
17	9.0950	7.5000	11.9000	0.0	2.9690	C.0028	0.0083
18	10.3000	8.3000	11.2500	0.0	2.9690	C.0028	0.0083
19	13.2500	10.5500	11.0000	0.0	2.9700	0.0028	0.0083
20	18.7500	15.2500	11.0000	0.0	2.9700	0.0028	0.0083
21	25.6500	21.0000	11.0000	0.0	2.9700	0.0028	0.0083
22	34.7000	28.7500	11.0000	0.0	2.9700	C.0028	0.0083
23	42.7000	35.5000	11.0000	0.0	2.9700	0.0028	0.0083
24	50.0000	38.5000	11.0000	0.0	2.9700	0.0028	0.0083
25	61.5000	47.5000	11.0000	0.0	2.9700	C.0028	0.0083
26	85.0000	65.5000	11.0000	0.0	2.9700	C.0028	0.0083
27	194.0000	149.0000	11.0000	0.0	2.9700	C.0028	0.0083
28	190.0000	143.0000	11.0000	0.0	2.9700	0.0028	0.0083
29	275.5000	225.0000	11.0000	0.0	2.9700	C.0028	0.0083
30	191.5000	167.5000	11.0000	0.0	2.9700	C.0028	0.0083
31	46.0000	34.5000	11.0000	0.0	2.9700	C.0028	0.0083
32	20.0000	17.3000	11.0000	0.0	2.9700	0.0028	0.0083
33	30.0000	21.6000	11.0000	0.0	2.9700	C.0028	0.0083
34	743.7998	609.7000	11.0000	0.0	2.9700	C.0028	0.0083

INPUT DATA FOR PU-242

GROUP	XXA (BN)	XXF (BN)	XSE (BN)	XSI (BN)	NU	MU	ZYE
1	1.9640	1.9500	3.1500	1.1240	4.0620	C.8190	0.0015
2	1.3770	1.3500	4.5000	1.6570	3.6910	C.7756	0.0019
3	1.4320	1.3750	4.5000	1.693C	3.4670	C.6856	0.0026
4	1.5930	1.4750	4.2000	1.1980	3.3300	C.5488	0.0036
5	1.7350	1.5050	4.75C0	0.4290	3.2460	0.4642	0.0045
6	C.8250	0.5750	5.75C0	0.9460	3.198C	C.2730	0.0052
7	0.3700	0.1450	7.2500	1.0120	3.1670	0.2890	0.0059
8	0.3800	0.C950	9.0000	0.6730	3.1490	C.2144	0.0066
9	0.4700	0.0700	10.6500	0.3190	3.1370	0.1446	0.0071
10	0.5300	0.0150	11.8000	0.0703	3.1310	C.C898	0.0076
11	0.6300	0.0	12.6000	0.0	3.1270	0.0550	0.0079
12	0.7550	0.0	13.0000	0.0	3.1240	0.0350	0.0080
13	0.9050	0.0	13.3000	0.0	3.1230	0.0159	0.0082
14	1.0950	0.0	13.5500	0.0	3.1220	0.0044	0.0083
15	1.2150	0.0	14.2500	0.0	3.1210	C.CC28	0.0083
16	1.5500	0.0	14.2000	0.0	3.1210	0.0028	0.0083
17	2.1250	0.0	14.2000	0.0	3.1200	0.0028	0.0083
18	3.2500	0.0	13.1000	0.0	3.1200	0.C028	0.0083
19	5.0000	0.0	11.5000	0.0	3.12C0	C.CC28	0.CC83
20	7.0000	0.0	11.0000	0.0	3.1200	0.0028	0.0083
21	7.0000	0.0	11.0000	0.0	3.1200	C.CC28	0.0083
22	7.0000	0.0	11.0000	0.0	3.120C	C.CC28	0.0083
23	7.5000	0.C	11.0000	0.0	3.1200	0.0028	0.0083
24	9.5000	0.0	11.0000	0.0	3.1200	C.CC28	0.0083
25	5.0000	0.0	11.0000	0.0	3.120C	C.CC28	0.0083
26	6.5000	0.0	11.0000	0.0	3.1200	C.C028	0.0083
27	5.0000	0.0	11.0000	0.0	3.1200	0.CC28	0.0083
28	5.0000	0.0	11.0000	0.0	3.1200	0.C028	0.0083
29	6.5000	0.0	11.0000	0.0	3.1200	0.C028	0.0083
30	14.5000	0.0	11.0000	0.0	3.1200	0.C028	0.0083
31	15.0000	0.0	11.0000	0.0	3.1200	0.0028	0.0083
32	16.6000	0.0	11.0000	0.0	3.1200	0.0028	0.0083
33	9.1000	0.0	11.0000	0.0	3.1200	0.0028	0.0083
34	13.1000	0.0	11.0000	0.0	3.1200	0.0028	0.0083

INPUT DATA FOR SS 304

GROUP	XXA (BN)	XSE (BN)	XSI (BN)	MU	ZYE
1	0.1310	1.9910	1.2640	0.8569	0.0053
2	0.0628	2.3050	1.2740	0.6924	0.0113
3	0.0242	2.2320	1.0060	0.4664	0.0195
4	0.0071	2.2320	0.7280	0.2595	0.0270
5	0.0043	2.3290	0.3098	0.1908	0.0295
6	0.0060	2.7830	0.0	0.1642	0.0304
7	0.0064	3.4370	0.0	0.1057	0.0324
8	0.0073	3.6800	0.0	0.0870	0.0330
9	0.0087	3.7440	0.0	0.0449	0.0350
10	0.0174	5.1280	0.0	0.0259	0.0356
11	0.0149	4.4860	0.0	0.0197	0.0356
12	0.0331	11.4940	0.0	0.0144	0.0356
13	0.0148	5.6600	0.0	0.0126	0.0349
14	0.0248	7.5960	0.0	0.0123	0.0356
15	0.0592	16.2100	0.0	0.0122	0.0361
16	0.0313	10.6900	0.0	0.0122	0.0362
17	0.0227	12.0600	0.0	0.0121	0.0360
18	0.0410	8.1800	0.0	0.0121	0.0357
19	0.2780	9.0700	0.0	0.0120	0.0357
20	0.0255	9.9000	0.0	0.0120	0.0357
21	0.2770	17.4000	0.0	0.0121	0.0359
22	0.0381	10.7800	0.0	0.0120	0.0356
23	0.0618	10.4100	0.0	0.0120	0.0356
24	0.0586	10.3700	0.0	0.0120	0.0356
25	0.0718	10.4000	0.0	0.0120	0.0356
26	0.0920	10.4000	0.0	0.0120	0.0356
27	0.1180	10.4000	0.0	0.0120	0.0356
28	0.1520	10.4000	0.0	0.0120	0.0356
29	0.1950	10.4000	0.0	0.0120	0.0356
30	0.2510	10.4000	0.0	0.0120	0.0356
31	0.3210	10.4000	0.0	0.0120	0.0356
32	0.4120	10.4000	0.0	0.0120	0.0356
33	0.6030	10.4000	0.0	0.0120	0.0356
34	1.1800	10.4000	0.0	0.0120	0.0356

INPUT DATA FOR SODIUM

GROUP	XXA (BN)	XSE (BN)	XSI (BN)	MU	ZYE
1	0.1758	1.4940	0.6070	0.0292	0.0852
2	0.0026	1.7320	0.5488	0.0292	0.0852
3	0.0001	2.0280	0.4843	0.0292	0.0852
4	0.0001	2.6290	0.3546	0.0292	0.0852
5	0.0002	3.2500	0.4420	0.0292	0.0852
6	0.0003	4.6100	0.1704	0.0292	0.0852
7	0.0004	3.4950	0.0001	0.0292	0.0852
8	0.0009	4.5670	0.0	0.0292	0.0852
9	0.0014	3.3020	0.0	0.0292	0.0852
10	0.0013	3.5450	0.0	0.0292	0.0852
11	0.0022	5.0140	0.0	0.0292	0.0852
12	0.0026	4.0040	0.0	0.0292	0.0852
13	0.0015	4.2670	0.0	0.0292	0.0852
14	0.0013	5.2390	0.0	0.0292	0.0852
15	0.0014	7.8790	0.0	0.0292	0.0852
16	0.0066	29.2700	0.0	0.0292	0.0852
17	0.0840	140.0000	0.0	0.0292	0.0852
18	0.0107	6.5100	0.0	0.0292	0.0852
19	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0
25	0.0	0.0	0.0	0.0	0.0
26	0.0	0.0	0.0	0.0	0.0
27	0.0	0.0	0.0	0.0	0.0
28	0.0	0.0	0.0	0.0	0.0
29	0.0	0.0	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0	0.0
31	0.0	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0	0.0
33	0.0	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0	0.0

INPUT DATA FOR OXYGEN

GROUP	XXA (BN)	XSF (BN)	XSI (BN)	PU	ZYE
1	0.2100	1.2250	0.1850	0.2367	0.0996
2	0.0725	1.5250	0.0	0.3541	0.0800
3	0.0	1.7000	0.0	0.3000	0.0906
4	0.0	2.1000	0.0	0.1405	0.1031
5	0.0	5.3000	0.0	0.1075	0.1198
6	0.0	3.7000	0.0	0.2527	0.0922
7	0.0	7.3000	0.0	0.0740	0.1188
8	0.0	3.1250	0.0	0.0080	0.1232
9	0.0	3.1750	0.0	0.0142	0.1243
10	0.0	3.2200	0.0	0.0202	0.1238
11	0.0	3.2750	0.0	0.0260	0.1232
12	0.0	3.3750	0.0	0.0311	0.1222
13	0.0	3.4750	0.0	0.0353	0.1209
14	0.0	3.5750	0.0	0.0387	0.1211
15	0.0	3.6750	0.0	0.0420	0.1207
16	0.0	3.7750	0.0	0.0421	0.1211
17	0.0	3.8000	0.0	0.0421	0.1211
18	0.0	3.8000	0.0	0.0421	0.1211
19	0.0	3.8000	0.0	0.0421	0.1210
20	0.0	3.8000	0.0	0.0421	0.1210
21	0.0	3.8000	0.0	0.0421	0.1210
22	0.0	3.8000	0.0	0.0421	0.1210
23	0.0	3.8000	0.0	0.0421	0.1210
24	0.0	3.8000	0.0	0.0421	0.1210
25	0.0	3.8000	0.0	0.0421	0.1210
26	0.0	3.8000	0.0	0.0421	0.1210
27	0.0	3.8000	0.0	0.0421	0.1210
28	0.0	3.8000	0.0	0.0421	0.1210
29	0.0	3.8000	0.0	0.0421	0.1210
30	0.0	3.8000	0.0	0.0421	0.1210
31	0.0	3.8000	0.0	0.0421	0.1210
32	0.0	3.8000	0.0	0.0421	0.1210
33	0.0	3.8000	0.0	0.0421	0.1210
34	0.0	3.8000	0.0	0.0421	0.1210

INPUT DATA FOR HYDROGEN

GROUP	XXA (BN)	XSE (BN)	XST (BN)	MU	ZYE
1	0.0	1.1650	0.0	0.6650	1.0000
2	0.0	1.6950	0.0	0.6667	1.0000
3	0.0	2.3350	0.0	0.6660	1.0000
4	0.0	3.1100	0.0	0.6660	1.0000
5	0.0	4.1150	0.0	0.6660	1.0000
6	0.0	5.4250	0.0	0.6660	1.0000
7	0.0	7.0000	0.0	0.6670	1.0000
8	0.0	8.8500	0.0	0.6670	1.0000
9	0.0	10.9500	0.0	0.6670	1.0000
10	0.0	13.2000	0.0	0.6670	1.0000
11	0.0	15.2000	0.0	0.6670	1.0000
12	0.0	16.8000	0.0	0.6670	1.0000
13	0.0	17.9500	0.0	0.6660	1.0000
14	0.0	18.8000	0.0	0.6670	1.0000
15	0.0	19.4500	0.0	0.6680	1.0000
16	0.0	19.9500	0.0	0.6670	1.0000
17	0.0	20.0000	0.0	0.6650	1.0000
18	0.0	20.1000	0.0	0.6670	1.0000
19	0.0	20.1000	0.0	0.6670	1.0000
20	0.0	20.2000	0.0	0.6680	1.0000
21	0.0	20.2500	0.0	0.6670	1.0000
22	0.0	20.3000	0.0	0.6650	1.0000
23	0.0	20.4000	0.0	0.6670	1.0000
24	0.0	20.4500	0.0	0.6670	1.0000
25	0.0	20.5000	0.0	0.6650	1.0000
26	0.0	20.6000	0.0	0.6650	1.0000
27	0.0	20.7000	0.0	0.6650	1.0000
28	0.0	20.7000	0.0	0.6650	1.0000
29	0.0	20.8000	0.0	0.6650	1.0000
30	0.0	20.9000	0.0	0.6650	1.0000
31	0.0	20.9000	0.0	0.6650	1.0000
32	0.0	20.9000	0.0	0.6650	1.0000
33	0.0	20.9000	0.0	0.6650	1.0000
34	0.0	20.9000	0.0	0.6650	1.0000

INPUT DATA FOR DEUT.

GROUP	XXA (BN)	XSE (BN)	XSI (BN)	MU	ZYF
1	0.0	1.1500	0.0	0.3330	0.7250
2	0.0	1.6000	0.0	0.3330	0.7250
3	0.0	2.5000	0.0	0.3330	0.7250
4	0.0	2.7000	0.0	0.3330	0.7250
5	0.0	2.9000	0.0	0.3330	0.7250
6	0.0	3.0000	0.0	0.3330	0.7250
7	0.0	3.1000	0.0	0.3330	0.7250
8	0.0	3.3000	0.0	0.3330	0.7250
9	0.0	3.4000	0.0	0.3330	0.7250
10	0.0	3.4000	0.0	0.3330	0.7250
11	0.0	3.4000	0.0	0.3330	0.7250
12	0.0	3.4000	0.0	0.3330	0.7250
13	0.0	3.4000	0.0	0.3330	0.7250
14	0.0	3.4000	0.0	0.3330	0.7250
15	0.0	3.4000	0.0	0.3330	0.7250
16	0.0	3.4000	0.0	0.3330	0.7250
17	0.0	3.4000	0.0	0.3330	0.7250
18	0.0	3.4000	0.0	0.3330	0.7250
19	0.0	3.4000	0.0	0.3330	0.7250
20	0.0	3.4000	0.0	0.3330	0.7250
21	0.0	3.4000	0.0	0.3330	0.7250
22	0.0	3.4000	0.0	0.3330	0.7250
23	0.0	3.4000	0.0	0.3330	0.7250
24	0.0	3.4000	0.0	0.3330	0.7250
25	0.0	3.4000	0.0	0.3330	0.7250
26	0.0	3.4000	0.0	0.3330	0.7250
27	0.0	3.4000	0.0	0.3330	0.7250
28	0.0	3.4000	0.0	0.3330	0.7250
29	0.0	3.4000	0.0	0.3330	0.7250
30	0.0	3.4000	0.0	0.3330	0.7250
31	0.0	3.4000	0.0	0.3330	0.7250
32	0.0	3.4000	0.0	0.3330	0.7250
33	0.0	3.4000	0.0	0.3330	0.7250
34	0.0	3.4000	0.0	0.3330	0.7250

INPUT DATA FOR BORON

GROUP	XXA (BN)	XSE (BN)	XSI (BN)	MU	ZYE
1	0.1500	1.3200	0.0	0.6856	0.0633
2	0.1400	1.5000	0.0	0.5300	0.0943
3	0.1650	1.8350	0.0	0.3515	0.1305
4	0.3150	1.7650	0.0	0.1493	0.1714
5	0.2200	2.3300	0.0	0.1193	0.1773
6	0.4750	3.4500	0.0	0.2007	0.1610
7	0.7050	3.9450	0.0	0.1602	0.1690
8	1.0250	3.9600	0.0	0.0852	0.1841
9	1.5650	3.3450	0.0	0.0671	0.1886
10	2.2050	2.4850	0.0	0.0670	0.1885
11	2.9250	2.0000	0.0	0.0670	0.1885
12	3.6750	1.6750	0.0	0.0672	0.1887
13	4.5500	1.6500	0.0	0.0670	0.1888
14	5.5500	1.8000	0.0	0.0669	0.1886
15	7.3000	1.0000	0.0	0.0670	0.1890
16	9.4000	1.2500	0.0	0.0672	0.1884
17	12.1000	1.4000	0.0	0.0671	0.1886
18	15.5000	1.7000	0.0	0.0671	0.1888
19	19.9000	2.3500	0.0	0.0670	0.1890
20	25.5000	2.2500	0.0	0.0671	0.1890
21	32.7000	3.0500	0.0	0.0670	0.1890
22	42.1000	2.9000	0.0	0.0672	0.1890
23	53.5000	3.7500	0.0	0.0672	0.1890
24	69.5000	4.0000	0.0	0.0705	0.1980
25	89.0000	0.0	0.0	0.0	0.0
26	113.0000	0.0	0.0	0.0	0.0
27	146.0000	0.0	0.0	0.0	0.0
28	186.0000	0.0	0.0	0.0	0.0
29	239.0000	0.0	0.0	0.0	0.0
30	305.0000	0.0	0.0	0.0	0.0
31	384.0000	0.0	0.0	0.0	0.0
32	518.0000	0.0	0.0	0.0	0.0
33	669.0000	0.0	0.0	0.0	0.0
34	********	0.0	0.0	0.0	0.0

