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TAFI-II, A COMPUTER CODE FOR MANAGEMENT OF RADIOACTIVE WASTE

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TAFI - II, A COMPUTER CODE FOR MANAGEMENT OF RADIOACTIVE WASTE

by

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ABSTRACT

A computer program, TAFI-II, was written in FORTRAN II to assist in the regulation and inventory control of radioactive fission products that are stored in waste tanks at the Savannah River Plant. The inventories and heat generation rates are computed for thirteen isotopes in each of twenty-four waste tanks. The program prepares a report that summarizes the data and provides an up-to-date status of the conditions in the waste tanks.

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TAFI-II, A COMPUTER CODE FOR MANAGEMENT OF RADIOACTIVE WASTE

INTRODUCTION

The chemical separations processes at the Savannah River Plant generate large volumes of aqueous waste that, because of their high fission product content and resultant gamma heat, are stored in cooled underground steel tanks until the short-lived isotopes have decayed to low levels. During this storage time the wastes separate into two layers: the sludge layer at the bottom containing about 85% of the total activity, and the liquid fraction or supernate containing the remainder of the isotopes. After the waste has decayed and separated for some time, the supernate is removed and concentrated by evaporation. The residue from the evaporation is then stored in uncooled tanks(1) to decay and separate further. To schedule and regulate movement of the waste, it is necessary to know the inventory of fission products and the heat generation rates in each tank. To assist in this, a computer code, TAFI-II, was written to facilitate these calculations and prepare reports at regular intervals.

DESCRIPTION OF THE WASTE TANK FARM

The waste tank farm consists of twelve tanks and one evaporator in each of the two chemical separations areas, F and H. The tanks are numbered in the order in which they were built. Tanks numbered 1-8 and 17-20 are in F Area, and 9-16 and 21-24 are in H Area. The tanks in each area are connected to the chemical separations buildings and to each other by shielded pipes through which the separations process waste is added, transferred from tank to tank, or transferred from one tank to another through the evaporator. At the present time there is no physical connection between the areas. Tanks 1-16 are cooled and receive fresh waste from the separations processes; tanks 17-24 are uncooled(1) and receive the evaporator bottoms.

EQUATIONS USED IN COMPUTER PROGRAM

The equations used to compute the concentrations of the 13 isotopes are described below. The 13 isotopes are: ^{89}Sr, ^{90}Sr, ^{90}Y, ^{91}Y, ^{95}Zr, ^{95}Nb, ^{106}Ru, ^{106}Rh, ^{137}Cs, ^{137}Ba, ^{144}Ce, ^{144}Pr, and ^{147}Pm. These particular isotopes are of interest in management of the waste because they (a) represent a long-term health hazard, (b) account for about 95% of the heat generation which is within the accuracy of measurements that can be made in waste tanks, or (c) may be of interest for future recovery. In the equations below the index J is used to define the isotope as it appears in this list; e.g., $J = 4 \equiv {}^{91}Y$.

In addition to the above 13 isotopes, the waste tanks contain small quantities of alpha emitters: ^{238}U, ^{235}U, ^{239}Pu, and ^{238}Pu. Because of their long half-lives, they are treated as if they were stable, and in the intertank transfers it is assumed that they follow the sludge.

Isotopic Concentration at Reactor Discharge

Equations 1-5 are used to compute the isotopic concentrations of an addition to the tank farm system at the end of the reactor irradiation.

The concentrations of ^{89}Sr, ^{90}Sr, ^{91}Y, ^{95}Zr, ^{106}Ru, ^{137}Cs, ^{144}Ce, and ^{147}Pm are given by

$$A_J^o = K\ P\ Y_J(1 - e^{-a_J T}) \qquad J = 1,2,4,5,7,9,11,13 \tag{1}$$

The concentrations of ^{90}Y, ^{95}Nb, ^{106}Rh, and ^{144}Pr, which are daughters of ^{90}Sr, ^{95}Zr, ^{106}Ru, and ^{144}Ce, respectively, are given by

$$A_J^o = K\ P\ Y_J \left\{ \left[\left(\frac{a_J}{a_J - a_{J-1}} \right) \left(1 - e^{-a_{J-1} T} \right) \right] - \left[\left(\frac{a_{J-1}}{a_J - a_{J-1}} \right) \left(1 - e^{-a_J T} \right) \right] \right\} \tag{2}$$

$$J = 3,6,8,12$$

The ^{137}Ba ($J = 10$) concentration is assumed to be 92% of the ^{137}Cs concentration since 8% of the ^{137}Cs decays directly to the stable ^{137}Ba isomer. Thus

$$A_J^o = 0.92\ A_{J-1}^o \qquad J = 10 \tag{3}$$

where

A_J^o = initial concentration for isotope J, curies/addition

$$K = \left(\frac{(3.16 \times 10^{16}\ \text{fissions/sec/MW})}{(3.7 \times 10^{10}\ \text{disintegrations/sec/curie})} \right) = 0.85 \times 10^{6}\ \text{curies/MW}$$

Y_J = fractional yield, atoms/fission

a_J = 0.693/half-life, days^{-1}

T = irradiation, days

For processing of highly enriched fuel the value of P in Equations 1 and 2 is expressed in terms of the ^{235}U burnup per tube as follows:

$$P = \left[\frac{^{235}U \text{ burnup, grams/tube}}{1.245 \text{ grams } ^{235}U/MWD}\right]\left[\frac{\text{No. tubes/addition}}{T, \text{ days}}\right], \text{ MW/addition} \quad (4)$$

whereas for processing of natural uranium fuel, P is expressed by

$$P = (\text{Megawatts/Ton of U})(\text{Tons of U/addition}) \quad (5)$$

Effect of Radioactive Decay

These equations are used to compute the effect of radioactive decay of the isotopes while they are in the reactor, from time-of-discharge until they are added to the waste tanks, and after they are in the waste system until the concentration reaches 10^{-5} curie at which time the concentration is set to zero.

Mother

$$B_J = A_J^o e^{-a_J T} \qquad J = 1,2,4,5,7,9,11,13 \quad (6)$$

Daughter

$$B_J = \left[A_{J-1}^o\left(\frac{a_J}{a_J - a_{J-1}}\right)\left(e^{-a_{J-1}T} - e^{-a_J T}\right)\right] + A_J^o e^{-a_J T} \qquad J = 3,6,8,12 \quad (7)$$

$$B_J = 0.92 \, A_{J-1}^o \qquad J = 10 \quad (8)$$

where

B_J = concentration of isotope J, curies

T = decay time, days

a_J = 0.693/half-life, days^{-1}

Heat Generation

The decay heat, Q_J, is computed from the concentration of each isotope, B_J, and a parameter H_J, the energy release per disintegration.

$$Q_J = B_J H_J \qquad J = 1,13 \quad (9)$$

Distribution of Isotopes between Supernate and Sludge

In the process of cooling for 2 to 3 years the waste separates into two layers, the supernate and sludge. The heavier sludge layer contains about 85% of the total activity in a tank. Each of the 13 isotopes has a partition factor, PF_J, which is defined as the fraction of the isotope in the supernate of a tank. These partition factors range from 0.02 for ^{89}Sr to 0.95 for ^{137}Cs.

Intertank Transfers

Four types of intertank transfers can be made in the operation of the tank farm. The types are defined by the material transferred, supernate or sludge, and whether or not the material being moved has its partition factors changed while in transit. The curies to be transferred in a supernate transfer are computed by

$$CT_J = TB_J \; PF_J \; PC \qquad J = 1,13 \tag{10}$$

and in a sludge transfer by

$$CT_J = TB_J \; PC(1.0 - PF_J) \qquad J = 1,13 \tag{11}$$

where

CT_J = curies transferred, isotope J

TB_J = total curies of isotope J in tank from which material is removed

PF_J = partition factor for isotope J

PC = fraction of supernate or sludge to be moved

Thus, total curies in the tanks after a transfer are

$$NTB_J = TB_J - CT_J \qquad J = 1,13 \tag{12}$$

for the sending tank, and

$$NTB_J = TB_J + CT_J \qquad J = 1,13 \tag{13}$$

for the receiving tank for all types of transfers.

Supernate Transfers

In supernate transfers the new partition factors (NPF_J) for the tank from which material is removed are calculated by

$$NPF_J = \frac{(PF_J\ TB_J) - CT_J}{(TB_J - CT_J)} \qquad J = 1,13 \qquad (14)$$

and the new partition factors for the receiving tank are calculated by

$$NPF_J = \frac{(PF_J\ TB_J) + CT_J}{(TB_J + CT_J)} \qquad J = 1,13 \qquad (15)$$

However, if some of the material is precipitated by passing it through an evaporator, the new partition factors for the receiving tank are calculated by

$$NPF_J = \frac{(PF_J\ TB_J) + (CT_J\ PFA_J)}{(TB_J + CT_J)} \qquad J = 1,13 \qquad (16)$$

where

PFA_J = fraction of the J^{th} isotope that remains in supernate after precipitation

Sludge Transfers

In sludge transfers the new partition factors for the sending tank are recomputed by

$$NPF_J = \frac{(PF_J\ TB_J)}{(TB_J - CT_J)} \qquad J = 1,13 \qquad (17)$$

The new partition factors for the receiving tank are computed from

$$NPF_J = \frac{(PF_J\ TB_J)}{(TB_J + CT_J)} \qquad J = 1,13 \qquad (18)$$

and, as in the case of a supernate transfer in which some of the material is precipitated, the new partition factors for the receiving tank are given by

$$NPF_J = \frac{(PF_J\ TB_J)}{TB_J + (CT_J\ PFA_J)} \qquad J = 1,13 \qquad (19)$$

Transfer of Alpha Emitters

The alpha emitters are assumed to be contained completely in the sludge. The concentrations of the N isotopes are given by the following expressions in which N = 1,4 and corresponds to ^{238}U, ^{235}U, ^{239}Pu, and the combined total of the ^{238}Pu and ^{239}Pu.

$$UP_N = STUP_N \, PC \qquad N = 1,4 \tag{20}$$

$$NTUP_N = STUP_N - UP_N \qquad N = 1,4 \tag{21}$$

$$RNTUP_N = RTUP_N + UP_N \qquad N = 1,4 \tag{22}$$

where

UP_N = fraction of alpha emitter N that is transferred

$STUP_N$ = total of alpha emitter N in the sending tank

$NTUP_N$ = new total in sending tank

$RNTUP_N$ = new total in receiving tank

DESCRIPTION OF THE COMPUTER PROGRAM

TAFI-II was written in FORTRAN II for an IBM 704 with 10 tapes and a core memory of 32,000 words. The over-all flow is shown in Figure 1 and the FORTRAN listing is given in Appendix A. The code consists of the main program and four subroutines. COMMON is used to transfer data between the different parts of the code.