INPUT DATA FOR F.P. U

GROUP	XXA (BN)	XSE (BN)	XSI (BN)	MU	ZYF
1	0.0064	0.0	0.0	0.0	0.0
2	0.0097	0.0	0.0	0.0	0.0
3	0.0148	0.0	0.0	0.0	0.0
4	0.0211	0.0	0.0	0.0	0.0
5	0.0316	0.0	0.0	0.0	0.0
6	0.0424	0.0	0.0	0.0	0.0
7	0.0554	0.0	0.0	0.0	0.0
8	0.0728	0.0	0.0	0.0	0.0
9	0.0913	0.0	0.0	0.0	0.0
10	0.1116	0.0	0.0	0.0	0.0
11	0.1425	0.0	0.0	0.0	0.0
12	0.1866	0.0	0.0	0.0	0.0
13	0.2467	0.0	0.0	0.0	0.0
14	0.3467	0.0	0.0	0.0	0.0
15	0.4791	0.0	0.0	0.0	0.0
16	0.6306	0.0	0.0	0.0	0.0
17	0.8467	0.0	0.0	0.0	0.0
18	1.1484	0.0	0.0	0.0	0.0
19	1.4500	0.0	0.0	0.0	0.0
20	2.2900	0.0	0.0	0.0	0.0
21	3.9700	0.0	0.0	0.0	0.0
22	4.2700	0.0	0.0	0.0	0.0
23	4.7100	0.0	0.0	0.0	0.0
24	7.9400	0.0	0.0	0.0	0.0
25	16.0000	0.0	0.0	0.0	0.0
26	2.5000	0.0	0.0	0.0	0.0
27	95.0000	0.0	0.0	0.0	0.0
28	0.5700	0.0	0.0	0.0	0.0
29	0.8000	0.0	0.0	0.0	0.0
30	1.4500	0.0	0.0	0.0	0.0
31	2.3400	0.0	0.0	0.0	0.0
32	26.4000	0.0	0.0	0.0	0.0
33	10.5000	0.0	0.0	0.0	0.0
34	19.6000	0.0	0.0	0.0	0.0

INPUT DATA FOR F.P. PU

GROUP	XXA (BN)	XSE (BN)	XSI (BN)	MU	ZYE
1	0.0087	0.0	0.0	0.0	0.0
2	0.0132	0.0	0.0	0.0	0.0
3	0.0202	0.0	0.0	0.0	0.0
4	0.0283	0.0	0.0	0.0	0.0
5	0.0420	0.0	0.0	0.0	0.0
6	0.0551	0.0	0.0	0.0	0.0
7	0.0711	0.0	0.0	0.0	0.0
8	0.0942	0.0	0.0	0.0	0.0
9	0.1200	0.0	0.0	0.0	0.0
10	0.1468	0.0	0.0	0.0	0.0
11	0.1816	0.0	0.0	0.0	0.0
12	0.2447	0.0	0.0	0.0	0.0
13	0.3210	0.0	0.0	0.0	0.0
14	0.4442	0.0	0.0	0.0	0.0
15	0.5574	0.0	0.0	0.0	0.0
16	0.8039	0.0	0.0	0.0	0.0
17	1.0368	0.0	0.0	0.0	0.0
18	1.4053	0.0	0.0	0.0	0.0
19	1.7800	0.0	0.0	0.0	0.0
20	2.7300	0.0	0.0	0.0	0.0
21	4.7200	0.0	0.0	0.0	0.0
22	5.1300	0.0	0.0	0.0	0.0
23	5.7400	0.0	0.0	0.0	0.0
24	9.4300	0.0	0.0	0.0	0.0
25	4.4800	0.0	0.0	0.0	0.0
26	5.4000	0.0	0.0	0.0	0.0
27	30.5000	0.0	0.0	0.0	0.0
28	1.7100	0.0	0.0	0.0	0.0
29	120.0000	0.0	0.0	0.0	0.0
30	2.6300	0.0	0.0	0.0	0.0
31	4.1000	0.0	0.0	0.0	0.0
32	20.0000	0.0	0.0	0.0	0.0
33	10.0000	0.0	0.0	0.0	0.0
34	23.0000	0.0	0.0	0.0	0.0

******** OUTPUT INFORMATION: CASE NO. 1 ********

18 GROUP RESULTS

GROUP	FLUX (NEUT/CM*CM*SEC)	SIG-A*FLUX (NEUT/CC*SEC)	NU*SIG-F*FLUX (NEUT/CC*SEC)	LEAKAGE (NEUT/CC*SEC)
1	0.1703	0.0041	0.0094	0.0
2	0.9145	0.0118	0.0278	0.0
3	2.1152	0.0221	0.0601	0.0
4	3.0998	0.0285	0.0711	0.0
5	3.3263	0.0148	0.0277	0.0
6	3.5684	0.0142	0.0225	0.0
7	3.5410	0.0131	0.0196	0.0
8	3.3016	0.0131	0.0177	0.0
9	3.2718	0.0152	0.0187	0.0
10	2.9021	0.0162	0.0183	0.0
11	2.5696	0.0194	0.0177	0.0
12	2.2809	0.0220	0.0170	0.0
13	2.0725	0.0238	0.0163	0.0
14	1.9226	0.0268	0.0168	0.0
15	1.7674	0.0308	0.0176	0.0
16	1.6363	0.0343	0.0188	0.0
17	1.5340	0.0407	0.0206	0.0
18	1.4307	0.0487	0.0257	0.0
19	1.3457	0.0273	0.0320	0.0
20	1.2484	0.0545	0.0466	0.0
21	1.1332	0.0365	0.0472	0.0
22	1.0380	0.0448	0.0655	0.0
23	0.9233	0.0600	0.0681	0.0
24	0.7556	0.0868	0.1247	0.0
25	0.5713	0.0762	0.0776	0.0
26	0.4514	0.0294	0.0319	0.0
27	0.3336	0.0747	0.1064	0.0
28	0.2086	0.0371	0.0696	0.0
29	0.1349	0.0291	0.0344	0.0
30	0.0966	0.0051	0.0114	0.0
31	0.0871	0.0033	0.0050	0.0
32	0.0610	0.0203	0.0045	0.0
33	0.0189	0.0180	0.0028	0.0
34	0.0	0.0	0.0	0.0

3 GROUP RESULTS

GROUP	FLUX (NEUT/CM*CM*SEC)	SIG-A*FLUX (NEUT/CC*SEC)	NU*SIG-F*FLUX (NEUT/CC*SEC)	LEAKAGE (NEUT/CC*SEC)
1	26.2110	0.1531	0.2929	0.0
2	13.7835	0.1977	0.1249	0.0
3	9.8384	0.6517	0.7539	0.0

3 GROUP CONSTANTS

GROUP	SIG-A	NU*SIG-F	SIG-R-E	SIG-R	SIG-R 1-3	D	KAPPA*SIG-F
1	0.00584	0.01118	0.03059	0.03239	0.0	1.41	0.120E-12
2	0.01434	0.00906	0.04725	0.04725	0.0	0.70	0.102E-12
3	0.06624	0.07658	0.0	0.0	0.0	0.63	0.861E-12

1 GROUP RESULTS

FLUX	D	SIG-A	NU*SIG-F	KAPPA*SIG-F
49.833	1.063	0.02012	0.02350	0.261E-12

BUCKLING IS 0.0 K-EFF IS 1.16829 BREEDING RATIO IS 0.679

ABSORTIONS BY ISOTOPE AND GROUP

GROUP	U-235	U-238	PU-239	PU-240	PU-241	PU-242
1	0.9430E-05	0.2064E-02	0.3458E-03	0.8803E-04	0.7041E-04	0.167?E-04
2	0.3566E-04	0.6692E-02	0.1442E-02	0.3935E-03	0.2755E-03	0.6296E-04
3	0.9047E-04	0.1582E-01	0.3805E-02	0.9835E-03	0.6598E-03	0.1514E-03
4	0.1378E-03	0.1962E-01	0.5806E-02	0.1406E-02	0.1065E-02	0.2469E-03
5	0.1468E-03	0.6424E-02	0.5490E-02	0.1182E-02	0.1106E-02	0.2886E-03
6	0.1599E-03	0.5914E-02	0.5658E-02	0.9038E-03	0.1212E-02	0.1472E-03
7	0.1754E-03	0.5407E-02	0.5582E-02	0.3855E-03	0.1266E-02	0.6551E-04
8	0.1873E-03	0.5774E-02	0.5174E-02	0.2841E-03	0.1335E-02	0.6273E-04
9	0.2177E-03	0.7258E-02	0.5370E-02	0.2995E-03	0.1640E-02	0.7689E-04
10	0.2297E-03	0.8105E-02	0.5113E-02	0.3051E-03	0.1863E-02	0.7691E-04
11	0.2458E-03	0.1133E-01	0.4932E-02	0.3399E-03	0.2050E-02	0.8094E-04
12	0.2599E-03	0.1334E-01	0.4865E-02	0.3834E-03	0.2205E-02	0.8610E-04
13	0.2745E-03	0.1544E-01	0.4977E-02	0.4327E-03	0.2194E-02	0.9378E-04
14	0.2942E-03	0.1764E-01	0.5438E-02	0.4897E-03	0.2337E-02	0.1053E-03
15	0.3216E-03	0.1988E-01	0.6310E-02	0.5564E-03	0.2450E-02	0.1074E-03
16	0.3532E-03	0.2264E-01	0.7435E-02	0.6427E-03	0.2552E-02	0.1268E-03
17	0.3840E-03	0.2723E-01	0.9076E-02	0.8329E-03	0.2619E-02	0.1630E-03
18	0.4679E-03	0.3249E-01	0.1096E-01	0.1103E-02	0.2766E-02	0.2325E-03
19	0.5655E-03	0.3488E-02	0.1373E-01	0.1687E-02	0.3347E-02	0.3364E-03
20	0.8451E-03	0.2640E-01	0.2049E-01	0.1540E-02	0.4394E-02	0.4370E-03
21	0.8078E-03	0.2107E-02	0.2165E-01	0.2602E-02	0.5456E-02	0.3966E-03
22	0.1107E-02	0.4077E-02	0.2984E-01	0.2203E-02	0.6761E-02	0.3633E-03
23	0.1177E-02	0.1031E-01	0.3339E-01	0.6773E-02	0.7400E-02	0.3462E-03
24	0.9143E-03	0.7890E-02	0.5767E-01	0.1235E-01	0.7092E-02	0.3589E-03
25	0.8500E-03	0.4697E-03	0.5192E-01	0.1579E-01	0.6595E-02	0.1428E-03
26	0.6715E-03	0.1150E-01	0.9375E-02	0.6231E-04	0.7201E-02	0.1467E-03
27	0.6480E-03	0.8339E-02	0.4900E-01	0.4085E-02	0.1215E-01	0.8341E-04
28	0.4051E-03	0.3593E-03	0.2849E-01	0.1771E-04	0.7438E-02	0.5214E-04
29	0.1063E-03	0.1021E-01	0.1142E-01	0.3452E-04	0.6976E-02	0.4384E-04
30	0.7610E-04	0.2747E-03	0.8712E-03	0.1001E-03	0.3471E-02	0.7001E-04
31	0.4165E-04	0.3181E-03	0.1276E-02	0.5481E-03	0.7517E-03	0.6530E-04
32	0.2934E-04	0.3888E-03	0.1732E-02	0.1763E-01	0.2292E-03	0.5067E-04
33	0.5427E-04	0.1363E-03	0.1171E-02	0.1636E-01	0.1063E-03	0.8591E-05
34	0.0	0.0	0.0	0.0	0.0	0.0
99	0.1229E-01	0.3293E 00	0.4298E 00	0.9279E-01	0.1090E 00	0.5094E-02

FISSIONS BY ISOTOPE AND GROUP

GROUP	U-235	U-238	PU-239	PU-240	PU-241	PU-242
1	0.9410E-05	0.2075E-02	0.3742E-03	0.6557E-04	0.7032E-04	0.1660E-04
2	0.3543E-04	0.6528E-02	0.1509E-02	0.3856E-03	0.2746E-03	0.6173E-04
3	0.8922E-04	0.1482E-01	0.3903E-02	0.9590E-03	0.6551E-03	0.1454E-03
4	0.1333E-03	0.1679E-01	0.5864E-02	0.1352E-02	0.1047E-02	0.2286E-03
5	0.1354E-03	0.1146E-02	0.5460E-02	0.1355E-02	0.1061E-02	0.2503E-03
6	0.1406E-03	0.6007E-04	0.5427E-02	0.7605E-03	0.1139E-02	0.1026E-03
7	0.1488E-03	0.0	0.5155E-02	0.2199E-03	0.1163E-02	0.2567E-04
8	0.1538E-03	0.0	0.4592E-02	0.1077E-03	0.1208E-02	0.1568E-04
9	0.1739E-03	0.0	0.4703E-02	0.8825E-04	0.1474E-02	0.1145E-04
10	0.1775E-03	0.0	0.4413E-02	0.6722E-04	0.1661E-02	0.2177E-05
11	0.1828E-03	0.0	0.4075E-02	0.6516E-04	0.1809E-02	0.0
12	0.1876E-03	0.0	0.3701E-02	0.6475E-04	0.1927E-02	0.0
13	0.1945E-03	0.0	0.3517E-02	0.5860E-04	0.1887E-02	0.0
14	0.2075E-03	0.0	0.3548E-02	0.5319E-04	0.2003E-02	0.0
15	0.2283E-03	0.0	0.3704E-02	0.5666E-04	0.2090E-02	0.0
16	0.2488E-03	0.0	0.4051E-02	0.6096E-04	0.2150E-02	0.0
17	0.2646E-03	0.0	0.4652E-02	0.7886E-04	0.2160E-02	0.0
18	0.3275E-03	0.0	0.6289E-02	0.9090E-04	0.2229E-02	0.0
19	0.3960E-03	0.0	0.7912E-02	0.1407E-03	0.2665E-02	0.0
20	0.5654E-03	0.0	0.1204E-01	0.2513E-04	0.3574E-02	0.0
21	0.5392E-03	0.0	0.1135E-01	0.2658E-04	0.4467E-02	0.0
22	0.7467E-03	0.0	0.1636E-01	0.2098E-04	0.5601E-02	0.0
23	0.8152E-03	0.0	0.1661E-01	0.6133E-04	0.6152E-02	0.0
24	0.6548E-03	0.0	0.3714E-01	0.1157E-03	0.5461E-02	0.0
25	0.5025E-03	0.0	0.2124E-01	0.1138E-03	0.5093E-02	0.0
26	0.3970E-03	0.0	0.5022E-02	0.3650E-06	0.5549E-02	0.0
27	0.3546E-03	0.0	0.2707E-01	0.3594E-04	0.9331E-02	0.0
28	0.2401E-03	0.0	0.1826E-01	0.4216E-07	0.5598E-02	0.0
29	0.5470E-04	0.0	0.6054E-02	0.3117E-07	0.5697E-02	0.0
30	0.3915E-04	0.0	0.8014E-03	0.3904E-07	0.3036E-02	0.0
31	0.3217E-04	0.0	0.1130E-02	0.1270E-06	0.5638E-03	0.0
32	0.2256E-04	0.0	0.1530E-02	0.3015E-05	0.1982E-03	0.0
33	0.5248E-04	0.0	0.8421E-03	0.1625E-04	0.7655E-04	0.0
34	0.0	0.0	0.0	0.0	0.0	0.0
99	0.8451E-02	0.4142E-01	0.2581E 00	0.6469E-02	0.8907E-01	0.8602E-03

THREE GROUP MICROSCOPIC CROSS SECTIONS

	SIG-A-1	SIG-A-2	SIG-A-3	SIG-C-1	SIG-C-2	SIG-C-3
U-235	0.1622E 01	0.4733E 01	0.2725E 02	0.2250E 00	0.1374E 01	0.9409E 01
U-238	0.2429E 00	0.7088E 00	0.9250E 00	0.1218E 00	0.7088E 00	0.9250E 00
PU-239	0.1802E 01	0.3367E 01	0.3759E 02	0.9818E-01	0.1235E 01	0.1683E 02
PU-240	0.8230E 00	0.9239E 00	0.2917E 02	0.1123E 00	0.8138E 00	0.2894E 02
PU-241	0.2133E 01	0.6342E 01	0.4448E 02	0.1501E 00	0.9208E 00	0.9119E 01
PU-242	0.9125E 00	0.1108E 01	0.6372E 01	0.2561E 00	0.1108E 01	0.6372E 01
SS 304	0.1199E-01	0.2777E-01	0.1208E 00			
SODIUM	0.1805E-02	0.1156E-01	0.1556E-02			
OXYGEN	0.3894E-02	0.0	0.0			
HYDROGEN	0.0	0.0	0.0			
DEUT.	0.0	0.0	0.0			
BORON	0.8129E 00	0.6010E 01	0.6019E 02			
F.P. U	0.5426E-01	0.3734E 00	0.7123E 01			
F.P. PU	0.7103E-01	0.4720E 00	0.6571E 01			

	SIG-F-1	SIG-F-2	SIG-F-3
U-235	0.1397E 01	0.3359E 01	0.1784E 02
U-238	0.1211E 00	0.0	0.0
PU-239	0.1703E 01	0.2132E 01	0.2077E 02
PU-240	0.7107E 00	0.1101E 00	0.2291E 00
PU-241	0.1983E 01	0.5421E 01	0.3536E 02
PU-242	0.6564E 00	0.0	0.0

5. FUELBURN Output

10.0 Wt. % PU

H_2O

V.F. Set 1

********** INPUT INFORMATION **********

BUCKLING = 0.1000E-03 1/CM**2
POWER DENSITY (KW/L) = 300.00
RATIO OF GROUP 1 FLUX TO THERMAL FLUX = 2.66
RATIO OF GROUP 2 FLUX TO THERMAL FLUX = 1.40
REMOVAL CROSS SECTIONS (1/CM) SIGR(1) = 0.032 SIGR(2) = 0.047
CLAD & COOLANT ABSORPTION (1/CM) SIGA3(1)=0.0003 SIGA3(2)=0.0003 SIGA3(3)=0.0013
DIFFUSION COEFFICIENTS (CM) DF(1) = 1.410 DF(2) = 0.700 DF(3) = 0.630

INITIAL ISOTOPE DENSITIES (KG/L)

U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
0.01276	0.0	5.15600	0.36790	0.11510	0.07509	0.02000

MICROSCOPIC CROSS SECTIONS (CM**2)

GROUP 1	U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
FISSION	0.14E-23	0.0	0.12E-24	0.17E-23	0.71E-24	0.20E-23	0.66E-24
CAPTURE	0.22E-24	0.0	0.12E-24	0.98E-25	0.11E-24	0.15E-24	0.26E-24
ABSORPTION	0.16E-23	0.0	0.24E-24	0.18E-23	0.82E-24	0.21E-23	0.91E-24

GROUP 2	U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
FISSION	0.34E-23	0.0	0.0	0.21E-23	0.11E-24	0.54E-23	0.0
CAPTURE	0.14E-23	0.0	0.71E-24	0.12E-23	0.81E-24	0.92E-24	0.11E-23
ABSORPTION	0.47E-23	0.0	0.71E-24	0.34E-23	0.92E-24	0.63E-23	0.11E-23

GROUP 3	U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
FISSION	0.18E-22	0.0	0.0	0.21E-22	0.23E-24	0.35E-22	0.0
CAPTURE	0.94E-23	0.0	0.92E-24	0.17E-22	0.29E-22	0.91E-23	0.64E-23
ABSORPTION	0.27E-22	0.0	0.92E-24	0.38E-22	0.29E-22	0.44E-22	0.64E-23

FISSION PRODUCT MICROSCOPIC CROSS SECTIONS (CM**2)
XASU2 = 0.105E-23 XASU3 = 0.142E-22
XANU2 = 0.242E-24 XANU3 = 0.199E-23
XASP2 = 0.115E-23 XASP3 = 0.182E-22
XANP2 = 0.368E-24 XANP3 = 0.304E-23
XAX = 0.178E-23

****** END OF INPUT INFORMATION ******

MACROSCOPIC CROSS SECTIONS (1/CM)

GROUP 1	U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
FISSION	0.45E-04	0.0	0.16E-02	0.16E-02	0.21E-03	0.37E-03	0.33E-04
CAPTURE	0.72E-05	0.0	0.16E-02	0.90E-04	0.33E-04	0.28E-04	0.13E-04
ABSORPTION	0.52E-04	0.0	0.32E-02	0.17E-02	0.24E-03	0.40E-03	0.46E-04

GROUP 2	U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
FISSION	0.11E-03	0.0	0.0	0.20E-02	0.32E-04	0.10E-02	0.0
CAPTURE	0.44E-04	0.0	0.92E-02	0.11E-02	0.24E-03	0.17E-03	0.56E-04
ABSORPTION	0.15E-03	0.0	0.92E-02	0.31E-02	0.27E-03	0.12E-02	0.56E-04

GROUP 3	U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
FISSION	0.57E-03	0.0	0.0	0.19E-01	0.67E-04	0.66E-02	0.0
CAPTURE	0.30E-03	0.0	0.12E-01	0.15E-01	0.85E-02	0.17E-02	0.32E-03
ABSORPTION	0.87E-03	0.0	0.12E-01	0.35E-01	0.86E-02	0.83E-02	0.32E-03

DATA AT END OF TIME STEP # 1 K = 1.162 SIGP = 0.01691

ISOTOPES	DENSITY(KG/L)
U-235	0.125E-01
U-236	0.896E-04
U-238	0.515E 01
PU-239	0.365E 00
PU-240	0.117E 00
PU-241	0.744E-01
PU-242	0.204E-01

THERMAL FLUX = 0.230E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.595E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.681
BURNUP THIS STEP = 1559. MWD/MT
TOTAL BURNUP = 1559. MWD/MT
ENERGY DENSITY IS 215049. KW-HR/L
TIME STEP ENDS AT 720. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 2 K = 1.154 SIGP = 0.01594

ISOTOPES	DENSITY(KG/L)
U-235	0.122E-01
U-236	0.178E-03
U-238	0.514E 01
PU-239	0.361E 00
PU-240	0.119E 00
PU-241	0.738E-01
PU-242	0.207E-01

THERMAL FLUX = 0.232E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.600E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.689
BURNUP THIS STEP = 1559. MWD/MT
TOTAL BURNUP = 3119. MWD/MT
ENERGY DENSITY IS 215072. KW-HR/L
TIME STEP ENDS AT 1440. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 3 K = 1.146 SIGP = 0.01500

ISOTOPES	DENSITY(KG/L)
U-235	0.119E-01
U-236	0.265E-03
U-238	0.513E 01
PU-239	0.358E 00
PU-240	0.120E 00
PU-241	0.732E-01
PU-242	0.211E-01

THERMAL FLUX = 0.234E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.606E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.697
BURNUP THIS STEP = 1560. MWD/MT
TOTAL BURNUP = 4678. MWD/MT
ENERGY DENSITY IS 215095. KW-HR/L
TIME STEP ENDS AT 2160. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 4 K = 1.138 SIGP = 0.01409

ISOTOPES	DENSITY(KG/L)
U-235	0.116E-01
U-236	0.351E-03
U-238	0.512E 01
PU-239	0.355E 00
PU-240	0.122E 00
PU-241	0.727E-01
PU-242	0.214E-01

THERMAL FLUX = 0.236E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.611E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.705
BURNUP THIS STEP = 1560. MWD/MT
TOTAL BURNUP = 6238. MWD/MT
ENERGY DENSITY IS 215113. KW-HR/L
TIME STEP ENDS AT 2880. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 5 K = 1.130 SIGP = 0.01321

ISOTOPES	DENSITY(KG/L)
U-235	0.114E-01
U-236	0.435E-03
U-238	0.512E 01
PU-239	0.352E 00
PU-240	0.124E 00
PU-241	0.722E-01
PU-242	0.217E-01

THERMAL FLUX = 0.238E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.616E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.713
BURNUP THIS STEP = 1560. MWD/MT
TOTAL BURNUP = 7797. MWD/MT
ENERGY DENSITY IS 215135. KW-HR/L
TIME STEP ENDS AT 3600. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 6 K = 1.123 SIGP = 0.01236

ISOTOPES	DENSITY(KG/L)
U-235	0.111E-01
U-236	0.518E-03
U-238	0.511E 01
PU-239	0.348E 00

THERMAL FLUX = 0.239E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.621E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.720
BURNUP THIS STEP = 1560. MWD/MT
TOTAL BURNUP = 9357. MWD/MT

DATA AT END OF TIME STEP # 7 K = 1.116 SIGP = 0.01153

ISOTOPES	DENSITY(KG/L)
U-235	0.108E-01
U-236	0.600E-03
U-238	0.510E 01
PU-239	0.345E 00
PU-240	0.127E 00
PU-241	0.713E-01
PU-242	0.224E-01

THERMAL FLUX = 0.241E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.625E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.728
BURNUP THIS STEP = 1560. MWD/MT
TOTAL BURNUP = 10918. MWD/MT
ENERGY DENSITY IS 215180. KW-HR/L
TIME STEP ENDS AT 5040. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 8 K = 1.108 SIGP = 0.01072

ISOTOPES	DENSITY(KG/L)
U-235	0.106E-01
U-236	0.681E-03
U-238	0.509E 01
PU-239	0.342E 00
PU-240	0.128E 00
PU-241	0.710E-01
PU-242	0.228E-01

THERMAL FLUX = 0.243E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.630E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.735
BURNUP THIS STEP = 1560. MWD/MT
TOTAL BURNUP = 12478. MWD/MT
ENERGY DENSITY IS 215199. KW-HR/L
TIME STEP ENDS AT 5760. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 9 K = 1.101 SIGP = 0.00994

ISOTOPES	DENSITY(KG/L)
U-235	0.103E-01
U-236	0.760E-03
U-238	0.508E 01
PU-239	0.339E 00
PU-240	0.130E 00
PU-241	0.707E-01
PU-242	0.231E-01

THERMAL FLUX = 0.245E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.635E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.742
BURNUP THIS STEP = 1560. MWD/MT
TOTAL BURNUP = 14038. MWD/MT
ENERGY DENSITY IS 215221. KW-HR/L
TIME STEP ENDS AT 6480. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 10 K = 1.095 SIGP = 0.00918

ISOTOPES	DENSITY(KG/L)
U-235	0.101E-01
U-236	0.838E-03
U-238	0.507E 01
PU-239	0.337E 00
PU-240	0.131E 00
PU-241	0.704E-01
PU-242	0.234E-01

THERMAL FLUX = 0.247E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.640E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.749
BURNUP THIS STEP = 1561. MWD/MT
TOTAL BURNUP = 15599. MWD/MT
ENERGY DENSITY IS 215241. KW-HR/L
TIME STEP ENDS AT 7200. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 11 K = 1.088 SIGP = 0.00845

ISOTOPES	DENSITY(KG/L)
U-235	0.983E-02
U-236	0.914E-03
U-238	0.507E 01
PU-239	0.334E 00
PU-240	0.132E 00
PU-241	0.702E-01
PU-242	0.238E-01

THERMAL FLUX = 0.248E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.644E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.756
BURNUP THIS STEP = 1561. MWD/MT
TOTAL BURNUP = 17160. MWD/MT
ENERGY DENSITY IS 215259. KW-HR/L
TIME STEP ENDS AT 7920. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 12 K = 1.081 SIGP = 0.00773

ISOTOPES	DENSITY(KG/L)
U-235	0.959E-02
U-236	0.990E-03
U-238	0.506E 01
PU-239	0.331E 00
PU-240	0.134E 00
PU-241	0.700E-01
PU-242	0.241E-01

THERMAL FLUX = 0.250E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.648E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.763
BURNUP THIS STEP = 1561. MWD/MT
TOTAL BURNUP = 18720. MWD/MT
ENERGY DENSITY IS 215282. KW-HR/L
TIME STEP ENDS AT 8640. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 13 K = 1.075 SIGP = 0.00704

ISOTOPES	DENSITY(KG/L)
U-235	0.936E-02
U-236	0.106E-02
U-238	0.505E 01
PU-239	0.328E 00
PU-240	0.135E 00
PU-241	0.698E-01
PU-242	0.244E-01

THERMAL FLUX = 0.252E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.653E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.769
BURNUP THIS STEP = 1561. MWD/MT
TOTAL BURNUP = 20281. MWD/MT
ENERGY DENSITY IS 215295. KW-HR/L
TIME STEP ENDS AT 9360. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 14 K = 1.069 SIGP = 0.00636

ISOTOPES	DENSITY(KG/L)
U-235	0.912E-02
U-236	0.114E-02
U-238	0.504E 01
PU-239	0.325E 00
PU-240	0.136E 00
PU-241	0.697E-01
PU-242	0.248E-01

THERMAL FLUX = 0.253E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.657E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.776
BURNUP THIS STEP = 1561. MWD/MT
TOTAL BURNUP = 21843. MWD/MT
ENERGY DENSITY IS 215320. KW-HR/L
TIME STEP ENDS AT 10080. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 15 K = 1.063 SIGP = 0.00570

ISOTOPES	DENSITY(KG/L)
U-235	0.890E-02
U-236	0.121E-02
U-238	0.503E 01
PU-239	0.323E 00
PU-240	0.137E 00
PU-241	0.696E-01
PU-242	0.251E-01

THERMAL FLUX = 0.255E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.661E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.782
BURNUP THIS STEP = 1561. MWD/MT
TOTAL BURNUP = 23404. MWD/MT
ENERGY DENSITY IS 215335. KW-HR/L
TIME STEP ENDS AT 10800. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 16 K = 1.057 SIGP = 0.00506

ISOTOPES	DENSITY(KG/L)
U-235	0.867E-02
U-236	0.128E-02
U-238	0.502E 01
PU-239	0.320E 00
PU-240	0.138E 00
PU-241	0.695E-01
PU-242	0.254E-01

THERMAL FLUX = 0.257E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.665E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.788
BURNUP THIS STEP = 1561. MWD/MT
TOTAL BURNUP = 24965. MWD/MT
ENERGY DENSITY IS 215355. KW-HR/L
TIME STEP ENDS AT 11520. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 17 K = 1.051 SIGP = 0.00444

ISOTOPES	DENSITY(KG/L)
U-235	0.845E-02
U-236	0.134E-02
U-238	0.502E 01
PU-239	0.318E 00

THERMAL FLUX = 0.258E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.669E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.794
BURNUP THIS STEP = 1562. MWD/MT
TOTAL BURNUP = 26527. MWD/MT

DATA AT END OF TIME STEP # 18 K = 1.045 SIGP = 0.00383

ISOTOPES	DENSITY(KG/L)
U-235	0.824E-02
U-236	0.141E-02
U-238	0.501E 01
PU-239	0.315E 00
PU-240	0.140E 00
PU-241	0.694E-01
PU-242	0.261E-01

THERMAL FLUX = 0.260E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.673E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.799
BURNUP THIS STEP = 1562. MWD/MT
TOTAL BURNUP = 28088. MWD/MT
ENERGY DENSITY IS 215385. KW-HR/L
TIME STEP ENDS AT 12960. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 19 K = 1.040 SIGP = 0.00324

ISOTOPES	DENSITY(KG/L)
U-235	0.803E-02
U-236	0.148E-02
U-238	0.500E 01
PU-239	0.313E 00
PU-240	0.141E 00
PU-241	0.694E-01
PU-242	0.264E-01

THERMAL FLUX = 0.261E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.677E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.805
BURNUP THIS STEP = 1562. MWD/MT
TOTAL BURNUP = 29650. MWD/MT
ENERGY DENSITY IS 215402. KW-HR/L
TIME STEP ENDS AT 13680. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 20 K = 1.034 SIGP = 0.00266

ISOTOPES	DENSITY(KG/L)
U-235	0.782E-02
U-236	0.154E-02
U-238	0.499E 01
PU-239	0.311E 00
PU-240	0.142E 00
PU-241	0.694E-01
PU-242	0.267E-01

THERMAL FLUX = 0.263E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.681E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.810
BURNUP THIS STEP = 1562. MWD/MT
TOTAL BURNUP = 31212. MWD/MT
ENERGY DENSITY IS 215421. KW-HR/L
TIME STEP ENDS AT 14400. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 21 K = 1.029 SIGP = 0.00210

ISOTOPES	DENSITY(KG/L)
U-235	0.762E-02
U-236	0.161E-02
U-238	0.498E 01
PU-239	0.308E 00
PU-240	0.142E 00
PU-241	0.695E-01
PU-242	0.270E-01

THERMAL FLUX = 0.264E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.684E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.815
BURNUP THIS STEP = 1562. MWD/MT
TOTAL BURNUP = 32774. MWD/MT
ENERGY DENSITY IS 215436. KW-HR/L
TIME STEP ENDS AT 15120. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 22 K = 1.024 SIGP = 0.00155

ISOTOPES	DENSITY(KG/L)
U-235	0.742E-02
U-236	0.167E-02
U-238	0.497E 01
PU-239	0.306E 00
PU-240	0.143E 00
PU-241	0.695E-01
PU-242	0.274E-01

THERMAL FLUX = 0.265E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.688E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.820
BURNUP THIS STEP = 1562. MWD/MT
TOTAL BURNUP = 34336. MWD/MT
ENERGY DENSITY IS 215446. KW-HR/L
TIME STEP ENDS AT 15840. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 23 K = 1.019 SIGP = 0.00101

ISOTOPES	DENSITY(KG/L)
U-235	0.723E-02
U-236	0.173E-02
U-238	0.496E 01
PU-239	0.304E 00
PU-240	0.144E 00
PU-241	0.696E-01
PU-242	0.277E-01

THERMAL FLUX = 0.267E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.691E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.825
BURNUP THIS STEP = 1562. MWD/MT
TOTAL BURNUP = 35898. MWD/MT
ENERGY DENSITY IS 215464. KW-HR/L
TIME STEP ENDS AT 16560. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 24 K = 1.014 SIGP = 0.00049

ISOTOPES	DENSITY(KG/L)
U-235	0.704E-02
U-236	0.179E-02
U-238	0.495E 01
PU-239	0.302E 00
PU-240	0.145E 00
PU-241	0.696E-01
PU-242	0.280E-01

THERMAL FLUX = 0.268E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.695E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.830
BURNUP THIS STEP = 1562. MWD/MT
TOTAL BURNUP = 37460. MWD/MT
ENERGY DENSITY IS 215476. KW-HR/L
TIME STEP ENDS AT 17280. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 25 K = 1.009 SIGP =-0.00003

ISOTOPES	DENSITY(KG/L)
U-235	0.686E-02
U-236	0.184E-02
U-238	0.495E 01
PU-239	0.299E 00
PU-240	0.145E 00
PU-241	0.697E-01
PU-242	0.283E-01

THERMAL FLUX = 0.269E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.698E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.834
BURNUP THIS STEP = 1562. MWD/MT
TOTAL BURNUP = 39023. MWD/MT
ENERGY DENSITY IS 215489. KW-HR/L
TIME STEP ENDS AT 18000. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 26 K = 1.004 SIGP =-0.00053

ISOTOPES	DENSITY(KG/L)
U-235	0.668E-02
U-236	0.190E-02
U-238	0.494E 01
PU-239	0.297E 00
PU-240	0.146E 00
PU-241	0.698E-01
PU-242	0.286E-01

THERMAL FLUX = 0.271E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.701E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.839
BURNUP THIS STEP = 1562. MWD/MT
TOTAL BURNUP = 40585. MWD/MT
ENERGY DENSITY IS 215500. KW-HR/L
TIME STEP ENDS AT 18720. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 27 K = 1.000 SIGP =-0.00102

ISOTOPES	DENSITY(KG/L)
U-235	0.650E-02
U-236	0.196E-02
U-238	0.493E 01
PU-239	0.295E 00
PU-240	0.146E 00
PU-241	0.699E-01
PU-242	0.290E-01