To allow for future expansion of the tank farm, as many as 34 tanks can be used with no changes to the code. Future tanks 25-28 have been assigned to H Area and 29-32 to F Area. The possibility of storing waste in deep-mined caverns[2] has been considered by assigning tank number 33 to F Area and tank number 34 to H Area as deep-mined caverns. A transfer of waste into any one of these tanks is all that is necessary to put that tank into the TAFI-II system.

The summary of contents and conditions in each tank, permanent library data, is kept as a consecutively numbered series of binary records on a library tape. The library tape is updated at the end of each job by Subroutine PART 4. Each record, called file on the control card, includes the file (record) number, the year, month, day for the job, the final gamma and alpha emitter concentrations, and the final

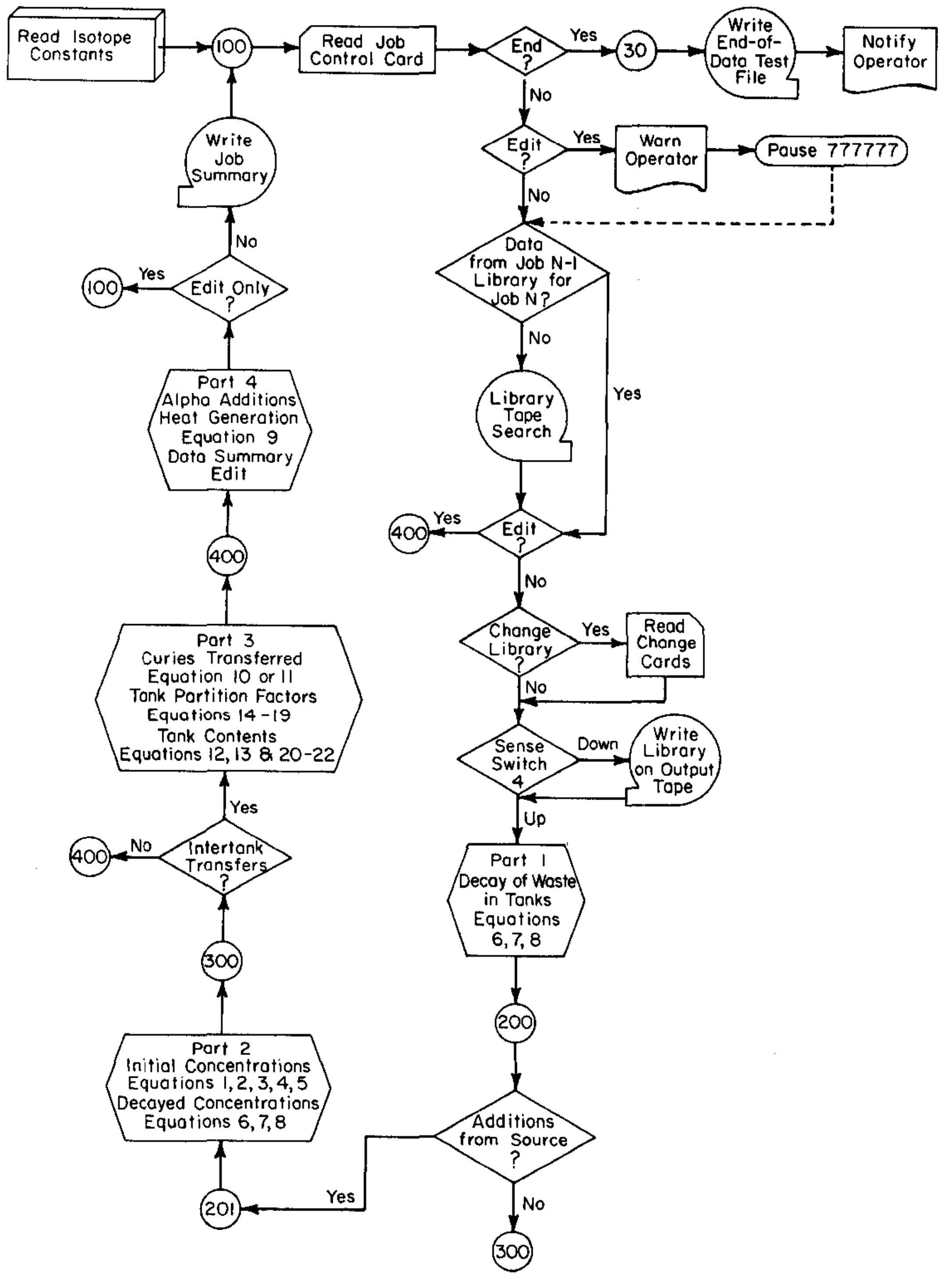

FIG. 1 OVER-ALL FLOW

tank partition factors. The file number for the current job is obtained by adding 1 to the starting file number (from the control card); this file number and the current data summary are written on the library tape as the starting file for the next job.

In the use of TAFI-II, care must be exercised in the sequencing of jobs. The job sequence and the transfers in a job must be in actual time sequence. At the end of a job or a set of jobs, if more than one is run at a time, the main program writes a dummy file to signal end-of-data. Because of this, care must be exercised in the use of the Edit option so that a good file will not be destroyed. At the end of each job, the main program writes a summary sheet that contains the file number and date that are required in the preparation of the control card for the next job.

Main Program

The main program reads the constants of the isotopes (half-life, yield, heat conversion factor, and name) from 13 cards (Appendix B, Figure 1) that immediately follow the transfer card. These constants are used for all jobs in a set, and if a constant for any isotope is to be changed the change must be made in the correct card in this deck.

The control card is read that identifies the job, the program options, and the library file for the job. The format and contents of the control card are given in Appendix B, Figure 2.

The binary library tape is then searched for the designated starting file. If changes are to be made in this file, the cards that contain the new information must follow the control card. The format of the change cards is shown in Appendix B, Figure 6. If Sense Switch 4 is DOWN the contents of the library file are written on the BCD output tape. The main program then calls Subroutine PART 1.

Subroutine PART 1

After the main program has set up the options and initial data, Subroutine PART 1 calculates the radioactive decay of the material in the tanks (from the library tape) for the specified number of days. Equations 6, 7, and 8 are used in this subroutine. If the concentration of an isotope becomes $\leqslant 10^{-5}$ curie, it is set to zero. The report written by PART 1 gives the concentration of each isotope in a tank at the beginning and the end of the decay time.

Subroutine PART 2

The additions to the system are handled by Equations 1-8 in PART 2. Each addition requires one input card that includes 1) the tank number to which the addition is to be added; 2) tons of uranium for Purex calculations or ^{235}U burnup for the enriched uranium calculations; 3) irradiation time, days; 4) blank for Purex calculations or power conversion factor for the enriched uranium calculations; 5) days since discharge to the end of the reporting period for this job; 6) charge identification; and 7) an option that allows the partition factors for this charge to be changed. If this option is used, the two change cards must immediately follow the addition card. These two cards should contain, in order, the partition factors for this charge. The format of the cards for additions to the system is given in Appendix B, Figure 3. The report for PART 2 consists of the concentration in curies and the partition factor for each isotope in each addition as it is added to the tank. The total curies for each addition and the total of all additions in a job are also reported.

Subroutine PART 3

In this subroutine the four types of intertank transfer are made with Equations 10-22. The input for this subroutine requires one card per transfer that includes (a) tank transferred from, (b) tank added to, (c) percent of supernate or sludge transferred, and (d) option number. The options are: 1 = supernate transfer using the latest computed values for partition factors; 2 = supernate transfer and concentration of material during transit; 3 = sludge transfer using 1.0 - latest computed partition factors; and 4 = sludge transfer and changed partition factors. The detailed flow chart is Figure 2. Appendix B, Figure 4, illustrates the input cards.

Subroutine PART 4

PART 4 calculates the heat generated in the tanks by each isotope by Equation 9. It also makes additions to the alpha emitters; the input for these additions requires one card per addition with (a) tank number to which the addition is made; (b) ^{238}U, 10^3 lb; (c) ^{235}U, kg; (d) ^{239}Pu, kg; and (e) $^{238-239}Pu$, curies, punched in this order (Appendix B, Figure 5).

The reports generated by PART 4 summarize the tank conditions (partition factors and concentration in curies) at the end of the job and gives a complete data summary of tank contents by area. The data summary is prepared for direct inclusion in a monthly report. PART 4 also updates the binary library tape at the end of each job.