THERMAL FLUX = 0.272E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.705E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.843
BURNUP THIS STEP = 1563. MWD/MT
TOTAL BURNUP = 42148. MWD/MT
ENERGY DENSITY IS 215518. KW-HR/L
TIME STEP ENDS AT 19440. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 28 K = 0.995 SIGP =-0.00151

ISOTOPES	DENSITY(KG/L)
U-235	0.632E-02
U-236	0.201E-02
U-238	0.492E 01
PU-239	0.293E 00

THERMAL FLUX = 0.273E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.708E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.847
BURNUP THIS STEP = 1563. MWD/MT
TOTAL BURNUP = 43710. MWD/MT

DATA AT END OF TIME STEP # 29 K = 0.990 SIGP =-0.00198

ISOTOPES	DENSITY(KG/L)
U-235	0.616E-02
U-236	0.206E-02
U-238	0.491E 01
PU-239	0.291E 00
PU-240	0.147E 00
PU-241	0.701E-01
PU-242	0.296E-01

THERMAL FLUX = 0.274E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.711E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.851
BURNUP THIS STEP = 1563. MWD/MT
TOTAL BURNUP = 45273. MWD/MT
ENERGY DENSITY IS 215540. KW-HR/L
TIME STEP ENDS AT 20880. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 30 K = 0.986 SIGP =-0.00244

ISOTOPES	DENSITY(KG/L)
U-235	0.599E-02
U-236	0.212E-02
U-238	0.490E 01
PU-239	0.289E 00
PU-240	0.148E 00
PU-241	0.703E-01
PU-242	0.299E-01

THERMAL FLUX = 0.275E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.714E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.855
BURNUP THIS STEP = 1563. MWD/MT
TOTAL BURNUP = 46836. MWD/MT
ENERGY DENSITY IS 215551. KW-HR/L
TIME STEP ENDS AT 21600. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 31 K = 0.982 SIGP =-0.00290

ISOTOPES	DENSITY(KG/L)
U-235	0.583E-02
U-236	0.217E-02
U-238	0.489E 01
PU-239	0.288E 00
PU-240	0.148E 00
PU-241	0.704E-01
PU-242	0.302E-01

THERMAL FLUX = 0.277E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.717E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.858
BURNUP THIS STEP = 1563. MWD/MT
TOTAL BURNUP = 48399. MWD/MT
ENERGY DENSITY IS 215558. KW-HR/L
TIME STEP ENDS AT 22320. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 32 K = 0.978 SIGP =-0.00335

ISOTOPES	DENSITY(KG/L)
U-235	0.567E-02
U-236	0.221E-02
U-238	0.488E 01
PU-239	0.286E 00
PU-240	0.149E 00
PU-241	0.705E-01
PU-242	0.306E-01

THERMAL FLUX = 0.278E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.720E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.862
BURNUP THIS STEP = 1563. MWD/MT
TOTAL BURNUP = 49962. MWD/MT
ENERGY DENSITY IS 215568. KW-HR/L
TIME STEP ENDS AT 23040. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 33 K = 0.973 SIGP =-0.00379

ISOTOPES	DENSITY(KG/L)
U-235	0.552E-02
U-236	0.226E-02
U-238	0.487E 01
PU-239	0.284E 00
PU-240	0.149E 00
PU-241	0.707E-01
PU-242	0.309E-01

THERMAL FLUX = 0.279E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.723E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.865
BURNUP THIS STEP = 1563. MWD/MT
TOTAL BURNUP = 51525. MWD/MT
ENERGY DENSITY IS 215579. KW-HR/L
TIME STEP ENDS AT 23760. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 34 K = 0.969 SIGP =-0.00422

ISOTOPES	DENSITY(KG/L)
U-235	0.536E-02
U-236	0.231E-02
U-238	0.486E 01
PU-239	0.282E 00
PU-240	0.149E 00
PU-241	0.708E-01
PU-242	0.312E-01

THERMAL FLUX = 0.280E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.725E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.868
BURNUP THIS STEP = 1563. MWD/MT
TOTAL BURNUP = 53088. MWD/MT
ENERGY DENSITY IS 215591. KW-HR/L
TIME STEP ENDS AT 24480. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 35 K = 0.965 SIGP =-0.00465

ISOTOPES	DENSITY(KG/L)
U-235	0.522E-02
U-236	0.236E-02
U-238	0.486E 01
PU-239	0.280E 00
PU-240	0.150E 00
PU-241	0.709E-01
PU-242	0.315E-01

THERMAL FLUX = 0.281E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.728E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.871
BURNUP THIS STEP = 1563. MWD/MT
TOTAL BURNUP = 54651. MWD/MT
ENERGY DENSITY IS 215597. KW-HR/L
TIME STEP ENDS AT 25200. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 36 K = 0.961 SIGP =-0.00507

ISOTOPES	DENSITY(KG/L)
U-235	0.507E-02
U-236	0.240E-02
U-238	0.485E 01
PU-239	0.279E 00
PU-240	0.150E 00
PU-241	0.711E-01
PU-242	0.319E-01

THERMAL FLUX = 0.282E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.731E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.874
BURNUP THIS STEP = 1563. MWD/MT
TOTAL BURNUP = 56214. MWD/MT
ENERGY DENSITY IS 215603. KW-HR/L
TIME STEP ENDS AT 25920. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 37 K = 0.957 SIGP =-0.00549

ISOTOPES	DENSITY(KG/L)
U-235	0.493E-02
U-236	0.244E-02
U-238	0.484E 01
PU-239	0.277E 00
PU-240	0.150E 00
PU-241	0.712E-01
PU-242	0.322E-01

THERMAL FLUX = 0.283E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.734E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.877
BURNUP THIS STEP = 1563. MWD/MT
TOTAL BURNUP = 57778. MWD/MT
ENERGY DENSITY IS 215616. KW-HR/L
TIME STEP ENDS AT 26640. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 38 K = 0.954 SIGP =-0.00590

ISOTOPES	DENSITY(KG/L)
U-235	0.480E-02
U-236	0.249E-02
U-238	0.483E 01
PU-239	0.276E 00
PU-240	0.150E 00
PU-241	0.714E-01
PU-242	0.325E-01

THERMAL FLUX = 0.284E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.736E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.880
BURNUP THIS STEP = 1563. MWD/MT
TOTAL BURNUP = 59341. MWD/MT
ENERGY DENSITY IS 215620. KW-HR/L
TIME STEP ENDS AT 27360. HOURS
TIME STEP LENGTH 720. HOURS

DATA AT END OF TIME STEP # 39 K = 0.950 SIGP =-0.00630

ISOTOPES	DENSITY(KG/L)
U-235	0.466E-02
U-236	0.253E-02
U-238	0.482E 01
PU-239	0.274E 00

THERMAL FLUX = 0.285E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.739E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.883
BURNUP THIS STEP = 1563. MWD/MT
TOTAL BURNUP = 60904. MWD/MT

6. FASCON-2 Output

10.5 Wt. % PU

80% D_2O

V.F. Set 2

******** INPUT INFORMATION ********

TABLE OF DENSITIES

NAME	DENSITY (1/BN-CM)
U-235	0.0000355
U-238	0.0141800
PU-239	0.0010635
PU-240	0.0003312
PU-241	0.0002153
PU-242	0.0000574
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349300
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0
F.P. U	0.0
F.P. PU	0.0

******** OUTPUT INFORMATION: CASE NO. 1 ********

18 GROUP RESULTS

GROUP	FLUX (NEUT/CM*CM*SEC)	SIG-A*FLUX (NEUT/CC*SEC)	NU*SIG-F*FLUX (NEUT/CC*SEC)	LEAKAGE (NEUT/CC*SEC)
1	0.1935	0.0050	0.0117	0.0
2	1.0701	0.0150	0.0359	0.0
3	2.4042	0.0277	0.0755	0.0
4	3.6203	0.0368	0.0921	0.0
5	4.0301	0.0201	0.0383	0.0
6	5.1305	0.0229	0.0371	0.0
7	5.5530	0.0231	0.0353	0.0
8	6.0016	0.0266	0.0368	0.0
9	7.2304	0.0374	0.0473	0.0
10	7.0485	0.0440	0.0509	0.0
11	6.6832	0.0560	0.0528	0.0
12	5.9589	0.0636	0.0509	0.0
13	5.2662	0.0668	0.0476	0.0
14	4.6663	0.0720	0.0467	0.0
15	3.8044	0.0733	0.0433	0.0
16	3.0773	0.0714	0.0405	0.0
17	2.5006	0.0733	0.0385	0.0
18	1.9153	0.0720	0.0394	0.0
19	1.5090	0.0317	0.0411	0.0
20	1.2090	0.0383	0.0517	0.0
21	0.8934	0.0316	0.0476	0.0
22	0.6368	0.0295	0.0460	0.0
23	0.4200	0.0273	0.0355	0.0
24	0.2037	0.0250	0.0385	0.0
25	0.0614	0.0094	0.0096	0.0
26	0.0186	0.0010	0.0015	0.0
27	0.0073	0.0017	0.0027	0.0
28	0.0001	0.0000	0.0000	0.0
29	0.0000	0.0000	0.0000	0.0
30	0.0000	0.0000	0.0000	0.0
31	0.0000	0.0000	0.0000	0.0
32	0.0000	0.0000	0.0000	0.0
33	0.0	0.0	0.0	0.0
34	0.0000	0.0000	0.0000	0.0

3 GROUP RESULTS

GROUP	FLUX (NEUT/CM*CM*SEC)	SIG-A*FLUX (NEUT/CC*SEC)	NU*SIG-F*FLUX (NEUT/CC*SEC)	LEAKAGE (NEUT/CC*SEC)
1	42.2822	0.2586	0.4608	0.0
2	31.9569	0.4764	0.3202	0.0
3	6.8747	0.2676	0.3086	0.0

3 GROUP CONSTANTS

GROUP	SIG-A	NU*SIG-F	SIG-R-F	SIG-R	SIG-R 1-3	D	KAPPA*SIG-F
1	0.00612	0.01090	0.01537	0.01760	0.0	1.27	0.118E-12
2	0.01491	0.01002	0.00838	0.00838	0.0	0.72	0.113E-12
3	0.03893	0.04490	0.0	0.0	0.0	0.68	0.506E-12

1 GROUP RESULTS

FLUX	D	SIG-A	NU*SIG-F	KAPPA*SIG-F
81.114	1.003	0.01236	0.01343	0.149E-12

BUCKLING IS 0.0 K-EFF IS 1.08683 BREEDING RATIO IS 1.077

ABSORTIONS BY ISOTOPE AND GROUP

GROUP	U-235	U-238	PU-239	PU-240	PU-241	PU-242
1	0.1164E-04	0.2549E-02	0.4508E-03	0.1147E-03	0.9179E-04	0.2182E-04
2	0.4530E-04	0.8509E-02	0.1935E-02	0.5281E-03	0.3698E-03	0.8458E-04
3	0.1116E-03	0.1953E-01	0.4960E-02	0.1282E-02	0.8603E-03	0.1976E-03
4	0.1747E-03	0.2490E-01	0.7777E-02	0.1883E-02	0.1426E-02	0.3310E-03
5	0.1931E-03	0.8458E-02	0.7629E-02	0.1642E-02	0.1537E-02	0.4014E-03
6	0.2495E-03	0.9239E-02	0.9330E-02	0.1490E-02	0.1999E-02	0.2430E-03
7	0.2987E-03	0.9213E-02	0.1004E-01	0.6934E-03	0.2278E-02	0.1179E-03
8	0.3697E-03	0.1140E-01	0.1079E-01	0.5923E-03	0.2785E-02	0.1309E-03
9	0.5223E-03	0.1743E-01	0.1361E-01	0.7591E-03	0.4156E-02	0.1951E-03
10	0.6055E-03	0.2139E-01	0.1424E-01	0.8497E-03	0.5190E-02	0.2144E-03
11	0.6940E-03	0.3203E-01	0.1471E-01	0.1014E-02	0.6115E-02	0.2417E-03
12	0.7372E-03	0.3785E-01	0.1458E-01	0.1149E-02	0.6607E-02	0.2582E-03
13	0.7572E-03	0.4264E-01	0.1451E-01	0.1261E-02	0.6395E-02	0.2736E-03
14	0.7753E-03	0.4652E-01	0.1514E-01	0.1363E-02	0.6505E-02	0.2933E-03
15	0.7516E-03	0.4650E-01	0.1558E-01	0.1373E-02	0.6049E-02	0.2653E-03
16	0.7210E-03	0.4625E-01	0.1604E-01	0.1386E-02	0.5506E-02	0.2738E-03
17	0.6795E-03	0.4822E-01	0.1697E-01	0.1557E-02	0.4897E-02	0.3050E-03
18	0.6799E-03	0.4726E-01	0.1682E-01	0.1694E-02	0.4247E-02	0.3573E-03
19	0.6884E-03	0.1291E-02	0.1765E-01	0.2169E-02	0.4305E-02	0.4331E-03
20	0.8884E-03	0.7205E-02	0.2276E-01	0.1710E-02	0.4880E-02	0.4858E-03
21	0.6914E-03	0.6818E-03	0.1957E-01	0.2352E-02	0.4934E-02	0.3590E-03
22	0.7370E-03	0.8834E-03	0.2100E-01	0.1550E-02	0.4758E-02	0.2559E-03
23	0.5815E-03	0.1446E-02	0.1742E-01	0.3533E-02	0.3861E-02	0.1809E-03
24	0.2675E-03	0.6843E-03	0.1783E-01	0.3818E-02	0.2193E-02	0.1111E-03
25	0.9920E-04	0.5486E-04	0.6401E-02	0.1947E-02	0.8132E-03	0.1763E-04
26	0.2999E-04	0.1440E-03	0.4423E-03	0.2940E-05	0.3398E-03	0.6928E-05
27	0.1550E-04	0.5772E-04	0.1238E-02	0.1032E-03	0.3069E-03	0.2109E-05
28	0.2461E-06	0.2184E-06	0.1828E-04	0.1136E-07	0.4774E-05	0.3349E-07
29	0.9321E-08	0.2420E-06	0.1058E-05	0.3197E-08	0.6462E-06	0.4065E-08
30	0.1869E-08	0.6754E-08	0.2261E-07	0.2598E-08	0.9008E-07	0.1810E-08
31	0.7274E-09	0.5534E-08	0.2342E-07	0.1006E-07	0.1381E-07	0.1200E-08
32	0.2334E-09	0.3095E-08	0.1455E-07	0.1481E-06	0.1926E-08	0.4261E-09
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.5553E-09	0.9956E-09	0.3290E-07	0.2093E-08	0.9528E-08	0.4474E-10
99	0.1238E-01	0.4923E 00	0.3294E 00	0.3782E-01	0.9341E-01	0.6058E-02

FISSIONS BY ISOTOPE AND GROUP

GROUP	U-235	U-238	PU-239	PU-240	PU-241	PU-242
1	0.1161E-04	0.2563E-02	0.4878E-03	0.1115E-03	0.9167E-04	0.2166E-04
2	0.4502E-04	0.8300E-02	0.2026E-02	0.5174E-03	0.3686E-03	0.8292E-04
3	0.1101E-03	0.1831E-01	0.5088E-02	0.1250E-02	0.8541E-03	0.1898E-03
4	0.1690E-03	0.2130E-01	0.7854E-02	0.1811E-02	0.1403E-02	0.3065E-03
5	0.1781E-03	0.1509E-02	0.7586E-02	0.1882E-02	0.1475E-02	0.3481E-03
6	0.2195E-03	0.9385E-04	0.8948E-02	0.1254E-02	0.1878E-02	0.1693E-03
7	0.2533E-03	0.0	0.9272E-02	0.3954E-03	0.2092E-02	0.4622E-04
8	0.3036E-03	0.0	0.9574E-02	0.2246E-03	0.2520E-02	0.3273E-04
9	0.4171E-03	0.0	0.1192E-01	0.2237E-03	0.3736E-02	0.2905E-04
10	0.4679E-03	0.0	0.1229E-01	0.1872E-03	0.4628E-02	0.6069E-05
11	0.5160E-03	0.0	0.1215E-01	0.1943E-03	0.5396E-02	0.0
12	0.5320E-03	0.0	0.1109E-01	0.1940E-03	0.5773E-02	0.0
13	0.5365E-03	0.0	0.1025E-01	0.1708E-03	0.5499E-02	0.0
14	0.5467E-03	0.0	0.9876E-02	0.1481E-03	0.5576E-02	0.0
15	0.5335E-03	0.0	0.9144E-02	0.1399E-03	0.5160E-02	0.0
16	0.5080E-03	0.0	0.8738E-02	0.1315E-03	0.4638E-02	0.0
17	0.4683E-03	0.0	0.8696E-02	0.1474E-03	0.4038E-02	0.0
18	0.4759E-03	0.0	0.9655E-02	0.1396E-03	0.3423E-02	0.0
19	0.4821E-03	0.0	0.1017E-01	0.1809E-03	0.3428E-02	0.0
20	0.5944E-03	0.0	0.1337E-01	0.2791E-04	0.3969E-02	0.0
21	0.4615E-03	0.0	0.1026E-01	0.2403E-04	0.4040E-02	0.0
22	0.4974E-03	0.0	0.1151E-01	0.1476E-04	0.3942E-02	0.0
23	0.4026E-03	0.0	0.8666E-02	0.3199E-04	0.3210E-02	0.0
24	0.1916E-03	0.0	0.1148E-01	0.3575E-04	0.1688E-02	0.0
25	0.5865E-04	0.0	0.2619E-02	0.1403E-04	0.6280E-03	0.0
26	0.1773E-04	0.0	0.2370E-03	0.1722E-07	0.2618E-03	0.0
27	0.8479E-05	0.0	0.6839E-03	0.9079E-06	0.2357E-03	0.0
28	0.1458E-06	0.0	0.1172E-04	0.2705E-10	0.3593E-05	0.0
29	0.4796E-08	0.0	0.5608E-06	0.2887E-11	0.5278E-06	0.0
30	0.9618E-09	0.0	0.2080E-07	0.1013E-11	0.7879E-07	0.0
31	0.5592E-09	0.0	0.2075E-07	0.2331E-11	0.1035E-07	0.0
32	0.1794E-09	0.0	0.1118E-07	0.2533E-10	0.1666E-08	0.0
33	0.0	0.0	0.0	0.0	0.0	0.0
34	0.4710E-09	0.0	0.2335E-07	0.9853E-12	0.7810E-08	0.0
99	0.9007E-02	0.5208E-01	0.2237E 00	0.9452E-02	0.7996E-01	0.1232E-02

THREE GROUP MICROSCOPIC CROSS SECTIONS

	SIG-A-1	SIG-A-2	SIG-A-3	SIG-C-1	SIG-C-2	SIG-C-3
U-235	0.1720E 01	0.4509E 01	0.1917E 02	0.2711E 00	0.1300E 01	0.6099E 01
U-238	0.2212E 00	0.6621E 00	0.6125E 00	0.1343E 00	0.6621E 00	0.6125E 00
PU-239	0.1796E 01	0.3163E 01	0.1931E 02	0.1270E 00	0.1105E 01	0.8545E 01
PU-240	0.7022E 00	0.8601E 00	0.8292E 01	0.1412E 00	0.7537E 00	0.8085E 01
PU-241	0.2273E 01	0.6115E 01	0.2070E 02	0.1808E 00	0.8711E 00	0.3928E 01
PU-242	0.7984E 00	0.1042E 01	0.5599E 01	0.2906E 00	0.1042E 01	0.5599E 01
SS 304	0.1158E-01	0.2719E-01	0.1230E 00			
SODIUM	0.1577E-02	0.8757E-02	0.2981E-02			
OXYGEN	0.2796E-02	0.0	0.0			
HYDROGEN	0.0	0.0	0.0			
DEUT.	0.0	0.0	0.0			
BORON	0.9925E 00	0.5578E 01	0.2791E 02			
F.P. U	0.6291E-01	0.3399E 00	0.2727E 01			
F.P. PU	0.8234E-01	0.4310E 00	0.3068E 01			

	SIG-F-1	SIG-F-2	SIG-F-3
U-235	0.1449E 01	0.3209E 01	0.1307E 02
U-238	0.8686E-01	0.0	0.0
PU-239	0.1669E 01	0.2058E 01	0.1076E 02
PU-240	0.5610E 00	0.1064E 00	0.2064E 00
PU-241	0.2092E 01	0.5244E 01	0.1678E 02
PU-242	0.5078E 00	0.0	0.0

7. FUELBURN-FASCON Linkage Output

10.5 Wt. % PU

80% D_2O

V.F. Set 2

Output for cycles 1, 5, 10, 15

********** INPUT INFORMATION **********

BUCKLING = 0.1000E-03 1/CM**2
POWER DENSITY (KW/L) = 434.00
RATIO OF GROUP 1 FLUX TO THERMAL FLUX = 6.15
RATIO OF GROUP 2 FLUX TO THERMAL FLUX = 4.65
REMOVAL CROSS SECTIONS (1/CM) SIGR(1) = 0.018 SIGR(2) = 0.008
CLAD & COOLANT ABSORPTION (1/CM) SIGA3(1)=0.0002 SIGA3(2)=0.0003 SIGA3(3)=0.0015
DIFFUSION COEFFICIENTS (CM) DF(1) = 1.270 DF(2) = 0.720 DF(3) = 0.680

INITIAL ISOTOPE DENSITIES (KG/L)

U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
0.01385	0.0	5.60200	0.42190	0.13195	0.08613	0.02306

MICROSCOPIC CROSS SECTIONS (CM**2)

GROUP 1	U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
FISSION	0.14E-23	0.0	0.87E-25	0.17E-23	0.56E-24	0.21E-23	0.51E-24
CAPTURE	0.27E-24	0.0	0.13E-24	0.13E-24	0.14E-24	0.18E-24	0.29E-24
ABSORPTION	0.17E-23	0.0	0.22E-24	0.18E-23	0.70E-24	0.23E-23	0.80E-24

GROUP 2	U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
FISSION	0.32E-23	0.0	0.0	0.21E-23	0.11E-24	0.52E-23	0.0
CAPTURE	0.13E-23	0.0	0.66E-24	0.11E-23	0.75E-24	0.87E-24	0.10E-23
ABSORPTION	0.45E-23	0.0	0.66E-24	0.32E-23	0.86E-24	0.61E-23	0.10E-23

GROUP 3	U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
FISSION	0.13E-22	0.0	0.0	0.11E-22	0.20E-24	0.17E-22	0.0
CAPTURE	0.61E-23	0.0	0.61E-24	0.85E-23	0.81E-23	0.39E-23	0.56E-23
ABSORPTION	0.19E-22	0.0	0.61E-24	0.19E-22	0.83E-23	0.21E-22	0.56E-23

FISSION PRODUCT MICROSCOPIC CROSS SECTIONS (CM**2)
XASU2 = 0.731E-24 XASU3 = 0.680E-23
XANU2 = 0.201E-24 XANU3 = 0.135E-23
XASP2 = 0.751E-24 XASP3 = 0.750E-23
XANP2 = 0.301E-24 XANP3 = 0.196E-23
XAX = 0.465E-27

****** END OF INPUT INFORMATION ******

MACROSCOPIC CROSS SECTIONS (1/CM)

GROUP 1	U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
FISSION	0.51E-04	0.0	0.12E-02	0.18E-02	0.19E-03	0.45E-03	0.29E-04
CAPTURE	0.96E-05	0.0	0.19E-02	0.14E-03	0.47E-04	0.39E-04	0.17E-04
ABSORPTION	0.61E-04	0.0	0.31E-02	0.19E-02	0.23E-03	0.49E-03	0.46E-04

GROUP 2	U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
FISSION	0.11E-03	0.0	0.0	0.22E-02	0.35E-04	0.11E-02	0.0
CAPTURE	0.46E-04	0.0	0.94E-02	0.12E-02	0.25E-03	0.19E-03	0.60E-04
ABSORPTION	0.16E-03	0.0	0.94E-02	0.34E-02	0.28E-03	0.13E-02	0.60E-04

GROUP 3	U-235	U-236	U-238	PU-239	PU-240	PU-241	PU-242
FISSION	0.46E-03	0.0	0.0	0.11E-01	0.68E-04	0.36E-02	0.0
CAPTURE	0.22E-03	0.0	0.87E-02	0.91E-02	0.27E-02	0.85E-03	0.32E-03
ABSORPTION	0.68E-03	0.0	0.87E-02	0.21E-01	0.27E-02	0.45E-02	0.32E-03

PU-240	0.0003376
PU-241	0.0002092
PU-242	0.0000581
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349300
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0
F.P. U	0.0000112
F.P. PU	0.0000551

ITERATION= 1 K-EFF IS 1.08339

ITERATION= 2 K-EFF IS 1.08419

ITERATION= 3 K-EFF IS 1.08500

ITERATION= 4 K-EFF IS 1.08580

DATA AT END OF TIME STEP # 1 K = 1.086 SIGP = 0.01273

ISOTOPES	DENSITY(KG/L)
U-235	0.1340E-01
U-236	0.1234E-03
U-238	0.5583E 01
PU-239	0.4259E 00
PU-240	0.1345E 00
PU-241	0.8370E-01
PU-242	0.2333E-01
NSU	0.219E 19
NNU	0.900E 19
NSPU	0.116E 20
NNPU	0.435E 20

THERMAL FLUX = 0.256E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.656E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.067
BURNUP THIS STEP = 2101. MWD/MT
TOTAL BURNUP = 2101. MWD/MT
ENERGY DENSITY IS 316543. KW-HR/L
TIME STEP ENDS AT 720. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000332
U-238	0.0140657
PU-239	0.0010830
PU-240	0.0003442
PU-241	0.0002035
PU-242	0.0000587
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349327
HYDROGEN	0.0013493
DEUT.	0.0049561
BORON	0.0
F.P. U	0.0000223
F.P. PU	0.0001102

ITERATION= 1 K-EFF IS 1.08239

ITERATION= 2 K-EFF IS 1.08317

ITERATION= 3 K-EFF IS 1.08396

ITERATION= 4 K-EFF IS 1.08475

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    ITERATION=   5          K-EFF IS 1.08553

    ITERATION=   6          K-EFF IS 1.08631

DATA AT END OF TIME STEP  #  2        K = 1.086          SIGP = 0.01234

 ISOTOPES        DENSITY(KG/L)       THERMAL FLUX =  0.261E 15   1/SEC*CM**2
  U-235            0.1296E-01        THERMAL FLUENCE =   0.664E 21   1/CM**2
  U-236            0.2432E-03        INSTANTANEOUS CONVERSION RATIO = 1.050
  U-238            0.5565E 01        BURNUP THIS STEP =  2127.   MWD/MT
  PU-239           0.4297E 00        TOTAL BURNUP =   4227.   MWD/MT
  PU-240           0.1371E 00        ENERGY DENSITY IS 320500.   KW-HR/L
  PU-241           0.8142E-01        TIME STEP ENDS AT    1440.   HOURS
  PU-242           0.2359E-01        TIME STEP LENGTH   720.   HOURS
  NSU              0.436E 19
  NNU              0.179E 20
  NSPU             0.232E 20
  NNPU             0.871E 20
                U-235                                    0.0000321
                U-238                                    0.0140397
                PU-239                                   0.0010913
                PU-240                                   0.0003508
                PU-241                                   0.0001982
                PU-242                                   0.0000593
                SS 304                                   0.0122600
                SODIUM                                   0.0
                OXYGEN                                   0.0349330
                HYDROGEN                                 0.0014750
                DEUT.                                    0.0048711
                BORON                                    0.0
                F.P. U                                   0.0000333
                F.P. PU                                  0.0001655

    ITERATION=   1          K-EFF IS 1.08281

    ITERATION=   2          K-EFF IS 1.08357

    ITERATION=   3          K-EFF IS 1.08433

    ITERATION=   4          K-EFF IS 1.08510

    ITERATION=   5          K-EFF IS 1.08586

DATA AT END OF TIME STEP  #  3        K = 1.086          SIGP = 0.01221

 ISOTOPES        DENSITY(KG/L)       THERMAL FLUX =  0.264E 15   1/SEC*CM**2
  U-235            0.1253E-01        THERMAL FLUENCE =   0.678E 21   1/CM**2
  U-236            0.3594E-03        INSTANTANEOUS CONVERSION RATIO = 1.037
  U-238            0.5547E 01        BURNUP THIS STEP =  2112.   MWD/MT
  PU-239           0.4330E 00        TOTAL BURNUP =   6339.   MWD/MT
  PU-240           0.1398E 00        ENERGY DENSITY IS 318263.   KW-HR/L
  PU-241           0.7929E-01        TIME STEP ENDS AT    2160.   HOURS
  PU-242           0.2384E-01        TIME STEP LENGTH   720.   HOURS
  NSU              0.651E 19
  NNU              0.268E 20
  NSPU             0.348E 20
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U-235	0.0000311
U-238	0.0139543
PU-239	0.0010988
PU-240	0.0003575
PU-241	0.0001532
PU-242	0.0000599
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349333
HYDROGEN	0.0015769
DEUT.	0.0047698
BORON	0.0
F.P. U	0.0000443
F.P. PU	0.0002208

ITERATION= 1 K-EFF IS 1.08231

ITERATION= 2 K-EFF IS 1.08305

ITERATION= 3 K-EFF IS 1.08379

ITERATION= 4 K-EFF IS 1.08453

ITERATION= 5 K-EFF IS 1.08527

ITERATION= 6 K-EFF IS 1.08601

DATA AT END OF TIME STEP # 4 K = 1.086 SIGP = 0.01193

ISOTOPES	DENSITY(KG/L)
U-235	0.1212E-01
U-236	0.4722E-03
U-238	0.5529E 01
PU-239	0.4360E 00
PU-240	0.1424E 00
PU-241	0.7730E-01
PU-242	0.2407E-01
NSU	0.865E 19
NNU	0.356E 20
NSPU	0.464E 20
NNPU	0.174E 21

THERMAL FLUX = 0.268E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.688E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.022
BURNUP THIS STEP = 2123. MWD/MT
TOTAL BURNUP = 8462. MWD/MT
ENERGY DENSITY IS 319933. KW-HR/L
TIME STEP ENDS AT 2880. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000300
U-238	0.0139493
PU-239	0.0011053
PU-240	0.0003643
PU-241	0.0001686
PU-242	0.0000605
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349337
HYDROGEN	0.0017059
DEUT.	0.0046414
BORON	0.0
F.P. U	0.0000551
F.P. PU	0.0002762

ITERATION= 1 K-EFF IS 1.08238

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 ITERATION=   2          K-EFF IS 1.08309

 ITERATION=   3          K-EFF IS 1.08381

 ITERATION=   4          K-EFF IS 1.08452

 ITERATION=   5          K-EFF IS 1.08524

 ITERATION=   6          K-EFF IS 1.08595

DATA AT END OF TIME STEP  #  5        K = 1.086          SIGP = 0.01175

 ISOTOPES        DENSITY(KG/L)       THERMAL FLUX =  0.272E 15   1/SEC*CM**2
 U-235             0.1172E-01         THERMAL FLUENCE =   0.700F 21   1/CM**2
 U-236             0.5816E-03         INSTANTANEOUS CONVERSION RATIO = 1.007
 U-238             0.5511E 01         BURNUP THIS STEP =  2121.   MWD/MT
 PU-239            0.4385E 00         TOTAL BURNUP =  10584.   MWD/MT
 PU-240            0.1451E 00         ENERGY DENSITY IS 319627.   KW-HR/L
 PU-241            0.7545E-01         TIME STEP ENDS AT    3600.   HOURS
 PU-242            0.2429E-01         TIME STEP LENGTH   720.   HOURS
 NSU               0.108E 20
 NNU               0.444E 20
 NSPU              0.581E 20
 NNPU              0.218E 21
              U-235                                  0.0000291
              U-238                                  0.0139050
              PU-239                                 0.0011109
              PU-240                                 0.0003711
              PU-241                                 0.0001643
              PU-242                                 0.0000610
              SS 304                                 0.0122600
              SODIUM                                 0.0
              OXYGEN                                 0.0349340
              HYDROGEN                               0.0018366
              DEUT.                                  0.0045115
              BORON                                  0.0
              F.P. U                                 0.0000659
              F.P. PU                                0.0003317

 ITERATION=   1          K-EFF IS 1.08223

 ITERATION=   2          K-EFF IS 1.08293

 ITERATION=   3          K-EFF IS 1.08362

 ITERATION=   4          K-EFF IS 1.08431

 ITERATION=   5          K-EFF IS 1.08500

 ITERATION=   6          K-EFF IS 1.08568

 ITERATION=   7          K-EFF IS 1.08637
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DATA AT END OF TIME STEP # 6 K = 1.086 SIGP = 0.01153

ISOTOPES	DENSITY(KG/L)
U-235	0.1134E-01
U-236	0.6879E-03
U-238	0.5494E 01
PU-239	0.4407E 00
PU-240	0.1479E 00
PU-241	0.7374E-01
PU-242	0.2450E-01
NSU	0.129E 20
NNU	0.530E 20
NSPU	0.657E 20
NNPU	0.262E 21

THERMAL FLUX = 0.276E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.711E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.990
BURNUP THIS STEP = 2130. MWD/MT
TOTAL BURNUP = 12714. MWD/MT
ENERGY DENSITY IS 321014. KW-HR/L
TIME STEP ENDS AT 4320. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000281
U-238	0.0138613
PU-239	0.0011154
PU-240	0.0003781
PU-241	0.0001804
PU-242	0.0000615
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349345
HYDROGEN	0.0019555
DEUT.	0.0043535
BORON	0.0
F.P. U	0.0000766
F.P. PU	0.0003872

ITERATION= 1 K-EFF IS 1.08252

ITERATION= 2 K-EFF IS 1.08319

ITERATION= 3 K-EFF IS 1.08385

ITERATION= 4 K-EFF IS 1.08451

ITERATION= 5 K-EFF IS 1.08517

ITERATION= 6 K-EFF IS 1.08583

DATA AT END OF TIME STEP # 7 K = 1.086 SIGP = 0.01141

ISOTOPES	DENSITY(KG/L)
U-235	0.1096E-01
U-236	0.7910E-03
U-238	0.5476E 01
PU-239	0.4425E 00
PU-240	0.1506E 00
PU-241	0.7217E-01
PU-242	0.2470E-01
NSU	0.150E 20
NNU	0.617E 20
NSPU	0.814E 20
NNPU	0.306E 21

THERMAL FLUX = 0.280E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.724E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.978
BURNUP THIS STEP = 2117. MWD/MT
TOTAL BURNUP = 14830. MWD/MT
ENERGY DENSITY IS 318945. KW-HR/L
TIME STEP ENDS AT 5040. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000272
U-238	0.0138181

PU-240	0.0003850
PU-241	0.0001768
PU-242	0.0000619
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349348
HYDROGEN	0.0021294
DEUT.	0.0042203
BORON	0.0
F.P. U	0.0000873
F.P. PU	0.0004429

ITERATION= 1 K-EFF IS 1.08191

ITERATION= 2 K-EFF IS 1.08255

ITERATION= 3 K-EFF IS 1.08318

ITERATION= 4 K-EFF IS 1.08382

ITERATION= 5 K-EFF IS 1.08445

ITERATION= 6 K-EFF IS 1.08508

ITERATION= 7 K-EFF IS 1.08571

ITERATION= 8 K-EFF IS 1.08633

DATA AT END OF TIME STEP # 8 K = 1.086 SIGP = 0.01114

ISOTOPES	DENSITY(KG/L)
U-235	0.1060E-01
U-236	0.8911E-03
U-238	0.5459E 01
PU-239	0.4440E 00
PU-240	0.1534E 00
PU-241	0.7072E-01
PU-242	0.2488E-01
NSU	0.171E 20
NNU	0.702E 20
NSPU	0.931E 20
NNPU	0.350E 21