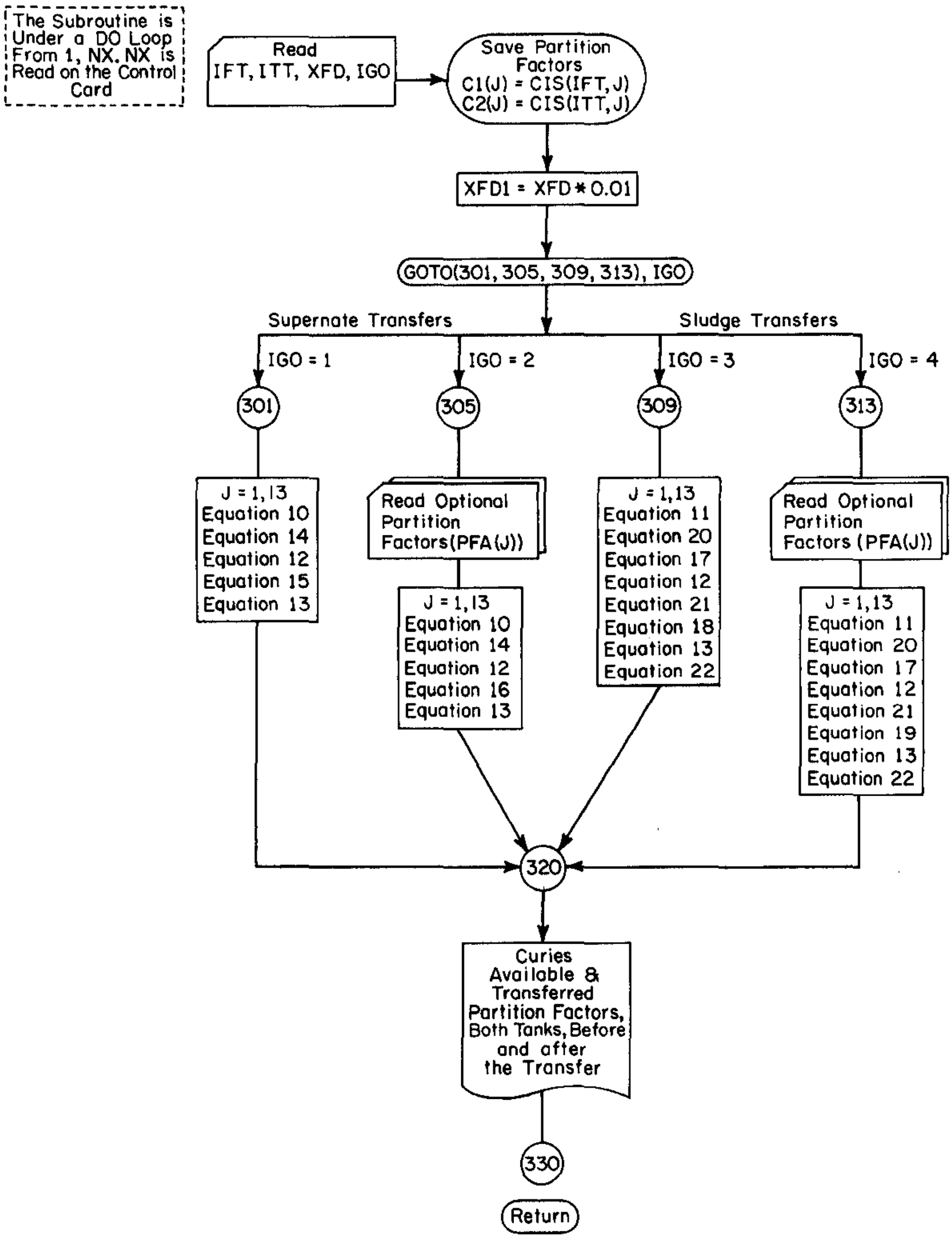

FIG. 2 SUBROUTINE PART 3 FLOW

ACKNOWLEDGMENT

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APPENDIX A - FORTRAN Listing

```
C                                  TAFI-II
C
C
C     TAFI IS A PROGRAM TO KEEP AN INVENTORY OF CERTAIN ISOTOPES THAT    TAFI
C     ARE FISSION PRODUCT BY-PRODUCTS OF THE SEPARATIONS PROCESSES IN    TAFI
C     THE 200 AREAS .  THESE WASTE PRODUCTS ARE ACCUMULATED IN THE
C     WASTE TANKS IN EACH AREA.
C                                                                        TAFI
C
C
C     TAFI-II IS DIVIDED INTO THE MAIN PROGRAM AND FOUR SUBROUTINES.
C     THE MAIN PROGRAM READS THE IDENT. AND OPTIONS AND SETS UP THE TANK
C     LIBRARY DATA AND THE CONSTANTS FOR EACH ISOTOPE TO BE USED BY THE
C     OTHER PARTS OF THE CODE.
C
C     PART 1 DECAYS THE MATERIAL IN THE TANKS FOR DDT DAYS AND WRITES
C     THE REPORT FOR CURIES IN THE TANKS BEFORE AND AFTER DECAY.
C
C     PART 2 CALCULATES THE ISOTOPIC CONTENTS OF AND ADJUSTS THE         TAFI
C     PARTITION FACTORS FOR ANY MATERIAL ADDED TO THE SYSTEM DURING      TAFI
C     THIS PERIOD OF TIME.                                               TAFI
C                                                                        TAFI
C     PART 3 HANDLES THE INTERTANK TRANSFERS BY CALCULATING THE FRACTION
C     TRANSFERED AND RECALCULATING THE PARTITION FACTORS FOR THE TANKS
C     INVOLVED IN THE TRANSFERS.
C                                                                        TAFI
C     PART 4 MAKES THE ADDITIONS TO THE ALPHA EMITTERS, CALCULATES
C     THE HEAT GENERATED IN EACH TANK AND WRITES THE FINAL DATA SUMMARY
C     FOR BOTH AREAS.
C                                                                        TAFI
C                                                                        TAFI
      DIMENSION TLIB(34,13),CIS(34,13),CURE(34,13),AHL(13),YLD(13),      TAFI
     1AHC(13),AOSS(34,4),PFN(13),PFA(13),CURA(13),PM(13),DUM2(13),       TAFI
     2DUM1(13),TAFI(3),ANAM(13),TOTB(34),TOTC(34),DENT(1),CURSV(13),THT(TAFI
     334),SUHT(34),FTOT(13),HTOT(13),TNKS(34),AGN(4),BGN(4),OGN(   4),TGNTAFI
     4(4),ASO(13)
C
      COMMON CURE,TLIB,CIS,PFN,IPG,AHL,YLD,AHC,TAFI,ANAM,DDT,NC,NL,NX,
     1AOSS,LIB,ILS,DUM1,DUM2,NTOUT,NF1,NF2,NTLIB,DA2,YR2,TMT2
C
      CALL EFM
      DO 6 I=1,34
      DO 5 J=1,13
      TLIB(I,J)=0.0
      CIS(I,J)=0.0
      CURE(I,J)=0.0
      AOSS(I,J)=0.0
    5 CONTINUE
    6 CONTINUE
      NTLIB=4                                                            TAFI
      NTOUT=10                                                           TAFI
      IPG=0                                                              TAFI
      NF2=0                                                              TAFI
      REWIND NTLIB
C                                                                        TAFI
C     CONSTANTS FOR EACH ISOTOPE AND ISOTOPE NAME                        TAFI
C     AHL = HALF-LIFE, DAYS                                              TAFI
C     YLD = YIELD, FRACTIONAL PERCENT                                    TAFI
C     AHC = HEAT CONVERSION FACTOR                                       TAFI
C     PFN = NORMAL PARTITION FACTOR, FRACTION IN SUPERNATE
C     ANAM = ISOTOPE NAME                                                TAFI
C
    1 DO 2 J=1,13                                                        TAFI
    2 READ 600,I,(AHL(I)),(YLD(I)),(AHC(I)),(PFN(I)),(ANAM(I))           TAFI
C
C                                                                        TAFI
C     READ IDENTIFICATION AND OPTIONS                                    TAFI
C     TAFI - IDENTIFICATION                                              TAFI
C     DDT - DAYS TO DECAY THE TANKS                                      TAFI
C     NF1,YR1,TMT1, DA1 - FILE NUMBER, YEAR, MONTH, DAY TO BE USED AS    TAFI
C     THE START FOR THIS JOB                                             TAFI
C     YR2, TMT2, DA2  - YEAR, MONTH, DAY OF THIS JOB                     TAFI
C     ILB - NUMBER OF CHANGES TO CURIES IN TANKS (TLIB)
C     ICS - NUMBER OF CHANGES TO TANK PARTITION FACTORS (CIS)
C     ILS - NUMBER OF CHANGES TO ALPHA EMITTERS (AOSS)
C     NC  - NUMBER OF CHARGES ADDED TO SYSTEM FROM SOURCE                TAFI
C     NX  - NUMBER OF INTERTANK TRANSFERS                                TAFI
C     NL - NUMBER OF ALPHA EMITTER LOSSES TO BE ADDED TO THE SYSTEM
C     LIB  - 0= END, 1 = READ DESIGATED FILE FOR COMPUTING, -1 = PRINT   TAFI
C     DESIGNATED FILE, NO COMPUTING                                      TAFI
C
```

```
C             NOTE - EACH SET OF CHANGE CARDS (2 CARDS/SET) DESIGNATES
C                    THE SPECIFIC TANK TO BE CHANGED AND THE ORDER
C                    DETERMINES WHAT IS TO BE CHANGED.
C                                                                        TAFI
C         THIS IS THE ENTRY POINT FOR RUNNING SUCESSIVE JOBS
C                                                                        TAFI
  100 READ 601, (TAFI(J), J=1,3),DDT,NF1,YR1,TMT1,DA1,YR2,TMT2,DA2,ILB,  TAFI
     1ICS,ILS,NC,NX,NL,LIB                                               TAFI
C
C         TAPE READ COUNTER
      IRD = 0
C
C         TEST FOR EDIT ONLY
      IF(LIB)82,30,84
   82 PRINT 632,NF1
C                                                                        TAFI
      PAUSE 777777
C
C         TEST - IS THE DATA JUST GENERATED TO BE USED AS THE STARTING POINT
C         FOR THE NEXT PROBLEM
   84 IF(NF1-NF2)99,85,99
C
C         SWAP MATRICES
C
   85 DO 86 I=1,34                                                       TAFI
      DO 86 J=1,13                                                       TAFI
      TLIB(I,J)=CURE(I,J)                                                TAFI
   86 CONTINUE                                                           TAFI
C
      GO TO 107
C
C         LIBRARY TAPE SEARCH
C
   99 BACKSPACE NTLIB
  101 READ TAPE NTLIB,IF,YR,TMT,DAY,TLIB,AOSS,CIS
C                                                                        TAFI
C         TEST - RIGHT FILE                                              TAFI
      IF(IF-1000) 104,105,702
  702 PRINT 628
      PAUSE 707070
C
  104 IF(NF1-IF)105,106,101
C
  105 REWIND NTLIB                                                       TAFI
      IRD = IRD + 1
C     IF AT FIRST YOU DON-T SUCEED TRY, TRY, THEN QUIT.
      IF(IRD-3) 1061,702,702
 1061 GO TO 101
C
  106 IF((YR1+TMT1)-(YR+TMT))701,107,701                                 TAFI
C                                                                        TAFI
  701 PRINT 604                                                          TAFI
      PAUSE 777777
C
C         IF LIB = -1  PRINT THE REQUESTED FILE FROM TAPE                TAFI
  107 IF (LIB)400,102,102                                                TAFI
C                                                                        TAFI
C                                                                        TAFI
C         TEST IS ANY OF THE INFORMATION IN THIS FILE TO BE UPDATED      TAFI
C                                                                        TAFI
  102 IF(ILB+ICS + ILS)108,117,108                                       TAFI
C
C         TEST - CHANGE CURIES FROM LIBRARY TAPE
C                                                                        TAFI
  108 IF(ILB)109,111,109                                                 TAFI
  109 DO 110  I=1,ILB                                                    TAFI
  110 READ 605, K, ((TLIB(K,J), J=1,13))                                 TAFI
C
C         TEST TANK PARTITION FACTORS                                    TAFI
  111 IF (ICS)112,114,112                                                TAFI
  112 DO 113 I=1,ICS                                                     TAFI
  113 READ 605, K,((CIS(K,J),J=1,13))                                    TAFI
C                                                                        TAFI
C         TEST - CHANGE ALPHA EMITTERS
  114 IF(ILS)115,117,115                                                 TAFI
  115 DO 116 I=1,ILS                                                     TAFI
  116 READ 600,K,((AOSS(K,J), J=1,4))                                    TAFI
C                                                                        TAFI
  117 CONTINUE                                                           TAFI
C                                                                        TAFI
C         TEST - DUMP LIBRARY
```

```
C
      IF(SENSE SWITCH 4)1113,130
 1113 IPG=IPG+1
      LINE=0
      DO 118 I=1,34
      IF(LINE)119,120,119
  120 WRITE OUTPUT TAPE NTOUT,630,(TAFI(J),J=1,3),IPG
  119 T1=0.0
      DO 121 J=1,13
      T1=T1+TLIB(I,J) +CIS(I,J)
  121 CONTINUE
      IF(T1)122,118,122
  122 WRITE OUTPUT TAPE NTOUT,631,I,((TLIB(I,J),CIS(I,J)),J=1,13)