THERMAL FLUX = 0.284E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.734E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 0.960
BURNUP THIS STEP = 2135. MWD/MT
TOTAL BURNUP = 16965. MWD/MT
ENERGY DENSITY IS 321724. KW-HR/L
TIME STEP ENDS AT 5760. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000263
U-238	0.0137756
PU-239	0.0011216
PU-240	0.0003921
PU-241	0.0001735
PU-242	0.0000624
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349354
HYDROGEN	0.0023189
DEUT.	0.0040319
BORON	0.0
F.P. U	0.0000978
F.P. PU	0.0004566

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 ITERATION=  1          K-EFF IS 1.08225

 ITERATION=  2          K-EFF IS 1.08286

 ITERATION=  3          K-EFF IS 1.08347

 ITERATION=  4          K-EFF IS 1.08407

 ITERATION=  5          K-EFF IS 1.08467

 ITERATION=  6          K-EFF IS 1.08527

 ITERATION=  7          K-EFF IS 1.08586

DATA AT END OF TIME STEP  #  9        K = 1.086          SIGP = 0.01103

 ISOTOPES        DENSITY(KG/L)       THERMAL FLUX =  0.287E 15   1/SEC*CM**2
  U-235            0.1025E-01        THERMAL FLUENCE =   0.747E 21   1/CM**2
  U-236            0.9883E-03        INSTANTANEOUS CONVERSION RATIO = 0.946
  U-238            0.5443E 01        BURNUP THIS STEP =  2121.   MWD/MT
  PU-239           0.445CE 00        TOTAL BURNUP =  19087.   MWD/MT
  PU-240           0.1562E 00        ENERGY DENSITY IS 319666.   KW-HR/L
  PU-241           0.6940E-01        TIME STEP ENDS AT    6480.   HOURS
  PU-242           0.2507E-01        TIME STEP LENGTH   720.   HOURS
  NSU              0.191E 20
  NNU              0.787E 20
  NSPU             0.105E 21
  NNPU             0.394E 21
                U-235                                    0.0000254
                U-238                                    0.0137336
                PU-239                                   0.0011233
                PU-240                                   0.0003991
                PU-241                                   0.0001705
                PU-242                                   0.0000628
                SS 304                                   0.0122600
                SODIUM                                   0.0
                OXYGEN                                   0.0349358
                HYDROGEN                                 0.0024830
                DEUT.                                    0.0038687
                BURON                                    0.0
                F.P. U                                   0.0001083
                F.P. PU                                  0.0005544

 ITERATION=  1          K-EFF IS 1.08168

 ITERATION=  2          K-EFF IS 1.08226

 ITERATION=  3          K-EFF IS 1.08283

 ITERATION=  4          K-EFF IS 1.08341

 ITERATION=  5          K-EFF IS 1.08397
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 ITERATION=   6          K-EFF IS 1.08454

 ITERATION=   7          K-EFF IS 1.08511

 ITERATION=   8          K-EFF IS 1.08567

 ITERATION=   9          K-EFF IS 1.08623

DATA AT END OF TIME STEP  # 10        K = 1.086           SIGP = 0.01078

 ISOTOPES        DENSITY(KG/L)      THERMAL FLUX =  0.291E 15   1/SEC*CM**2
  U-235            0.9911E-02       THERMAL FLUENCE =   0.757E 21   1/CM**2
  U-236            0.1083E-02       INSTANTANEOUS CONVERSION RATIO = 0.929
  U-238            0.5426E 01       BURNUP THIS STEP =  2136.   MWD/MT
  PU-239           0.4457E 00       TOTAL BURNUP =  21223.   MWD/MT
  PU-240           0.1590E 00       ENERGY DENSITY IS 321955.   KW-HR/L
  PU-241           0.6820E-01       TIME STEP ENDS AT    7200.   HOURS
  PU-242           0.2524E-01       TIME STEP LENGTH   720.   HOURS
  NSU              0.212E 20
  NNU              0.871E 20
  NSPU             0.117E 21
  NNPU             0.438E 21
              U-235                                  0.0000254
              U-238                                  0.0140336
              PU-239                                 0.0011289
              PU-240                                 0.0004011
              PU-241                                 0.0001713
              PU-242                                 0.0000631
              SS 304                                 0.0122600
              SODIUM                                 0.0
              OXYGEN                                 0.0349364
              HYDROGEN                               0.0012750
              DEUT.                                  0.0050710
              BORON                                  0.0
              F.P. U                                 0.0
              F.P. PU                                0.0

 ITERATION=   1          K-EFF IS 1.07369
              U-235                                  0.0000254
              U-238                                  0.0140247
              PU-239                                 0.0011346
              PU-240                                 0.0004031
              PU-241                                 0.0001722
              PU-242                                 0.0000635
              SS 304                                 0.0122600
              SODIUM                                 0.0
              OXYGEN                                 0.0349364
              HYDROGEN                               0.0012750
              DEUT.                                  0.0050710
              BORON                                  0.0
              F.P. U                                 0.0
              F.P. PU                                0.0

 ITERATION=   2          K-EFF IS 1.07593
              U-235                                  0.0000254
              U-238                                  0.0140158
              PU-239                                 0.0011402
              PU-240                                 0.0004051
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 ITERATION=   4          K-EFF IS 1.08935
          U-235                                  0.0000099
          U-238                                  0.0137488
          PU-239                                 0.0012735
          PU-240                                 0.0005835
          PU-241                                 0.0001358
          PU-242                                 0.0000700
          SS 304                                 0.0122600
          SODIUM                                 0.0
          OXYGEN                                 0.0349334
          HYDROGEN                               0.0012750
          DEUT.                                  0.0050710
          BORON                                  0.0
          F.P. U                                 0.0
          F.P. PU                                0.0

 ITERATION=   5          K-EFF IS 1.08696
          U-235                                  0.0000095
          U-238                                  0.0137028
          PU-239                                 0.0012781
          PU-240                                 0.0005889
          PU-241                                 0.0001357
          PU-242                                 0.0000701
          SS 304                                 0.0122600
          SODIUM                                 0.0
          OXYGEN                                 0.0349334
          HYDROGEN                               0.0012750
          DEUT.                                  0.0050710
          BORON                                  0.0
          F.P. U                                 0.0000099
          F.P. PU                                0.0000563