      LINE=LINE+1
      IF(I-34)123,124,123
  123 IF(LINE-5)118,124,118
  124 WRITE OUTPUT TAPE NTOUT,609
      LINE=0
      IPG=IPG+1
  118 CONTINUE
C
  130 CONTINUE
C                                                                       TAFI
C
      CALL PART1
C                                                                       TAFI
C                                                                       TAFI
C     TEST - TRANSFERS (ADDITIONS) FROM SOURCE
C                                                                       TAFI
  200 IF(NC)201,300,201                                                 TAFI
  201 CALL PART2
C                                                                       TAFI
C
C     TEST - INTERTANK TRANSFERS
C                                                                       TAFI
  300 IF (NX)303,400,303                                                TAFI
  303 CALL PART3
C                                                                       TAFI
C
  400 CALL PART4
C                                                                       TAFI
C
      IF(LIB)100,500,500
  500 IPG=IPG+1
C                                                                       TAFI
      WRITE OUTPUT TAPE NTOUT,606,(TAFI(J),J=1,3),IPG                   TAFI
      WRITE OUTPUT TAPE NTOUT,627,DDT,NF1,YR1,TMT1,DA1,NF2,YR2,TMT2,DA2,TAFI
     1ILB,ICS,ILS,NC,NX,NL                                              TAFI
C                                                                       TAFI
      WRITE OUTPUT TAPE NTOUT,609                                       TAFI
C                                                                       TAFI
      GO TO 100                                                         TAFI
C
C                                                                       TAFI
   30 NEND=1000
      WRITE TAPE NTLIB,NEND,YR2,TMT2,DA2,CURE,AOSS,CIS
      REWIND NTLIB
      PRINT 602                                                         TAFI
C
  600 FORMAT (I2,4E9.4,1A6)                                             TAFI
C
  601 FORMAT(3A6,E9.4,I3,6F2.0,7I2)                                     TAFI
C
  602 FORMAT(60HOPROBLEM COMPLETED - HAVE TAPE 10 PRINTED AT 6 LINES PERTAFI
     1INCH/25H STORE TAPE 4 IN THE SAFE,20X1H=//////////)              TAFI
C
  604 FORMAT(96HOERROR - FILE DATE ON CARD DOES NOT APPEAR ON LIBRARY TATAFI
     1PE.  END RUN.  NOTIFY SUBMITTOR AT ONCE.//////////)              TAFI
C
  605 FORMAT(7X,I2,6E9.4/(7E9.4))
C
  606 FORMAT(1H1,50X,17HSECRET WORK SHEET/ 50X,3A6,37X,5HPAGE ,I2)      TAFI
C
  609 FORMAT(1H0,49X,17HSECRET WORK SHEET)                              TAFI
C
  627 FORMAT(1H0,25X,27HSUMMARY SHEET FOR THIS JOB.///10X,18HTANKS DECAYTAFI
     1ED FOR ,F6.0,1X,4HDAYS/10X,12HFILE NUMBER ,I3,1X,15HWITH THIS DATETAFI
     1 ,F3.0,1H/,F3.0,1H/,F3.0,31H WAS USED AS THE STARTING POINT/10X,12TAFI
     2HFILE NUMBER ,I3,16H WITH THIS DATE ,F3.0,1H/,F3.0,1H/,F3.0, 55H STAFI
     3HOULD BE USED AS THE STARTING POINT FOR THE NEXT JOB./10X,43HTHE CTAFI
```

```
     4URIES IN THE LIBRARY FILE WERE CHANGED,I3,6H TIMES/10X,34HTHE PARTTAFI
     5ITION FACTORS WERE CHANGED,I3,6H TIMES/10X,32HTHE ALPHA EMITTERS
     6WERE CHANGED,I3,6H TIMES/10X,10HTHERE WERE,I3,28H CHARGES ADDED TOTAFI
     7 THE SYSTEM/10X10HTHERE WERE,I3,20H INTERTANK TRANSFERS/10X,10HTHETAFI
     8RE WERE,I3,33H ADDITIONS TO THE ALPHA EMITTERS ///)                 TA
C
  628 FORMAT(107H0   ERROR - FILE NUMBER REQUESTED ON CARD DOES NOT APPE
     1AR ON THE TAPE.  END RUN.  NOTIFY SUBMITTOR AT ONCE.////////)
C
  630 FORMAT( 1H1,40X,17HSECRET WORK SHEET/75H TANK SUMMARY AT START OF
     1JOB, CURIES AND PARTITION FACTOR FOR EACH ISOTOPE ,/10X,3A6,
     2 20X,4HPAGE,I3 /5H TANK/)
C
  631 FORMAT(I4, 3(8E12.4),2E12.4//)
C
  632 FORMAT(13H1EDITING FILE,I4,62H BE SURE THE RING IS OUT OF THE LIBR
     1ARY TAPE FOR THIS PROBLEM.//86H IF THIS IS THE LAST PROBLEM THE EN
     2D WILL BE SIGNALED BY A SELECT ON THE LIBRARY TAPE.//65H DO NOT AL
     3LOW THE LIBRARY TAPE TO BE WRITTEN ON FOR THIS PROBLEM./65H ======
     4===========================================================/////////)
      END(2,0,0,0,0)



C                                PART 1                                  TAFI
C                                                                        TAFI
C     THE LIBRARY MATERIAL HAS BEEN BROUGHT UP-TO-DATE, NOW THE MATERIALTAFI
C     IN THE TANKS IS TO BE DECAYED FOR THE SPECIFIED NUMBER OF DAYS     TAFI
C                                                                        TAFI
C                                                                        TAFI
      SUBROUTINE PART1
C
      DIMENSION TLIB(34,13),CIS(34,13),CURE(34,13),AHL(13),YLD(13),      TAFI
     1AHC(13),AOSS(34,4),PFN(13),PFA(13),CURA(13),PM(13),DUM2(13),       TAFI
     2DUM1(13),TAFI(3),ANAM(13),TOT8(34),TOTC(34),DENT(1),CURSV(13),THT(TAFI
     334),SUHT(34),FTOT(13),HTOT(13),TNKS(34),AGN(4),BGN(4),DGN(  4),TGNTAFI
     4(4),ASO(13)                                                        TAFI
C
      COMMON CURE,TLIB,CIS,PFN,IPG,AHL,YLD,AHC,TAFI,ANAM,DDT,NC,NL,NX,
     1AOSS,LIB,ILS,DUM1,DUM2,NTOUT,NF1,NF2,NTLIB,DA2,YR2,TMT2
C
C     DOUBLE DO  I = TANK INDEX AND J = ISOTOPE INDEX
C
  120 DO 139 I=1,34                                                      TAFI
      DO 138 J=1,13                                                      TAFI
C     M-CALCULATION FOR MOTHER ISOTOPE  STATEMENT 131                    TAFI
C     D - CALCULATION FOR DAUGHTER ISOTOPE STATEMENT 132 OR 133          TAFI
C                             ISOTOPE INDEX NUMBER                       TAFI
C              1   2   3   4   5   6   7   8   9   10  11  12  13        TAFI
      GO TO(131,131,132,131,131,132,131,132,131,133,131,132,131),J       TAFI
C                                                                        TAFI
  131 SAM=.693/AHL(J)                                                    TAFI
      CURE(I,J)=TLIB(I,J)*EXPF(-SAM*DDT)                                 TAFI
      IF(CURE(I,J) - 1.E-6)137,137,138
C                                                                        TAFI
  132 SAM=.693/AHL(J-1)                                                  TAFI
      SAD=.693/AHL(J)                                                    TAFI
      Z1D=SAD/(SAD-SAM)                                                  TAFI
      CURE(I,J)=Z1D*(TLIB(I,J-1)*(EXPF(-SAM*DDT)-EXPF(-SAD*              TAFI
     1DDT))) + TLIB(I,J)*EXPF(-SAD*DDT)                                  TAFI
      IF(CURE(I,J) - 1.E-6)137,137,138
C
  133 CURE(I,J)=0.92*CURE(I,J-1)
      IF(CURE(I,J) - 1.E-6)137,137,138
C
  137 CURE(I,J)=0.0                                                      TAFI
  138 CONTINUE                                                           TAFI
  139 CONTINUE                                                           TAFI
C
C     NO NEED FOR THIS REPORT IF THERE ARE NO CHANGES
C
      IF(DDT)145,190,145
C                                                                        TAFI
C     SUMS FOR ISOTOPES BEFORE AND AFTER DECAY                           TAFI
  145 DO 140  I=1,34                                                     TAFI
      TOTB(I)=0.0
      TOTC(I)=0.0
      DO 141  J=1,13                                                     TAFI
```

```
      TOTB(I)=TOTB(I)+TLIB(I,J)
      TOTC(I)=TOTC(I)+CURE(I,J)
  141 CONTINUE
  140 CONTINUE
C                                                                       TAFI
C     MATERIAL IN THE TANKS HAS BEEN DECAYED FOR THE SPECIFIED NUMBER   TAFI
C     OF DAYS.  WRITE REPORT FOR PART 1                                 TAFI
C                                                                       TAFI
      IPG=IPG+1
      LINE=0
      DO 180 I=1,34
      IF(TOTB(I) + TOTC(I))150,180,150
  150 IF(LINE)152,151,152
  151 WRITE OUTPUT TAPE NTOUT,606,     (TAFI(J),J=1,3),IPG              TAFI
      WRITE OUTPUT TAPE NTOUT,607                                       TAFI
      IPG = IPG + 1
C                                                                       TAFI
  152 T1=0.0
      DO 153 J=1,13
  153 T1=T1+TLIB(I,J)+CURE(I,J)
      IF(T1)156,159,156
  156 LINE=LINE+1
      WRITE OUTPUT TAPE NTOUT,608,I,((ANAM(K)),K=1,4),  ((TLIB(I,J),CURE(TAFI
     1I,J)),J=1,4),((ANAM(K)),K=5,8),((TLIB(I,J),CURE(I,J)),J=5,8), ( (  TAFI
     2ANAM (K)),K=9,12),((TLIB(I,J),CURE(I,J)),J=9,12),  ANAM(13),      TAFI
     3TLIB(I,13),CURE(I,13),TOTB(I),TOTC(I)                             TAFI
C                                                                       TAFI
  159 IF(I-34)157,158,157
  157 IF(LINE-5)180,158,180
  158 WRITE OUTPUT TAPE NTOUT, 609
      LINE =0
  180 CONTINUE
C                                                                       TAFI