 ITERATION=   1          K-EFF IS 1.08665

DATA AT END OF TIME STEP  # 40        K = 1.087          SIGP = 0.01496

 ISOTOPES        DENSITY(KG/L)      THERMAL FLUX =  0.246E 15   1/SEC*CM**2
  U-235            0.3721E-02       THERMAL FLUENCE =   0.629E 21   1/CM**2
  U-236            0.2764E-02       INSTANTANEOUS CONVERSION RATIO = 1.076
  U-238            0.5414E 01       BURNUP THIS STEP =  2065.   MWD/MT
  PU-239           0.5071E 00       TOTAL BURNUP =  83972.   MWD/MT
  PU-240           0.2346E 00       ENERGY DENSITY IS 311244.   KW-HR/L
  PU-241           0.5428E-01       TIME STEP ENDS AT   28800.   HOURS
  PU-242           0.2815E-01       TIME STEP LENGTH   720.   HOURS
  NSU              0.194E 19
  NNU              0.797E 19
  NSPU             0.118E 20
  NNPU             0.445E 20
          U-235                                  0.0000092
          U-238                                  0.0136570
          PU-239                                 0.0012824
          PU-240                                 0.0005942
          PU-241                                 0.0001356
          PU-242                                 0.0000702
          SS 304                                 0.0122600
          SODIUM                                 0.0
          OXYGEN                                 0.0349334
          HYDROGEN                               0.0012750
          DEUT.                                  0.0050710
          BORON                                  0.0
```

ITERATION= 1 K-EFF IS 1.08635

DATA AT END OF TIME STEP # 41 K = 1.086 SIGP = 0.01515

ISOTOPES	DENSITY(KG/L)
U-235	0.3602E-02
U-236	0.2796E-02
U-238	0.5396E 01
PU-239	0.5088E 00
PU-240	0.2367E 00
PU-241	0.5425E-01
PU-242	0.2819E-01
NSU	0.387E 19
NNU	0.159E 20
NSPU	0.237E 20
NNPU	0.890E 20

THERMAL FLUX = 0.245E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.626E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.074
BURNUP THIS STEP = 2066. MWD/MT
TOTAL BURNUP = 86037. MWD/MT
ENERGY DENSITY IS 311274. KW-HR/L
TIME STEP ENDS AT 29520. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000089
U-238	0.0136113
PU-239	0.0012866
PU-240	0.0005995
PU-241	0.0001356
PU-242	0.0000702
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349334
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0
F.P. U	0.0000296
F.P. PU	0.0001691

ITERATION= 1 K-EFF IS 1.08608

DATA AT END OF TIME STEP # 42 K = 1.086 SIGP = 0.01534

ISOTOPES	DENSITY(KG/L)
U-235	0.3487E-02
U-236	0.2828E-02
U-238	0.5378E 01
PU-239	0.5105E 00
PU-240	0.2388E 00
PU-241	0.5423E-01
PU-242	0.2822E-01
NSU	0.579E 19
NNU	0.238E 20
NSPU	0.356E 20
NNPU	0.134E 21

THERMAL FLUX = 0.245E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.623E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.071
BURNUP THIS STEP = 2066. MWD/MT
TOTAL BURNUP = 88103. MWD/MT
ENERGY DENSITY IS 311307. KW-HR/L
TIME STEP ENDS AT 30240. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000087
U-238	0.0135658
PU-239	0.0012907
PU-240	0.0006047
PU-241	0.0001356
PU-242	0.0000703
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349334
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0

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   ITERATION=   1          K-EFF IS 1.08582

DATA AT END OF TIME STEP  # 43        K = 1.086          SIGP = 0.01554

 ISOTOPES        DENSITY(KG/L)      THERMAL FLUX =  0.244E 15   1/SEC*CM**2
 U-235             0.3376E-02        THERMAL FLUENCE =   0.620E 21   1/CM**2
 U-236             0.2857E-02        INSTANTANEOUS CONVERSION RATIO = 1.068
 U-238             0.5360E 01        BURNUP THIS STEP =  2066.   MWD/MT
 PU-239            0.5121E 00        TOTAL BURNUP =  90169.   MWD/MT
 PU-240            0.2409E 00        ENERGY DENSITY IS 311343.   KW-HR/L
 PU-241            0.5423E-01        TIME STEP ENDS AT   30960.   HOURS
 PU-242            0.2825E-01        TIME STEP LENGTH   720.   HOURS
 NSU               0.771E 19
 NNU               0.318E 20
 NSPU              0.474E 20
 NNPU              0.178E 21
                 U-235                                  0.0000084
                 U-238                                  0.0135204
                 PU-239                                 0.0012547
                 PU-240                                 0.0006059
                 PU-241                                 0.0001356
                 PU-242                                 0.0000704
                 SS 304                                 0.0122600
                 SODIUM                                 0.0
                 OXYGEN                                 0.0349334
                 HYDROGEN                               0.0012750
                 DEUT.                                  0.0050710
                 BORON                                  0.0
                 F.P. U                                 0.0000493
                 F.P. PU                                0.0002820

   ITERATION=   1          K-EFF IS 1.08557

   ITERATION=   2          K-EFF IS 1.08607

DATA AT END OF TIME STEP  # 44        K = 1.086          SIGP = 0.01563

 ISOTOPES        DENSITY(KG/L)      THERMAL FLUX =  0.244E 15   1/SEC*CM**2
 U-235             0.3268E-02        THERMAL FLUENCE =   0.617E 21   1/CM**2
 U-236             0.2866E-02        INSTANTANEOUS CONVERSION RATIO = 1.063
 U-238             0.5342E 01        BURNUP THIS STEP =  2070.   MWD/MT
 PU-239            0.5137E 00        TOTAL BURNUP =  92247.   MWD/MT
 PU-240            0.2430E 00        ENERGY DENSITY IS 313066.   KW-HR/L
 PU-241            0.5424E-01        TIME STEP ENDS AT   31680.   HOURS
 PU-242            0.2828E-01        TIME STEP LENGTH   720.   HOURS
 NSU               0.963E 19
 NNU               0.396E 20
 NSPU              0.593E 20
 NNPU              0.223E 21
                 U-235                                  0.0000081
                 U-238                                  0.0134752
                 PU-239                                 0.0012983
                 PU-240                                 0.0006151
                 PU-241                                 0.0001357
                 PU-242                                 0.0000705
                 SS 304                                 0.0122600
                 SODIUM                                 0.0
                 OXYGEN                                 0.0349326
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DEUT.	0.0050456
BORON	0.0
F.P. U	0.0000590
F.P. PU	0.0003385

ITERATION= 1 K-EFF IS 1.08579

ITERATION= 2 K-EFF IS 1.08628

DATA AT END OF TIME STEP # 45 K = 1.086 SIGP = 0.01582

ISOTOPES	DENSITY(KG/L)
U-235	0.3165E-02
U-236	0.2914E-02
U-238	0.5324E 01
PU-239	0.5151E 00
PU-240	0.2451E 00
PU-241	0.5428E-01
PU-242	0.2831E-01
NSU	0.115E 20
NNU	0.475E 20
NSPU	0.712E 20
NNPU	0.267E 21

THERMAL FLUX = 0.245E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.617E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.057
BURNUP THIS STEP = 2078. MWD/MT
TOTAL BURNUP = 94324. MWD/MT
ENERGY DENSITY IS 313094. KW-HR/L
TIME STEP ENDS AT 32400. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000079
U-238	0.0134304
PU-239	0.0013017
PU-240	0.0006202
PU-241	0.0001358
PU-242	0.0000705
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349326
HYDROGEN	0.0013244
DEUT.	0.0050209
BORON	0.0
F.P. U	0.0000688
F.P. PU	0.0003950

ITERATION= 1 K-EFF IS 1.08597

DATA AT END OF TIME STEP # 46 K = 1.086 SIGP = 0.01614

ISOTOPES	DENSITY(KG/L)
U-235	0.3065E-02
U-236	0.2941E-02
U-238	0.5306E 01
PU-239	0.5165E 00
PU-240	0.2471E 00
PU-241	0.5433E-01
PU-242	0.2834E-01
NSU	0.134E 20
NNU	0.553E 20
NSPU	0.830E 20
NNPU	0.312E 21

THERMAL FLUX = 0.244E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.617E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.055
BURNUP THIS STEP = 2067. MWD/MT
TOTAL BURNUP = 96391. MWD/MT
ENERGY DENSITY IS 311422. KW-HR/L
TIME STEP ENDS AT 33120. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000076
U-238	0.0133656
PU-239	0.0013050
PU-240	0.0006253
PU-241	0.0001360
PU-242	0.0000706

SODIUM	0.0
OXYGEN	0.0349226
HYDROGEN	0.0013244
DEUT.	0.0050209
BORON	0.0
F.P. U	0.0000785
F.P. PU	0.0004515

ITERATION= 1 K-EFF IS 1.08566

ITERATION= 2 K-EFF IS 1.08611

DATA AT END OF TIME STEP # 47 K = 1.086 SIGP = 0.01619

ISOTOPES	DENSITY(KG/L)
U-235	0.2968E-02
U-236	0.2967E-02
U-238	0.5288E 01
PU-239	0.5177E 00
PU-240	0.2491E 00
PU-241	0.5440E-01
PU-242	0.2837E-01
NSU	0.153E 20
NNU	0.631E 20
NSPU	0.949E 20
NNPU	0.357E 21

THERMAL FLUX = 0.244E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.614E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.045
BURNUP THIS STEP = 2078. MWD/MT
TOTAL BURNUP = 98469. MWD/MT
ENERGY DENSITY IS 313103. KW-HR/L
TIME STEP ENDS AT 33840. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000074
U-238	0.0133411
PU-239	0.0013080
PU-240	0.0006304
PU-241	0.0001362
PU-242	0.0000707
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349327
HYDROGEN	0.0013493
DEUT.	0.0049561
BORON	0.0
F.P. U	0.0000881
F.P. PU	0.0005081

ITERATION= 1 K-EFF IS 1.08577

ITERATION= 2 K-EFF IS 1.08622

DATA AT END OF TIME STEP # 48 K = 1.086 SIGP = 0.01635

ISOTOPES	DENSITY(KG/L)
U-235	0.2874E-02
U-236	0.2953E-02
U-238	0.5271E 01
PU-239	0.5189E 00
PU-240	0.2512E 00
PU-241	0.5449E-01
PU-242	0.2839E-01
NSU	0.172E 20
NNU	0.709E 20
NSPU	0.107E 21
NNPU	0.401E 21

THERMAL FLUX = 0.245E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.615E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.044
BURNUP THIS STEP = 2078. MWD/MT
TOTAL BURNUP = 100546. MWD/MT
ENERGY DENSITY IS 313104. KW-HR/L
TIME STEP ENDS AT 34560. HOURS
TIME STEP LENGTH 720. HOURS

ITERATION= 7 K-EFF IS 1.08834

U-235	0.0000021
U-238	0.0136394
PU-239	0.0012732
PU-240	0.0007038
PU-241	0.0001377
PU-242	0.0000642
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349316
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0
F.P. U	0.0
F.P. PU	0.0

ITERATION= 8 K-EFF IS 1.08590

U-235	0.0000020
U-238	0.0135934
PU-239	0.0012778
PU-240	0.0007080
PU-241	0.0001386
PU-242	0.0000644
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349316
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0
F.P. U	0.0000056
F.P. PU	0.0000567

ITERATION= 1 K-EFF IS 1.08649

DATA AT END OF TIME STEP # 88 K = 1.086 SIGP = 0.01524

ISOTOPES	DENSITY(KG/L)
U-235	0.7939E-03
U-236	0.3552E-02
U-238	0.5371E 01
PU-239	0.5069E 00
PU-240	0.2821E 00
PU-241	0.5545E-01
PU-242	0.2586E-01
NSU	0.187E 19
NNU	0.771E 19
NSPU	0.119E 20

THERMAL FLUX = 0.245E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.630E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.099
BURNUP THIS STEP = 2067. MWD/MT
TOTAL BURNUP = 182931. MWD/MT
ENERGY DENSITY IS 311453. KW-HR/L
TIME STEP ENDS AT 63360. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000020
U-238	0.0135475
PU-239	0.0012821
PU-240	0.0007121
PU-241	0.0001395
PU-242	0.0000645
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349316
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0
F.P. U	0.0000191
F.P. PU	0.0001133

ITERATION= 1 K-EFF IS 1.08704

DATA AT END OF TIME STEP # 89 K = 1.087 SIGP = 0.01569

ISOTOPES	DENSITY(KG/L)
U-235	0.7684E-03
U-236	0.3559E-02
U-238	0.5352E 01
PU-239	0.5087E 00
PU-240	0.2837E 00
PU-241	0.5581E-01
PU-242	0.2593E-01
NSU	0.374E 19
NNU	0.154E 20
NSPU	0.238E 20
NNPU	0.895E 20

THERMAL FLUX = 0.244E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.626E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.094
BURNUP THIS STEP = 2067. MWD/MT
TOTAL BURNUP = 184998. MWD/MT
ENERGY DENSITY IS 311479. KW-HR/L
TIME STEP ENDS AT 64080. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000019
U-238	0.0135019
PU-239	0.0012863
PU-240	0.0007162
PU-241	0.0001404
PU-242	0.0000647
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349316
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0
F.P. U	0.0000287
F.P. PU	0.0001700

ITERATION= 1 K-EFF IS 1.08756

DATA AT END OF TIME STEP # 90 K = 1.088 SIGP = 0.01613

ISOTOPES	DENSITY(KG/L)
U-235	0.7438E-03
U-236	0.3565E-02
U-238	0.5334E 01
PU-239	0.5105E 00
PU-240	0.2853E 00
PU-241	0.5617E-01
PU-242	0.2599E-01
NSU	0.561E 19
NNU	0.231E 20
NSPU	0.357E 20

THERMAL FLUX = 0.243E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.621E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.090
BURNUP THIS STEP = 2067. MWD/MT
TOTAL BURNUP = 187065. MWD/MT
ENERGY DENSITY IS 311508. KW-HR/L
TIME STEP ENDS AT 64800. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000018
U-238	0.0134565
PU-239	0.0012904
PU-240	0.0007202
PU-241	0.0001413
PU-242	0.0000649
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349316
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0
F.P. U	0.0000362
F.P. PU	0.0002267

ITERATION= 1 K-EFF IS 1.08805

ITERATION= 2 K-EFF IS 1.08780

ITERATION= 3 K-EFF IS 1.08755

DATA AT END OF TIME STEP # 91 K = 1.088 SIGP = 0.01675

ISOTOPES	DENSITY(KG/L)
U-235	0.7201E-03
U-236	0.3572E-02
U-238	0.5316E 01
PU-239	0.5120E 00
PU-240	0.2869E 00
PU-241	0.5651E-01
PU-242	0.2606E-01
NSU	0.746E 19
NNU	0.3C7E 20
NSPU	0.477E 20
NNPU	0.179E 21

THERMAL FLUX = 0.241E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.618E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.090
BURNUP THIS STEP = 2055. MWD/MT
TOTAL BURNUP = 185120. MWD/MT
ENERGY DENSITY IS 309689. KW-HR/L
TIME STEP ENDS AT 65520. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000018
U-238	0.0134111
PU-239	0.0012945
PU-240	0.0007242
PU-241	0.0001421
PU-242	0.0000650
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349224
HYDROGEN	0.0012478
DEUT.	0.0050571
BORON	0.0
F.P. U	0.0000477
F.P. PU	0.0002835

ITERATION= 1 K-EFF IS 1.08806

ITERATION= 2 K-EFF IS 1.08781

ITERATION= 3 K-EFF IS 1.08757

DATA AT END OF TIME STEP # 92 K = 1.088 SIGP = 0.01724

ISOTOPES	DENSITY(KG/L)
U-235	0.6972E-03
U-236	0.3578E-02
U-238	0.5299E 01
PU-239	0.5156E 00
PU-240	0.2885E 00
PU-241	0.5684E-01
PU-242	0.2609E-01
NSU	0.932E 19
NNU	0.384E 20
NSPU	0.596E 20
NNPU	0.224E 21

THERMAL FLUX = 0.239E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.611E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.089
BURNUP THIS STEP = 2055. MWD/MT
TOTAL BURNUP = 191175. MWD/MT
ENERGY DENSITY IS 309734. KW-HR/L
TIME STEP ENDS AT 66240. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000017
U-238	0.0133658
PU-239	0.0012586
PU-240	0.0007282
PU-241	0.0001429
PU-242	0.0000651
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349323
HYDROGEN	0.0012206
DEUT.	0.0051241
BORON	0.0
F.P. U	0.0000572
F.P. PU	0.0003402

ITERATION= 1 K-EFF IS 1.08809

ITERATION= 2 K-EFF IS 1.08785

ITERATION= 3 K-EFF IS 1.08762

DATA AT END OF TIME STEP # 93 K = 1.088 SIGP = 0.01776

ISOTOPES	DENSITY(KG/L)
U-235	0.6751E-03
U-236	0.3584E-02
U-238	0.5281E 01
PU-239	0.5152E 00
PU-240	0.2901E 00
PU-241	0.5715E-01
PU-242	0.2616E-01
NSU	0.112E 20
NNU	0.460E 20
NSPU	0.715E 20
NNPU	0.269E 21

THERMAL FLUX = 0.237E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.604E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.088
BURNUP THIS STEP = 2056. MWD/MT
TOTAL BURNUP = 193231. MWD/MT
ENERGY DENSITY IS 309754. KW-HR/L
TIME STEP ENDS AT 66960. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000017
U-238	0.0133206
PU-239	0.0014027
PU-240	0.0007321
PU-241	0.0001436
PU-242	0.0000653
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349323
HYDROGEN	0.0011932
DEUT.	0.0051514
BOREN	0.0
F.P. U	0.0000666
F.P. PU	0.0003570

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    ITERATION=   1          K-EFF IS 1.08815

    ITERATION=   2          K-EFF IS 1.08792

    ITERATION=   3          K-EFF IS 1.08769

DATA AT END OF TIME STEP  # 94        K = 1.088          SIGP = 0.01832

 ISOTOPES        DENSITY(KG/L)       THERMAL FLUX =  0.234E 15   1/SEC*CM**2
 U-235             0.6538E-03         THERMAL FLUENCE =   0.597E 21   1/CM**2
 U-236             0.3590E-02         INSTANTANEOUS CONVERSION RATIO = 1.087
 U-238             0.5263E 01         BURNUP THIS STEP =  2056.   MWD/MT
 PU-239            0.5166E 00         TOTAL BURNUP = 195286.   MWD/MT
 PU-240            0.2917E 00         ENERGY DENSITY IS 309777.   KW-HR/L
 PU-241            0.5745E-01         TIME STEP ENDS AT   67680.   HOURS
 PU-242            0.2622E-01         TIME STEP LENGTH   720.   HOURS
 NSU               0.130E 20
 NNU               0.536E 20
 NSPU              0.835E 20
 NNPU              0.314E 21
              U-235                                  0.0000016
              U-238                                  0.0132754
              PU-239                                 0.0013068
              PU-240                                 0.0007360
              PU-241                                 0.0001443
              PU-242                                 0.0000654
              SS 304                                 0.0122600
              SODIUM                                 0.0
              OXYGEN                                 0.0349322
              HYDROGEN                               0.0011656
              DEUT.                                  0.0091788
              BORON                                  0.0
              F.P. U                                 0.0000761
              F.P. PU                                0.0004558

    ITERATION=   1          K-EFF IS 1.08823

    ITERATION=   2          K-EFF IS 1.08801

    ITERATION=   3          K-EFF IS 1.08778

DATA AT END OF TIME STEP  # 95        K = 1.088          SIGP = 0.01891

 ISOTOPES        DENSITY(KG/L)       THERMAL FLUX =  0.232E 15   1/SEC*CM**2
 U-235             0.6533E-03         THERMAL FLUENCE =   0.598E 21   1/CM**2
 U-236             0.3595E-02         INSTANTANEOUS CONVERSION RATIO = 1.086
 U-238             0.5245E 01         BURNUP THIS STEP =  2056.   MWD/MT
 PU-239            0.5185E 00         TOTAL BURNUP = 197342.   MWD/MT
 PU-240            0.2932E 00         ENERGY DENSITY IS 309801.   KW-HR/L
 PU-241            0.5773E-01         TIME STEP ENDS AT   68400.   HOURS
 PU-242            0.2628E-01         TIME STEP LENGTH   720.   HOURS
 NSU               0.149E 20
 NNU               0.612E 20
 NSPU              0.954E 20
 NNPU              0.358E 21
              U-235                                  0.0000016
              U-238                                  0.0132304
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PU-240	0.0007398
PU-241	0.0001449
PU-242	0.0000656
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349321
HYDROGEN	0.0011378
DEUT.	0.0052065
BORON	0.0
F.P. U	0.0000855
F.P. PU	0.0005106

ITERATION= 1 K-EFF IS 1.08834

ITERATION= 2 K-EFF IS 1.08813

ITERATION= 3 K-EFF IS 1.08791

ITERATION= 4 K-EFF IS 1.08769

DATA AT END OF TIME STEP # 96 K = 1.088 SIGP = 0.01968

ISOTOPES	DENSITY(KG/L)
U-235	0.6134E-03
U-236	0.3600E-02
U-238	0.5227E 01
PU-239	0.5201E 00
PU-240	0.2948E 00
PU-241	0.5799E-01
PU-242	0.2634E-01
NSU	0.167E 20
NNU	0.688E 20
NSPU	0.107E 21
NNPU	0.403E 21

THERMAL FLUX = 0.229E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.582E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.047
BURNUP THIS STEP = 2050. MWD/MT
TOTAL BURNUP = 199392. MWD/MT
ENERGY DENSITY IS 308877. KW-HR/L
TIME STEP ENDS AT 69120. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000615
U-238	0.0131853
PU-239	0.0013152
PU-240	0.0007436
PU-241	0.0001456
PU-242	0.0000657
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349320
HYDROGEN	0.0010658
DEUT.	0.0052483
BORON	0.C
F.P. U	0.0000950
F.P. PU	0.0005674

ITERATION= 1 K-EFF IS 1.08829

ITERATION= 2 K-EFF IS 1.08808

ITERATION= 3 K-EFF IS 1.08787

ITERATION= 4 K-EFF IS 1.08766

DATA AT END OF TIME STEP # 97 K = 1.088 SICP = 0.02043

ISOTOPES	DENSITY(KG/L)
U-235	0.5943E-03
U-236	0.3605E-02
U-238	0.5209E 01
PU-239	0.5218E 00
PU-240	0.2963E 00
PU-241	0.5823E-01
PU-242	0.2640E-01
NSU	0.186E 20
NNU	0.764E 20
NSPU	0.119E 21
NNPU	0.448E 21

THERMAL FLUX = 0.226E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.573E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.088
BURNUP THIS STEP = 2050. MWD/MT
TOTAL BURNUP = 201442. MWD/MT
ENERGY DENSITY IS 30887a. KW-HR/L
TIME STEP ENDS AT 69840. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000015
U-238	0.0135596
PU-239	0.0013086
PU-240	0.0007399
PU-241	0.0001448
PU-242	0.0000654
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349319
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0
F.P. U	0.0
F.P. PU	0.0

ITERATION= 1 K-EFF IS 1.10145

U-235	0.0000015
U-238	0.0135710
PU-239	0.0013071
PU-240	0.0007382
PU-241	0.0001441
PU-242	0.0000651
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349319
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0
F.P. U	0.0
F.P. PU	0.0

ITERATION= 2 K-EFF IS 1.09897

U-235	0.0000015
U-238	0.0135823
PU-239	0.0012956
PU-240	0.0007325
PU-241	0.0001434
PU-242	0.0000647
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349319
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0
F.P. U	0.0
F.P. PU	0.0

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 ITERATION=   8          K-EFF IS 1.08831
              U-235                                  0.0000004
              U-238                                  0.0136135
              PU-239                                 0.0012575
              PU-240                                 0.0007423
              PU-241                                 0.0001452
              PU-242                                 0.0000611
              SS 304                                 0.0122600
              SODIUM                                 0.0
              OXYGEN                                 0.0349310
              HYDROGEN                               0.0012750
              DEUT.                                  0.0050710
              BORON                                  0.0
              F.P. U                                 0.0
              F.P. PU                                0.0

 ITERATION=   9          K-EFF IS 1.08586
              U-235                                  0.0000004
              U-238                                  0.0135674
              PU-239                                 0.0012625
              PU-240                                 0.0007459
              PU-241                                 0.0001462
              PU-242                                 0.0000614
              SS 304                                 0.0122600
              SODIUM                                 0.0
              OXYGEN                                 0.0349310
              HYDROGEN                               0.0012750
              DEUT.                                  0.0050710
              BORON                                  0.0
              F.P. U                                 0.0000095
              F.P. PU                                0.0000567

 ITERATION=   1          K-EFF IS 1.08664

DATA AT END OF TIME STEP  #157        K = 1.087          SIGP = 0.01535

 ISOTOPES        DENSITY(KG/L)      THERMAL FLUX =  0.245E 15   1/SEC*CM**2
  U-235            0.1639E-03       THERMAL FLUENCE =   0.631E 21   1/CM**2
  U-236            0.3721E-02       INSTANTANEOUS CONVERSION RATIO = 1.109
  U-238            0.5360E 01       BURNUP THIS STEP =  2067.   MWD/MT
  PU-239           0.5005E 00       TOTAL BURNUP = 283408.   MWD/MT
  PU-240           0.2972E 00       ENERGY DENSITY IS 311488.   KW-HR/L
  PU-241           0.5850E-01       TIME STEP ENDS AT   58640.   HOURS
  PU-242           0.2466E-01       TIME STEP LENGTH   720.   HOURS
  NSU              0.186E 19
  NNU              0.766E 19
  NSPU             0.119E 20
  NNPU             0.448E 20
              U-235                                  0.0000004
              U-238                                  0.0135215
              PU-239                                 0.0012672
              PU-240                                 0.0007495
              PU-241                                 0.0001472
              PU-242                                 0.0000616
              SS 304                                 0.0122600
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OXYGEN	0.0349310
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0
F.P. U	0.0000190
F.P. PU	0.0001134

ITERATION= 1 K-EFF IS 1.08738

DATA AT END OF TIME STEP #138 K = 1.087 SIGP = 0.01586

ISOTOPES	DENSITY(KG/L)
U-235	0.1587E-03
U-236	0.3722E-02
U-238	0.5342E 01
PU-239	0.5028E 00
PU-240	0.2986E 00
PU-241	0.5887E-01
PU-242	0.2475E-01
NSU	0.372E 19
NNU	0.153E 20
NSPU	0.238E 20
NNPU	0.896E 20

THERMAL FLUX = 0.244E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.627E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.104
BURNUP THIS STEP = 2067. MWD/MT
TOTAL BURNUP = 285475. MWD/MT
ENERGY DENSITY IS 311514. KW-HR/L
TIME STEP ENDS AT 99360. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000004
U-238	0.0134758
PU-239	0.0012718
PU-240	0.0007531
PU-241	0.0001481
PU-242	0.0000619
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349310
HYDROGEN	0.0012750
DEUT.	0.0050710
BORON	0.0
F.P. U	0.0000285
F.P. PU	0.0001702

ITERATION= 1 K-EFF IS 1.08806

ITERATION= 2 K-EFF IS 1.08782

ITERATION= 3 K-EFF IS 1.08757

DATA AT END OF TIME STEP #139 K = 1.088 SIGP = 0.01652

ISOTOPES	DENSITY(KG/L)
U-235	0.1536E-03
U-236	0.3724E-02
U-238	0.5324E 01
PU-239	0.5046E 00
PU-240	0.3001E 00
PU-241	0.5924E-01
PU-242	0.2487E-01
NSU	0.557E 19
NNU	0.229E 20
NSPU	0.358E 20
NNPU	0.134E 21

THERMAL FLUX = 0.242E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.622E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.103
BURNUP THIS STEP = 2055. MWD/MT
TOTAL BURNUP = 287530. MWD/MT
ENERGY DENSITY IS 309688. KW-HR/L
TIME STEP ENDS AT 100080. HOURS
TIME STEP LENGTH 720. HOURS

PU-239	0.0012764
PU-240	0.0007567
PU-241	0.0001489
PU-242	0.0000621
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349324
HYDROGEN	0.0012478
DEUT.	0.0050571
BORON	0.0
F.P. U	0.0000380
F.P. PU	0.0002270

ITERATION= 1 K-EFF IS 1.08827

ITERATION= 2 K-EFF IS 1.08803

ITERATION= 3 K-EFF IS 1.08779

DATA AT END OF TIME STEP #140 K = 1.088 SIGP = 0.01707

ISOTOPES	DENSITY(KG/L)
U-235	0.1487E-03
U-236	0.3725E-02
U-238	0.5306E 01
PU-239	0.5064E 00
PU-240	0.3015E 00
PU-241	0.5958E-01
PU-242	0.2493E-01
NSU	0.742E 19
NNU	0.305E 20
NSPU	0.477E 20
NNPU	0.179E 21

THERMAL FLUX = 0.240E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.615E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.101
BURNUP THIS STEP = 2055. MWD/MT
TOTAL BURNUP = 289586. MWD/MT
ENERGY DENSITY IS 309740. KW-HR/L
TIME STEP ENDS AT 100800. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000004
U-238	0.0133848
PU-239	0.0012810
PU-240	0.0007602
PU-241	0.0001497
PU-242	0.0000623
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349323
HYDROGEN	0.0012206
DEUT.	0.0051241
BORON	0.0
F.P. U	0.0000474
F.P. PU	0.0002837

ITERATION= 1 K-EFF IS 1.08848

ITERATION= 2 K-EFF IS 1.08825

ITERATION= 3 K-EFF IS 1.08802

ITERATION= 4 K-EFF IS 1.08778

ISOTOPES	DENSITY(KG/L)
U-235	0.1439E-03
U-236	0.3726E-02
U-238	0.5288E 01
PU-239	0.5082E 00
PU-240	0.3029E 00
PU-241	0.5990E-01
PU-242	0.2502E-01
NSU	0.526E 19
NNU	0.381E 20
NSPU	0.597E 20
NNPU	0.224E 21

THERMAL FLUX = 0.237E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.608E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.102
BURNUP THIS STEP = 2049. MWD/MT
TOTAL BURNUP = 291635. MWD/MT
ENERGY DENSITY IS 308826. KW-HR/L
TIME STEP ENDS AT 101520. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000004
U-238	0.0133353
PU-239	0.0012857
PU-240	0.0007637
PU-241	0.0001505
PU-242	0.0000625
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349322
HYDROGEN	0.0011794
DEUT.	0.0051651
BORON	0.0
F.P. U	0.0000568
F.P. PU	0.0000405

ITERATION= 1 K-EFF IS 1.08850

ITERATION= 2 K-EFF IS 1.08827

ITERATION= 3 K-EFF IS 1.08805

ITERATION= 4 K-EFF IS 1.08782

ITERATION= 5 K-EFF IS 1.08758

DATA AT END OF TIME STEP #142 K = 1.088 SIGP = 0.01853

ISOTOPES	DENSITY(KG/L)
U-235	0.1394E-03
U-236	0.3727E-02
U-238	0.5270E 01
PU-239	0.5101E 00
PU-240	0.3043E 00
PU-241	0.6020E-01
PU-242	0.2511E-01
NSU	0.111E 20
NNU	0.457E 20
NSPU	0.716E 20
NNPU	0.269E 21

THERMAL FLUX = 0.233E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.599E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.103
BURNUP THIS STEP = 2043. MWD/MT
TOTAL BURNUP = 293678. MWD/MT
ENERGY DENSITY IS 307874. KW-HR/L
TIME STEP ENDS AT 102240. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000003
U-238	0.0132938
PU-239	0.0012906
PU-240	0.0007671
PU-241	0.0001511
PU-242	0.0000627
SS 304	0.0122600

OXYGEN	0.0349321
HYDROGEN	0.0011238
DEUT.	0.0052203
BURON	0.0
F.P. U	0.0000663
F.P. PU	0.0003973

ITERATION= 1 K-EFF IS 1.08836

ITERATION= 2 K-EFF IS 1.08814

ITERATION= 3 K-EFF IS 1.08791

ITERATION= 4 K-EFF IS 1.08768

DATA AT END OF TIME STEP #143 K = 1.088 SIGP = 0.01919

ISOTOPES	DENSITY(KG/L)
U-235	0.1350E-03
U-236	0.3729E-02
U-238	0.5252E 01
PU-239	0.5120E 00
PU-240	0.3056E 00
PU-241	0.1046E-01
PU-242	0.2520E-01
NSU	0.130E 20
NNU	0.533E 20
NSPU	0.835E 20
NNPU	0.514E 21

THERMAL FLUX = 0.230E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.58AE 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.104
BURNUP THIS STEP = 2049. MWD/MT
TOTAL BURNUP = 295727. MWD/MT
ENERGY DENSITY IS 308810. KW-HR/L
TIME STEP ENDS AT 102960. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000003
U-238	0.0132483
PU-239	0.0012955
PU-240	0.0007705
PU-241	0.0001517
PU-242	0.0000629
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349320
HYDROGEN	0.0010816
DEUT.	0.0052623
BORON	0.0
F.P. U	0.0000757
F.P. PU	0.0004541

ITERATION= 1 K-EFF IS 1.08649

ITERATION= 2 K-EFF IS 1.08827

ITERATION= 3 K-EFF IS 1.08805

ITERATION= 4 K-EFF IS 1.08783

ITERATION= 5 K-EFF IS 1.08761

ISOTOPES	DENSITY(KG/L)
U-235	0.1307E-03
U-236	0.3730E-02
U-238	0.5234E 01
PU-239	0.5140E 00
PU-240	0.3070E 00
PU-241	0.6070E-01
PU-242	0.2529E-01
NSU	0.148E 20
NNU	0.605E 20
NSPU	0.955E 20
NNPU	0.359E 21

THERMAL FLUX = 0.226E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.576E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.106
BURNUP THIS STEP = 2043. MWD/MT
TOTAL BURNUP = 297770. MWD/MT
ENERGY DENSITY IS 307829. KW-HR/L
TIME STEP ENDS AT 10368C. HOURS
TIME STEP LENGTH 720. HOURS

U-235	0.0000003
U-238	0.0132028
PU-239	0.0013006
PU-240	0.0007739
PU-241	0.0001523
PU-242	0.0000632
SS 304	0.0122600
SODIUM	0.0
OXYGEN	0.0349318
HYDROGEN	0.0010247
DEUT.	0.0053190
BORON	0.0
F.P. U	0.0000851
F.P. PU	0.0005110

ITERATION= 1 K-EFF IS 1.08847

ITERATION= 2 K-EFF IS 1.08826

ITERATION= 3 K-EFF IS 1.08805

ITERATION= 4 K-EFF IS 1.08783

ITERATION= 5 K-EFF IS 1.08762

DATA AT END OF TIME STEP #145 K = 1.088 SICP = 0.02114

ISOTOPES	DENSITY(KG/L)
U-235	0.1266E-03
U-236	0.3731E-02
U-238	0.5216E 01
PU-239	0.5160E 00
PU-240	0.3083E 00
PU-241	0.6092E-01
PU-242	0.2537E-01
NSU	0.166E 20
NNU	0.685E 20
NSPU	0.107E 21
NNPU	0.404E 21

THERMAL FLUX = 0.222E 15 1/SEC*CM**2
THERMAL FLUENCE = 0.567E 21 1/CM**2
INSTANTANEOUS CONVERSION RATIO = 1.108
BURNUP THIS STEP = 2043. MWD/MT
TOTAL BURNUP = 299813. MWD/MT
ENERGY DENSITY IS 307799. KW-HR/L
TIME STEP ENDS AT 104400. HOURS
TIME STEP LENGTH 720. HOURS

8. ODMUG Output

10.5 Wt. % PU

80% D_2O

V.F. Set 2

79.5 cm Core

30.0 cm Blankets

NO. GRPS= 3 BCL= 2 BCR= 1 GEOM= 0.0 NRGNS= 3 EPS= 0.100E-03

REG	GRP	D	SIG-A	SIG-R	NU*SIG-F
1	1	0.1270E 01	0.6120E-02	0.1760E-01	0.1090E-01
1	2	0.7200E 00	0.1491E-01	0.8300E-02	0.1002E-01
1	3	0.6800E 00	0.3893E-01	0.0	0.4490E-01
2	1	0.1420E 01	0.2950E-02	0.2692E-01	0.3320E-02
2	2	0.8200E 00	0.8960E-02	0.2543E-01	0.2500E-03
2	3	0.8300E 00	0.1180E-01	0.0	0.2120E-02
3	1	0.2120E 01	0.8000E-04	0.4743E-01	0.0
3	2	0.1540E 01	0.0	0.7497E-01	0.0
3	3	0.1390E 01	0.0	0.0	0.0

REG	GRP	NU	SIG-P	BUCKLING
1	1	0.2920E 01	0.0	0.1000E-03
1	2	0.2890E 01	0.0	0.1000E-03
1	3	0.2880E 01	0.0	0.1000E-03
2	1	0.2800E 01	0.0	0.1000E-03
2	2	0.2470E 01	0.0	0.1000E-03
2	3	0.2430E 01	0.0	0.1000E-03
3	1	0.1000E-01	0.0	0.1000E-03
3	2	0.1000E-01	0.0	0.1000E-03
3	3	0.1000E-01	0.0	0.1000E-03

REG	THICKNESS	NO. PTS.
1	39.75	10
2	30.00	10
3	15.00	10

ITERATION NO. 1 LAMBDA= 0.2787026E 01
L = 1 RFS= 0.1987E 02 0.2263E 02 0.2655E 02
LAMBDA UPPER= 1.069 LAMBDA LOWER= 0.168 EPS(L)= 0.323E 00

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                    ITERATION NO.    3      LAMBDA=  0.9858876E 00
L =  3  RES=  0.5054E 00      0.3375E 00       0.2655E 00
LAMBDA UPPER= 1.037  LAMBDA LOWER= 0.821  EPS(L)= 0.219E 00


                    ITERATION NO.    4      LAMBDA=  0.9950205E 00
L =  4  RES=  0.2981E 00      0.1973E 00       0.1309E 00
LAMBDA UPPER= 1.026  LAMBDA LOWER= 0.926  EPS(L)= 0.101E 00


     SUBROUTINE CHBYSHV

          SIGB= 0.55575E 00

     I= 0      RATIO= 0.10072E 00

     I= 1      RATIO= 0.38758E-01

     I= 2      RATIO= 0.80533E-02

     I= 3      RATIO= 0.16140E-02

     I= 4      RATIO= 0.32299E-03

     I= 5      RATIO= 0.64632E-04

     J      THETA(J)
     1       1.18412
     2       0.78957
     3       0.36480
     4       0.12936
     5       0.01379


                    ITERATION NO.    5      LAMBDA=  0.1004353E 01
L =  1  RES=  0.5296E-01      0.3244E-01       0.1235E-01
LAMBDA UPPER= 1.013  LAMBDA LOWER= 0.998  EPS(L)= 0.144E-01


                    ITERATION NO.    6      LAMBDA=  0.1004605E 01
L =  2  RES=  0.2143E-01      0.1437E-01       0.1202E-01
LAMBDA UPPER= 1.007  LAMBDA LOWER= 0.993  EPS(L)= 0.134E-01


                    ITERATION NO.    7      LAMBDA=  0.1005180E 01
L =  3  RES=  0.8475E-02      0.5503E-02       0.2778E-02
LAMBDA UPPER= 1.006  LAMBDA LOWER= 1.004  EPS(L)= 0.229E-02


                    ITERATION NO.    8      LAMBDA=  0.1005272E 01
L =  4  RES=  0.5016E-02      0.3293E-02       0.1949E-02
LAMBDA UPPER= 1.006  LAMBDA LOWER= 1.004  EPS(L)= 0.149E-02
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                    ITERATION NO.   9      LAMBDA=  0.1005335E 01
L =  5  RES=  0.3103E-02      0.2039E-02      0.1209E-02
LAMBDA UPPER= 1.006  LAMBDA LOWER= 1.005  EPS(L)= 0.928E-03


     SUBROUTINE CHBYSHV

          SIGB= 0.61941E 00

     I= 0      RATIO= 0.92774E-03

     I= 1      RATIO= 0.41624E-03

     I= 2      RATIO= 0.10383E-03

     I= 3      RATIO= 0.24672E-04

     J      THETA(J)
     1       1.36922
     2       0.44866
     3       0.04329


                    ITERATION NO.  10      LAMBDA=  0.1005430E 01
L =  1  RES=  0.3304E-03      0.2185E-03      0.1381E-03
LAMBDA UPPER= 1.005  LAMBDA LOWER= 1.005  EPS(L)= 0.102E-03

                         EIGENVALUE CONVERGENCE ACHIEVED


                    ITERATION NO.  11      LAMBDA=  0.1005430E 01
```

COMPUTATION CONVERGED AFTER 11 ITERATIONS

KEFF= 1.00543

THE CONVERGED FLUXES

GROUP 1	GROUP 2	GROUP 3
0.1258554E 01	0.9212530E 00	0.1947612E 00
0.1249166E 01	0.9143601E 00	0.1933112E 00
0.1221137E 01	0.8937734E 00	0.1889896E 00
0.1174888E 01	0.8597634E 00	0.1818891E 00
0.1111094E 01	0.8127576E 00	0.1721975E 00
0.1030643E 01	0.7532961E 00	0.1602858E 00
0.9345097E 00	0.6819665E 00	0.1469384E 00
0.8233930E 00	0.5993297E 00	0.1339496E 00
0.6967757E 00	0.5059364E 00	0.1256404E 00
0.5503650E 00	0.4028096E 00	0.1326666E 00
0.3693524E 00	0.2936264E 00	0.1814759E 00
0.2508428E 00	0.2248665E 00	0.2160289E 00
0.1715562E 00	0.1670704E 00	0.2164114E 00
0.1181564E 00	0.1217973E 00	0.1986098E 00
0.8191270E-01	0.8769548E-01	0.1728144E 00
0.5708799E-01	0.6257123E-01	0.1451047E 00
0.3988964E-01	0.4425354E-01	0.1188383E 00
0.2778612E-01	0.3089333E-01	0.9568173E-01
0.1905903E-01	0.2101189E-01	0.7633519E-01
0.1250510E-01	0.1344910E-01	0.6103071E-01
0.7231280E-02	0.7280000E-02	0.4988157E-01
0.5739614E-02	0.5868781E-02	0.4077652E-01
0.4538648E-02	0.4703976E-02	0.4296975E-01
0.3567558E-02	0.3740954E-02	0.3860179E-01
0.2777158E-02	0.2941309E-02	0.3378847E-01
0.2127417E-02	0.2272050E-02	0.2862581E-01
0.1585427E-02	0.1704744E-02	0.2319385E-01
0.1123737E-02	0.1214683E-02	0.1756022E-01
0.7189622E-03	0.7600732E-03	0.1178314E-01
0.3506022E-03	0.3812611E-03	0.5914040E-02
0.0	0.0	0.0

REG	GROUP	AVE. FLUX
1	1	0.96059E 00
2	1	0.96711E-01
3	1	0.26146E-02
1	2	0.70314E 00
2	2	0.92408E-01
3	2	0.27249E-02
1	3	0.16240E 00
2	3	0.14166E 00
3	3	0.27416E-01

TO NORMALIZE FLUX TO 0.250E 10 WATTS,MULTIPLY BY 0.111E 16

POINTWISE SOURCE VALUES

POINT NO.	SOURCE
1	0.1640816E-01
2	0.3257146E-01
3	0.3184071E-01
4	0.3063586E-01
5	0.2897777E-01
6	0.2689919E-01
7	0.2445377E-01
8	0.2173859E-01
9	0.1895439E-01
10	0.1655872E-01
11	0.8484293E-02
12	0.1052644E-02
13	0.8362783E-03
14	0.6593952E-03
15	0.5159625E-03
16	0.4007388E-03
17	0.3090228E-03
18	0.2366459E-03
19	0.1800210E-03
20	0.1361838E-03
21	0.5141228E-04
22	0.0
23	0.0
24	0.0
25	0.0
26	0.0
27	0.0
28	0.0
29	0.0
30	0.0
31	0.0

POINTWISE NORMALIZED FLUX VALUES

GROUP 1	GROUP 2	GROUP 3
0.1391667E 16	0.1018693E 16	0.2153611E 15
0.1381285E 16	0.1011072E 16	0.2137581E 15
0.1350296E 16	0.9883096E 15	0.2089797E 15
0.1299159E 16	0.9507047E 15	0.2011285E 15
0.1228625E 16	0.8987305E 15	0.1904126E 15
0.1139670E 16	0.8329831E 15	0.1772416E 15
0.1033373E 16	0.7541122E 15	0.1624829E 15
0.9105070E 15	0.6627365E 15	0.1481206E 15
0.7704986E 15	0.5594654E 15	0.1389331E 15
0.6085998E 15	0.4454289E 15	0.1467033E 15
0.4084353E 15	0.3246947E 15	0.2006777E 15
0.2773858E 15	0.2486599E 15	0.2388869E 15
0.1897098E 15	0.1847485E 15	0.2393101E 15
0.1306594E 15	0.1346850E 15	0.2196250E 15
0.9058052E 14	0.9697493E 14	0.1911003E 15
0.6312904E 14	0.6919224E 14	0.1604586E 15
0.4411086E 14	0.4893639E 14	0.1314129E 15
0.3072657E 14	0.3416244E 14	0.1058061E 15
0.2107594E 14	0.2323535E 14	0.8441253E 14
0.1382847E 14	0.1487229E 14	0.6748872E 14
0.7996538E 13	0.8050578E 13	0.5515990E 14
0.6347011E 13	0.6489826E 13	0.5172629E 14
0.5018952E 13	0.5201762E 13	0.4751677E 14
0.3945092E 13	0.4136833E 13	0.4268659E 14
0.3071051E 13	0.3252568E 13	0.3736393E 14
0.2352553E 13	0.2512488E 13	0.3165498E 14
0.1753204E 13	0.1885149E 13	0.2564820E 14
0.1242656E 13	0.1343226E 13	0.1941842E 14
0.7950461E 12	0.8626240E 12	0.1503002E 14
0.3877048E 12	0.4216076E 12	0.6539851E 13
0.0	0.0	0.0

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CONVERSION RATIOS FOR PLUTONIUM RECYCLE IN LIGHT WATER REACTORS - BREEDING POTENTIAL IN D_2O-H_2O COOLED REACTORS

by

George T. Story

(ABSTRACT)

The conversion properties of close packed, water cooled, plutonium fueled lattices are studied. Lattices with both ordinary water and light-heavy water mixtures are considered.

The effects of volume fractions, plutonium concentrations, and heavy water fraction on the neutronics are studied through the use of computer calculations.

A preliminary design for a D_2O-H_2O cooled breeder reactor is presented and the breeding characteristics of such a core are examined.