  190 RETURN
C                                                                       TAFI
  606 FORMAT(1H1,50X,17HSECRET WORK SHEET/ 50X,3A6,37X,5HPAGE ,I2)      TAFI
C
  607 FORMAT(71H CURIES IN TANKS BEFORE AND AFTER DECAY, IF LESS THAN 10
     1 E-5 SET = 0.0.//1X4HTANK,3X,6HBEFORE,7X,5HAFTER,6X,6HBEFORE,7X,
     25HAFTER,6X,6HBEFORE,7X5HAFTER,6X,6HBEFORE,7X,5HAFTER//)
C
  608 FORMAT(I3,11X,1A6,18X,1A6,18X,1A6,18X,1A6/4X,8E12.4/14X,1A6,18X,1ATAFI
     16,18X,1A6,18X,1A6/4X,8E12.4/14X,1A6,18X,1A6,18X,1A6,18X,1A6/4X,8E1TAFI
     22.4/14X,1A6,18X,6HTOTALS/4X,4E12.4//)
C
  609 FORMAT(1H0,49X,17HSECRET WORK SHEET)                              TAFI
C
      END(2,0,1,0,0)
```

```
C                               PART 2                                  TAFI
C                                                                       TAFI
C     THIS SUBROUTINE HANDLES THE CHARGES THAT ARE ADDED TO THE SYSTEM
C     IN THIS PERIOD OF TIME.  THE INITIAL ISOTOPIC CONCENTRATIONS
C     ARE CALCULATED AND THEN DECAYED AND ADDED TO THE TANKS.
C     THE TANK PARTITION FACTORS ARE RECALCULATED FOR EACH ADDITION
C     ACCORDING TO THE OPTION ON THE ADDITION CARD
C
      SUBROUTINE PART2
C
      DIMENSION TLIB(34,13),CIS(34,13),CURE(34,13),AHL(13),YLD(13),     TAFI
     1AHC(13),AOSS(34,4),PFN(13),PFA(13),CURA(13),PM(13),DUM2(13),      TAFI
     2DUM1(13),TAFI(3),ANAM(13),TOTB(34),TOTC(34),DENT(1),CURSV(13),THT(TAFI
     334),SUHT(34),FTOT(13),HTOT(13),TNKS(34),AGN(4),BGN(4),OGN(   4),TGNTAFI
     44(4),ASO(13)
C
      COMMON CURE,TLIB,CIS,PFN,IPG,AHL,YLD,AHC,TAFI,ANAM,DDT,NC,NL,NX,
     1AOSS,LIB,ILS,DUM1,DUM2,NTOUT,NF1,NF2,NTLIB,DA2,YR2,TMT2
C
C                                                                       TAFI
  205 CONK=0.85E+6
      SUM2=0.0                                                          TAFI
      LINE=0                                                            TAFI
C                                                                       TAFI
C     ADD ALL TRANSFERS FROM SOURCE TO THE SYSTEM
C
```

```
      DO 250 NT=1,NC                                                    TAFI
      DENT = 0.0                                                        TAFI
      P4=0.0                                                            TAFI
      SUM1=0.0                                                          TAFI
      READ 610,JT,P1,P2,P3,P4,DSD,DENT,NML                              TAFI
C     P4=0.0 CALCULATE P BY PUREX METHOD                                TAFI
  210 IF(P4)212,211,212                                                 TAFI
C                                                                       TAFI
  211 P=P1*P2                                                           TAFI
      GO TO 214                                                         TAFI
C                                                                       TAFI
  212 P=((P1/P4)*(1./P3))*P2                                            TAFI
C                                                                       TAFI
  214 DO 230 J=1,13                                                     TAFI
      ASO (J)=0.0                                                       TAFI
      CURSV(J)=0.0                                                      TAFI
C                                                                       TAFI
C     SAME SCHEME TO DECAY THE ISOTOPES AS THE TANK DECAY               TAFI
C             1   2   3   4   5   6   7   8   9   10  11  12  13        TAFI
      GO TO(215,215,216,215,215,216,215,216,215,217,215,216,215),J      TAFI
C                                                                       TAFI
C     MOTHER                                                            TAFI
C           CONCENTRATION  AT REACTOR DISCHARGE - ASO                   TAFI
  215 SA=0.693/AHL(J)                                                   TAFI
      ASO(J)=(CONK*P*YLD(J))*(1.*-(EXPF(-SA*P3)))                       TAFI
C           CONCENTRATION AS ADDED TO TANKS - CURSV                     TAFI
C                                                                       TAFI
      CURSV(J)=ASO(J)* EXPF(-SA*DSD)                                    TAFI
      IF(CURSV(J))229,230,230                                           TAFI
C     DAUGHTER                                                          TAFI
C           CONCENTRATION AT REACTOR DISCHARGE                          TAFI
  216 SA=0.693/AHL(J-1)                                                 TAFI
      SB=0.693/AHL(J)                                                   TAFI
      Z1=SB/(SB-SA)                                                     TAFI
      Z2=SA/(SB-SA)                                                     TAFI
      ASO(J)=(CONK*P*YLD(J)) * (Z1*(1.-EXPF(-SA*P3)))-Z2*(1.-EXPF(-SB   TAFI
     1*P3))                                                             TAFI
C           CONCENTRATION AS ADDED TO TANKS                             TAFI
      CURSV(J) = Z1 *(ASO(J-1) *(EXPF(-SA*DSD)-EXPF(-SB*DSD))) +ASO(J)* TAFI
     1EXPF(-SB*DSD)                                                     TAFI
      IF(CURSV(J))229,230,230                                           TAFI
C                                                                       TAFI
  217 CURSV(J)=0.92*CURSV(J-1)                                          TAFI
      IF(CURSV(J))229,230,230                                           TAFI
C                                                                       TAFI
  229 CURSV(J)=0.0                                                      TAFI
  230 CONTINUE                                                          TAFI
C                                                                       TAFI
C     CALCULATE  NEW PARTITION FACTORS FOR EACH ISOTOPE                 TAFI
C     AND ADD THE ISOTOPES TO THE DESIGNATED TANK                       TAFI
C     IF NML =0 NORMAL PARTITION FACTORS WILL BE USED TO RECALCULATE    TAFI
C     THE PARTITION FACTORS FOR THE TANK                                TAFI
C     TANK PARTITION FACTORS ARE CALLED CIS                             TAFI
C     NORMAL PARTITION FACTORS FOR EACH CHARGE ARE CALLED PFN           TAFI
C     ABNORMAL PARTITION FACTORS ARE CALLED PFA                         TAFI
C                                                                       TAFI
      IF(NML)240,231,240                                                TAFI
C                                                                       TAFI
  231 DO 235 J=1,13                                                     TAFI
      CIS(JT,J)=((CIS(JT,J)*CURE(JT,J))+CURSV(J)*PFN(J))/(CURE(JT,J)+CURTAFI
     1SV(J))                                                            TAFI
      SUM1=SUM1+CURSV(J)                                                TAFI
  235 CURE(JT,J)=CURE(JT,J)+CURSV(J)                                    TAFI
      GO TO 245                                                         TAFI
C                                                                       TAFI
C                                                                       TAFI
  240 READ 605,NG,(PFA(J),J=1,13)                                       TAFI
      NG=0                                                              TAFI
      DO 241 J=1,13                                                     TAFI
      CIS(JT,J)=( CIS(JT,J)*CURE(JT,J)+CURSV(J)*PFA(J))/(CURE(JT,J)+CURSTAFI
     1V(J))                                                             TAFI
      SUM1=SUM1+CURSV(J)                                                TAFI
  241 CURE(JT,J)=CURE(JT,J)+CURSV(J)                                    TAFI
      GO TO 245                                                         TAFI
C                                                                       TAFI
C                                                                       TAFI
  245 SUM2=SUM2+SUM1                                                    TAFI
C                                                                       TAFI
C     WRITE THE REPORT FOR THE TRANSFERS FROM SOURCE                    TAFI
C                                                                       TAFI
C     PRINT HEADING                                                     TAFI
```

```
      IF(LINE)247,246,247                                               TAFI
  246 IPG=IPG+1                                                         TAFI
      WRITE OUTPUT TAPE NTOUT,606,(TAFI(I),I=1,3),IPG                   TAFI
      WRITE OUTPUT TAPE NTOUT,611                                       TAFI
C                                                                       TAFI
C                                                                       TAFI
  247 WRITE OUTPUT TAPE NTOUT,613,JT,P1,P2,P3,P4,DSD,DENT,NML,P         TAFI
      WRITE OUTPUT TAPE NTOUT,608,JT,(ANAM(K),K=1,4),((CURSV(J),CIS(JT,
     1J)),J=1,4),(ANAM(K),K=5,8),((CURSV(J),CIS(JT,J)),J=5,8),
     2(ANAM(K),K=9,12),((CURSV(J),CIS(JT,J)),J=9,12),ANAM(13
     3),CURSV(13),CIS(JT,13),SUM1,SUM2
C
      LINE=LINE+1                                                       TAFI
      IF(NT-NC)248,249,248                                              TAFI
  248 IF(LINE-5)250,249,250                                             TAFI
  249 WRITE OUTPUT TAPE NTOUT,609                                       TAFI
      LINE=0                                                            TAFI
  250 CONTINUE                                                          TAFI
C                                                                       TAFI
  260 RETURN
C
  605 FORMAT(7X,I2,6E9.4/(7E9.4))
C
  606 FORMAT(1H1,50X,17HSECRET WORK SHEET/ 50X,3A6,37X,5HPAGE ,I2//)    TAFI
C
  608 FORMAT(I3,11X,1A6,18X,1A6,18X,1A6,18X,1A6/4X,8E12.4/14X,1A6,18X,1ATAFI
     16,18X,1A6,18X,1A6/4X,8E12.4/14X,1A6,18X,1A6,18X,1A6,18X,1A6/4X,8E1TAFI
     22.4/14X,1A6,18X,6HTOTALS/4X,4E12.4)                               TAFI
C
  609 FORMAT(1H0,49X,17HSECRET WORK SHEET)                              TAFI
C
  610 FORMAT(I2,5E9.4,1A6,I2)                                           TAFI
C
  611 FORMAT(39X,21HTRANSFERS FROM SOURCE/5H TANK,3X,6HCURIES,3X,11HPARTTAFI
     1. FACT.,4X,6HCURIES,3X,11HPART. FACT.,4X,6HCURIES,3X,11HPART. FACTTAFI
     2.,4X,6HCURIES,3X,11HPART. FACT.//)                                TAFI
C
  613 FORMAT(6H0INPUT1X,I2,5(1X,E9.4),1X,1A6,1X,11HOPTION NO. I1,1X,3HP=TAFI
     1 E9.4)                                                            TAFI
C
      END(2,0,0,0,0)
```

```
C                                PART 3                                 TAFI
C
      SUBROUTINE PART3
C                                                                       TAFI
      DIMENSION TLIB(34,13),CIS(34,13),CURE(34,13),AHL(13),YLD(13),     TAFI
     1AHC(13),AOSS(34,4),PFN(13),PFA(13),CURA(13),PM(13),DUM2(13),      TAFI
     2DUM1(13),TAFI(3),ANAM(13),TOTB(34),TOTC(34),DENT(1),CURSV(13),THT(TAFI
     334),SUHT(34),FTOT(13),HTOT(13),TNKS(34),AGN(4),BGN(4),OGN(  4),TGNTAFI
     4(4),ASO(13)                                                       TAFI
      DIMENSION C1(13),C2(13),ATFR(4)
C
      COMMON CURE,TLIB,CIS,PFN,IPG,AHL,YLD,AHC,TAFI,ANAM,DDT,NC,NL,NX,
     1AOSS,LIB,ILS,DUM1,DUM2,NTOUT,NF1,NF2,NTLIB,DA2,YR2,TMT2
C
C                                                                       TAFI
C     THIS PART OF THE CODE HANDLES THE INTERTANK TRANSFERS             TAFI
C     THE CALCULATIONS ARE FOR THE FRACTION TRANSFERED (PM)
C     AND THE RECALCULATION OF THE TANK PARTITION FACTORS (CIS)         TAFI
C
C     THE FOUR OPTIONS ON TYPE OF TRANSFER ARE
C        IGO = 1  SUPERNATE TRANSFER WITH CALCULATED PARTITION FACTORS
C        IGO = 2  SUPERNATE TRANSFER WITH OPTIONAL PARTITION FACTORS
C        IGO = 3  SLUDGE TRANSFER WITH CALCULATED PARTITION FACTORS
C        IGO = 4  SLUDGE TRANSFER WITH OPTIONAL PARTITION FACTORS
C
C     IF IGO = 3 OR 4, CIS IS RECALCULATED FROM (1.0 - PARTITION FACTOR)
C                                                                       TAFI
C                                                                       TAFI
      LINE=0
      DO 330 NT=1,NX                                                    TAFI
      SUM1=0.0                                                          TAFI
      SUM2=0.0                                                          TAFI
      READ 612,IFT,ITT,XFD,IGO                                          TAFI
```

```
      XFD1=XFD*0.01                                                     TAFI
C     PRESERVE PARTITICN FACTORS FOR COMPARISONS
      DO 3301 J=1,13
      C1(J) =0.0
      C2(J) =0.0
      C1 (J) = CIS(IFT,J)
 3301 C2 (J) = CIS(ITT,J)
C
      GO TO (301,305,309,313),IGO                                       TAFI
C
C     SUPERNATE TRANSFER                                                TAFI
C     TRANSFER COMPUTEC ON THE BASIS OF THE LATEST COMPUTED VALUES OF   TAFI
C     THE TANK PARTITICN FACTORS                                        TAFI
C                                                                       TAFI
  301 DO 302 J=1,13                                                     TAFI
      DUM1(J) = 0.0
      DUM2(J) = 0.0
      PM (J) =0.0
      PM(J)=XFD1*CURE(IFT,J)*CIS(IFT,J)                                 TAFI
      IF(PM(J)) 302,302,303
  303 DUM1(J) = CURE(IFT,J)
      SUM1=SUM1+DUM1(J)
      SUM2=SUM2+PM(J)
      CIS(IFT,J) = (CIS(IFT ,J) * CURE(IFT,J) - PM(J))/(CURE(IFT,J)-PM(J
     1))
C
C     SUBTRACT FROM TANK IFT                                            TAFI
      CURE(IFT,J)=CURE(IFT,J)-PM(J)                                     TAFI
C                                                                       TAFI
C     ADD TO TANK ITT                                                   TAFI
      DUM2(J)=CURE(ITT,J)                                               TAFI
      CIS( ITT,J) = (CIS(ITT,J)*CURE(ITT,J)+PM(J))/(CURE(ITT,J)+PM(J))
      CURE(ITT,J) = CURE(ITT,J) + PM(J)
  302 CONTINUE
      GO TO 320                                                         TAFI
C                                                                       TAFI
C
C     SUPERNATE TRANSFER WITH OPTIONAL PARTITION FACTORS
C
  305 READ 605,NG,(PFA(J),J=1,13)                                       TAFI
      DO 306 J=1,13                                                     TAFI
      PM (J) =0.0
      DUM1(J) = 0.0
      DUM2(J) = 0.0
      PM(J)=XFD1*CURE(IFT,J)*CIS(IFT,J)
      IF(PM(J)) 306,306,307
  307 DUM1(J) = CURE(IFT,J)
      SUM1 = SUM1 + DUM1(J)
      SUM2=SUM2+PM(J)                                                   TAFI
      CIS(IFT,J) = (CIS(IFT, J) * CURE(IFT,J) - PM(J))/(CURE(IFT,J)-PM(J
     1))
      CURE(IFT,J)=CURE(IFT,J)-PM(J)                                     TAFI
C                                                                       TAFI
      CIS(ITT,J) = (CIS(ITT,J)*CURE(ITT,J)+PM(J)*PFA(J))/(CURE(ITT,J)
     1+PM(J))
      DUM2(J)=CURE(ITT,J)                                               TAFI
      CURE(ITT,J) = CURE(ITT,J) + PM(J)
  306 CONTINUE
      GO TO 320                                                         TAFI
C                                                                       TAFI
C                                                                       TAFI
C     SLUDGE TRANSFER WITH COMPUTED PARTITION FACTORS                   TAFI
C     ALPHA EMITTERS (PL+U ISOTOPES) ARE TRANSFERED WITH THE SLUDGE
C
C
  309 DO 310 J=1,13                                                     TAFI
      PM (J) =0.0
      DUM1(J) = 0.0
      DUM2(J) = 0.0
      A=(1.-CIS(IFT,J))                                                 TAFI
      PM(J)=CURE(IFT,J)*A*XFD1
      IF(PM(J))  310,310,311
  311 DUM1(J) = CURE(IFT,J)
      SUM1 = SUM1 + DUM1(J)
      SUM2=SUM2+PM(J)                                                   TAFI
      CIS(IFT,J) = (CIS(IFT,J)*CURE(IFT,J))/(CURE(IFT,J) - PM(J))
      CURE(IFT,J)=CURE(IFT,J)-PM(J)                                     TAFI
C                                                                       TAFI
      CIS(ITT,J)=(CIS(ITT,J)*CURE(ITT,J))/(CURE(ITT,J)+PM(J))
      DUM2(J) = CURE(ITT,J)                                             TAFI
      CURE(ITT,J) = CURE(ITT,J) + PM(J)
```

```
  310 CONTINUE
C
C      ALPHA EMITTER TRANSFER
       DO 312 N = 1,4
       ATFR(N) = 0.
       ATFR(N) = AOSS(IFT,N) * XFD1
       AOSS(IFT,N) = AOSS(IFT,N) - ATFR(N)
       AOSS(ITT,J) = AOSS(ITT,N) + ATFR(N)
  312 CONTINUE
       GO TO 320                                                        TAFI
C
C                                                                       TAFI
C      SLUDGE TRANSFER WITH OPTIONAL PARTITION FACTORS
C                                                                       TAFI
  313 READ 605,NG,(PFA(J),J=1,13)                                       TAFI
       DO 314 J=1,13                                                    TAFI
       DUM1(J) = 0.0
       DUM2(J) = 0.0
       PM (J) =0.0
       PM(J)=XFD1*CURE(IFT,J)*(1.0 - CIS(IFT,J))
       IF(PM(J)) 314,314,315
  315 DUM1(J) = CURE(IFT,J)
       SUM1 = SUM1 + DUM1(J)
       SUM2=SUM2+PM(J)                                                  TAFI
       CIS(IFT,J) = (CIS(IFT,J)*CURE(IFT,J))/(CURE(IFT,J) - PM(J))
       CURE(IFT,J)=CURE(IFT,J)-PM(J)                                    TAFI
C                                                                       TAFI
       CIS(ITT,J)=(CIS(ITT,J)*CURE(ITT,J))/(CURE(ITT,J)+PM(J)*PFA(J))
       DUM2(J)=CURE(ITT,J)                                              TAFI
       CURE(ITT,J) = CURE(ITT,J) + PM(J)
  314 CONTINUE
C                                                                       TAFI
C      ALPHA EMITTER TRANSFER
       DO 316 N = 1,4
       ATFR(N) = 0.
       ATFR(N) = AOSS(IFT,N) * XFD1
       AOSS(IFT,N) = AOSS(IFT,N) - ATFR(N)
       AOSS(ITT,N) = AOSS(ITT,N) + ATFR(N)
  316 CONTINUE
C                                                                       TAFI
C      WRITE REPORT ON THE TRANSFERS BETWEEN TANKS                      TAFI
C                                                                       TAFI
  320 IF(LINE)322,321,322                                               TAFI
  321 IPG=IPG+1                                                         TAFI
C      HEADING FOR TRANSFERS BETWEEN TANKS                              TAFI
       WRITE OUTPUT TAPE NTOUT,606,(TAFI(I),I=1,3),IPG                  TAFI
       WRITE OUTPUT TAPE NTOUT,614                                      TAFI
  322 WRITE OUTPUT TAPE NTOUT,615,IFT,ITT,XFD,IGO                       TAFI
       WRITE OUTPUT TAPE NTOUT,608,NT,((ANAM(J)),J=1,4),((DUM1(I),PM(I)),TAFI
     1I=1,4),((ANAM(J)),J=5,8),((DUM1(I),PM(I)),I=5,8),((ANAM(J)),J     TAFI
     2=9,12),((DUM1(I),PM(I)),I=9,12),ANAM(13),DUM1(13),PM(13),SUM1,    TAFI
     3SUM2                                                              TAFI
C
       IF (IGO - 3) 3221,3222 ,3222
C
 3222 WRITE OUTPUT TAPENTOUT,620, ((AOSS(IFT,N),ATFR(N)),N=1,4)
C
 3221 WRITE OUTPUT TAPE NTOUT,617,IFT,((C1(     J),CIS(IFT,J)),J=1,5),
     1((C1(     J),CIS(IFT,J)),J=6,10),((C1(     J),CIS(IFT,J)),
     2J=11,13)
       WRITE OUTPUT TAPE NTOUT, 617,ITT,((C2(     J),CIS(ITT,J)),J=
     11,5),((C2(     J),CIS(ITT,J)),J=6,10),((C2(     J ),CIS(ITT,J)),
     2J=11,13)
       LINE=LINE+1
       IF(NT-NX)323,329,323                                             TAFI
  323 IF(LINE-2)330,329,330
  329 WRITE OUTPUT TAPE NTOUT,609                                       TAFI
       LINE=0                                                           TAFI
C                                                                       TAFI
  330 CONTINUE                                                          TAFI
C
       RETURN
C                                                                       TAFI
  605 FORMAT(7X,I2,6E9.4/(7E9.4))
C
  606 FORMAT(1H1,50X,17HSECRET WORK SHEET/ 50X,3A6,37X,5HPAGE ,I2//)    TAFI
C
  608 FORMAT(I3,11X,1A6,18X,1A6,18X,1A6,18X,1A6/4X,8E12.4/14X,1A6,18X,1ATAFI
     16,18X,1A6,18X,1A6/4X,8E12.4/14X,1A6,18X,1A6,18X,1A6,18X,1A6/4X,8E1TAFI
     22.4/14X,1A6,18X,6HTOTALS/4X,4E12.4)                               TAFI
```

```
C
  609 FORMAT(1H0,49X,17HSECRET WORK SHEET)                               TAFI
C
  612 FORMAT(2I2,E9.4,I1)
C
  614 FORMAT(40X,19HINTERTANK TRANSFERS/6X,9HAVAILABLE,3X,10HTRANSFERED,TAFI
     13X,9HAVAILABLE,2X,10HTRANSFERED,3X,9HAVAILABLE,2X,10HTRANSFERED,3XTAFI
     2,9HAVAILABLE,2X,10HTRANSFERED//)                                   TAFI
C
  615 FORMAT(17H0INPUT DATA, FROM,I3,1X,3HTO ,I2,1X14HPERCENT MOVED ,F6.TAFI
     12,1X,11HOPTION NO. ,I1//)
C
  617 FORMAT(35H0PARTITION FACTOR CHANGES FOR TANK I2,1X,42HEACH ISOTOPE
     1 BEFORE AND AFTER THE TRANSFER/ 4X,8E12.4/4X,8E12.4/4X,8E12.4
     2/4X,2E12.4)
C
  620 FORMAT(16H ALPHA TRANSFER ,8E12.4//)
C
      END(2,0,0,0,0)


C                               PART 4                                   TAFI
C
C
      SUBROUTINE PART4
C
      DIMENSION TLIB(34,13),CIS(34,13),CURE(34,13),AHL(13),YLD(13),      TAFI
     1AHC(13),AOSS(34,4),PFN(13),PFA(13),CURA(13),PM(13),DUM2(13),       TAFI
     2DUM1(13),TAFI(3),ANAM(13),TOTB(34),TOTC(34),DENT(1),CURSV(13),THT(TAFI
     334),SUHT(34),FTOT(13),HTOT(13),TNKS(34),AGN(4),BGN(4),OGN(   4),TGNTAFI
     4(4),ASO(13)
      DIMENSION T8(34,13),T9(34,13)
C
      COMMON CURE,TLIB,CIS,PFN,IPG,AHL,YLD,AHC,TAFI,ANAM,DDT,NC,NL,NX,
     1AOSS,LIB,ILS,DUM1,DUM2,NTOUT,NF1,NF2,NTLIB,DA2,YR2,TMT2
C
C                                                                        TAFI
C     THIS PART OF THE PROGRAM CALCULATES THE HEAT GENERATED IN EACH     TAFI
C     TANK AND SPLITS THE HEAT INTO SLUDGE AND SUPERNATE ACCORDING TO    TAFI
C     THE COMPUTED PARTITION FACTORS.  IT ALSO WRITES THE FINAL REPORT   TAFI
C     FOR THE MONTH AND UPDATES THE LIBRARY TAPE.  IF IT IS NECESSARY    TAFI
C     TO ADD TO THE ALPHA EMITTERS IT IS DONE IN THIS PART OF THE CODE
C                                                                        TAFI
C
      LINE = 0
C     TEST - ADDITIONS TO ALPHA EMITTERS
      IF(NL )4501,4505,4501
 4501 DO 4502 IL=1,NL
      DO 4503 J=1,4                                                      TAFI
 4503 OGN(   J)=0.0
C
C     I - TANK NUMBER
C     OGN(1) - U-238, THOUS. LB.
C     OGN(2) - U-235, KG.
C     OGN(3) - PU-239, KG.
C     OGN(4) - PU-238-239, CURIES
C
      READ 618,I,(OGN(   J),J=1,4)
      DO 4502 J=1,4                                                      TAFI
      AOSS(I,J)=AOSS(I,J)+OGN(   J)
 4502 CONTINUE                                                           TAFI
C
C     PLACE LIBRARY DATA IN CURE MATRIX FOR PRINTING                     TAFI
 4505 IF(LIB)4100,4500,4500                                              TAFI
 4100 DO 4110 I=1,34                                                     TAFI
      DO 4110 J=1,13                                                     TAFI
 4110 CURE (I,J) = TLIB(I,J)                                             TAFI
C                                                                        TAFI
C     CALCULATE HEAT IN EACH TANK                                        TAFI
 4500 DO 410 I=1,34                                                      TAFI
      THT(I) = 0.0
       SUHT (I) = 0.0
      DO 401 J=1,13                                                      TAFI
C
C     CALCULATION OF ISOTOPIC CONTRIBUTIONS TO HEATS
      T8(I,J)=0.0
      T9(I,J)=0.0
```

```
C       TOTAL HEAT                                                      TAFI
        T8(I,J)=T8(I,J)+(CURE(I,J)*AHC(J))
        THT(I)=THT(I)+T8(I,J)
C       HEAT IN SUPERNATE                                               TAFI
        T9(I,J)=T9(I,J)+(CURE(I,J)*AHC(J)*CIS(I,J))
  401   SUHT(I)=SUHT(I)+T9(I,J)
C                                                                       TAFI
C       WRITE SUMMARY REPCRT FOR THE TANK PARTITION FACTORS             TAFI
C                                                                       TAFI
        IF(THT(I) + SUHT(I)) 4002,405,4002
 4002   IF(LINE) 403,402,403
C       PAGE HEADING                                                    TAFI
  402   IPG=IPG+1                                                       TAFI
C                                                                       TAFI
        WRITE OUTPUT TAPE NTOUT,606,(TAFI(J),J=1,3),IPG                 TAFI
        WRITE OUTPUT TAPE NTOUT,616                                     TAFI
C                                                                       TAFI
  403   WRITE OUTPUT TAPE NTOUT,617,(ANAM(K),K=1,7),I,(CIS(I,J),J=1,7)
       1(ANAM(K),K=8,13),(CIS(I,J),J=8,13)                              TAFI
        WRITE OUTPUT TAPE NTOUT,617,(ANAM(K),K=1,7),I,(T8(I,J),J=1,7),
       1(ANAM(K),K=8,13),(T8(I,J),J=8,13)
C
  404   LINE=LINE+2
  405   IF(I-34)406,409,4C6
  406   IF(LINE-8)410,409,410
  409   WRITE OUTPUT TAPE NTOUT,609                                     TAFI
        LINE=0                                                          TAFI
  410   CONTINUE                                                        TAFI
C                                                                       TAFI
C                                                                       TAFI
C       SUM THE ISOTOPES IN EACH AREA                                   TAFI
C                                                                       TAFI
        DO 426 N=1,4                                                    TAFI
C
        DO 425 J=1,13                                                   TAFI
        BGN(N)=0.0                                                      TAFI
        AGN(N)=0.0                                                      TAFI
        FTOT(J)=0.0                                                     TAFI
        HTOT(J)=0.0                                                     TAFI
        DUM1(J)=0.0                                                     TAFI
C
C       TOTALS FOR F AREA                                               TAFI
C       F-AREA TANKS 1-8                                                TAFI
        DO 411 I=1,8                                                    TAFI
C       ALPHA EMITTER SUM
        AGN(N)=AGN(N)+AOSS(I,N)                                         TAFI
C       TOTAL CURIES IN EACH TANK
        TNKS(I)=0.0                                                     TAFI
        DO 4111 K=1,13                                                  TAFI
        TNKS(I)=TNKS(I)+CLRE(I,K)                                       TAFI
 4111   CONTINUE                                                        TAFI
C
C       TOTAL ISOTOPES IN AREA
  411   FTOT(J)=FTOT(J)+CLRE(I,J)                                       TAFI
C
C       F-AREA TANKS 17-2C                                              TAFI
        DO 412 I=17,20                                                  TAFI
        AGN(N)=AGN(N)+AOSS(I,N)                                         TAFI
        TNKS(I)=0.0                                                     TAFI
        DO 4121 K=1,13                                                  TAFI
        TNKS(I)=TNKS(I)+CLRE(I,K)                                       TAFI
 4121   CONTINUE                                                        TAFI
C
  412   FTOT(J)=FTOT(J)+CLRE(I,J)                                       TAFI
C                                                                       TAFI
C       H-AREA TANKS 9-16                                               TAFI
        DO 413 I=9,16                                                   TAFI
C       ALPHA EMITTER SUM
        BGN(N)=BGN(N)+AOSS(I,N)                                         TAFI
C       TOTAL CURIES IN EACH TANK
        TNKS(I)=0.0                                                     TAFI
        DO 4131 K=1,13                                                  TAFI
        TNKS(I)=TNKS(I)+CLRE(I,K)                                       TAFI
 4131   CONTINUE                                                        TAFI
C       TOTAL ISOTOPES IN AREA
  413   HTOT(J)=HTOT(J)+CURE(I,J)                                       TAFI
C                                                                       TAFI
C       H-AREA TANKS 21-24                                              TAFI
        DO 414 I=21,24                                                  TAFI
        BGN(N)=BGN(N)+AOSS(I,N)                                         TAFI
```

```
      TNKS(I)=0.0                                                       TAFI
      DO 4141 K=1,13                                                    TAFI
      TNKS(I)=TNKS(I)+CURE(I,K)                                         TAFI
 4141 CONTINUE                                                          TAFI
  414 HTOT(J)=HTOT(J)+CURE(I,J)                                         TAFI
C
C     FIRST ADDITIONAL TANK NUMBERS ARE ASSIGNED TO H-AREA              TAFI
C
  416 DO 417 I=25,28                                                    TAFI
      BGN(N)=BGN(N)+AOSS(I,N)                                           TAFI
      TNKS(I)=0.0                                                       TAFI
      DO 4171 K=1,13                                                    TAFI
      TNKS(I)=TNKS(I)+CURE(I,K)                                         TAFI
 4171 CONTINUE                                                          TAFI
  417 HTOT(J)=HTOT(J)+CURE(I,J)                                         TAFI
C                                                                       TAFI
C     SECOND SET OF TANKS ASSIGNED TO F-AREA                            TAFI
  419 DO 420 I=29,32                                                    TAFI
      AGN(N)=AGN(N)+AOSS(I,N)                                           TAFI
      TNKS(I)=0.0                                                       TAFI
      DO 4201 K=1,13                                                    TAFI
      TNKS(I)=TNKS(I)+CURE(I,K)                                         TAFI
 4201 CONTINUE                                                          TAFI
  420 FTOT(J)=FTOT(J)+CURE(I,J)                                         TAFI
C     ALPHA EMITTER SUM
      TGN(N)=TGN(N)+AGN(N)+BGN(N)                                       TAFI
C                                                                       TAFI
C     SUM FOR GRAND TOTAL F +H INTO DUM1                                TAFI
      DUM1(J)=DUM1(J)+FTOT(J)+HTOT(J)                                   TAFI
C                                                                       TAFI
  425 CONTINUE                                                          TAFI
  426 CONTINUE                                                          TAFI
C                                                                       TAFI
      GFT=0.0                                                           TAFI
      GHT=0.0                                                           TAFI
      GTO=0.0                                                           TAFI
      FT1=0.0                                                           TAFI
      FT2=0.0                                                           TAFI
      HT1=0.0                                                           TAFI
      HT2=0.0                                                           TAFI
      GTHT=0.0                                                          TAFI
      GTSU=0.0                                                          TAFI
      DO 4601 I=1,8
C
      M=I+8
C     TOTAL HEATS
      FT1=FT1+THT(I)
      HT1=HT1+THT(M)
C
C     SUPERNATE HEATS
      FT2=FT2+SUHT(I)
      HT2=HT2+SUHT(M)
 4601 CONTINUE
C
      DO 4602 I=17,20
      M=I+4
      FT1=FT1+THT(I)
      HT1=HT1+THT(M)
      FT2=FT2+SUHT(I)
      HT2=HT2+SUHT(M)
 4602 CONTINUE
C     FUTURE FIRST TANK NUMBERS ASSIGNED TO H-AREA SO INDEX IS CHANGED
      DO 4603 I=25,28
      M=I+4
      HT1=HT1+THT(I)
      FT1=FT1+THT(M)
      HT2=HT2+SUHT(I)
      FT2=FT2+SUHT(M)
 4603 CONTINUE
      DO 427 J=1,13
      GFT = GFT + FTOT(J)
      GHT = GHT + HTOT(J)
  427 CONTINUE
      GTHT=FT1+HT1                                                      TAFI
      GTSU=FT2+HT2                                                      TAFI
      GTO=GHT+GFT                                                       TAFI
C
      DO 428 N =1,4
      TGN(N)=0.0
  428 TGN(N) = TGN(N) + AGN(N) + BGN(N)                                 TAFI
C
```

```
C                                                                        TAFI
C     WRITE THE FINAL REPORT FOR THIS JOB                                TAFI
C
C     FIRST PAGE                                                         TAFI
      IPG=IPG+1                                                          TAFI
      WRITE OUTPUT TAPE NTOUT,619,IPG,(TAFI(J),J=1,3)                    TAFI
      WRITE OUTPUT TAPE NTOUT,620,(ANAM(J),J=1,8)                        TAFI
C     F-AREA TANKS                                                       TAFI
      DO 430 I=1,8                                                       TAFI
  430 WRITE OUTPUT TAPE NTOUT,621,I,(CURE(I,J),J=1,8)                    TAFI
      DO 431 I=17,20                                                     TAFI
  431 WRITE OUTPUT TAPE NTOUT,621,I,(CURE(I,J),J=1,8)                    TAFI
C                                                                        TAFI
C     MORE TANKS IN F-AREA                                               TAFI
  432 DO 433 I=29,32                                                     TAFI
C     TEST FOR PRINTING OF ADDITIONAL TANKS                              TAFI
      T1=0.0                                                             TAFI
      DO 4333 J=1,13                                                     TAFI
 4333 T1=T1+CURE(I,J)                                                    TAFI
      IF(T1)4334,433,4334                                                TAFI
 4334 WRITE OUTPUT TAPE NTOUT,621,I,(CURE(I,J),J =1,8)
  433 CONTINUE                                                           TAFI
C     TOTALS OF EACH ISCTOPE IN F-AREA                                   TAFI
C                                                                        TAFI
  434 WRITE OUTPUT TAPE NTOUT,622,(FTOT(J),J=1,8)                        TAFI
C                                                                        TAFI
C     IS THE DEEP MINE CAVERN IN USE                                     TAFI
      FDM=0.0                                                            TAFI
      DO 435 I=1,13                                                      TAFI
  435 FDM=FDM+CURE(33,I)                                                 TAFI
      IF(FDM)436,440,436                                                 TAFI
  436 WRITE OUTPUT TAPE NTOUT,625,(CURE(33,J),J=1,8)                     TAFI
C                                                                        TAFI
C
C     H-AREA TANKS                                                       TAFI
  440 DO 441 I=9,16                                                      TAFI
  441 WRITE OUTPUT TAPE NTOUT,621,I,(CURE(I,J),J=1,8)                    TAFI
      DO 442 I=21,24                                                     TAFI
  442 WRITE OUTPUT TAPE NTOUT,621,I,(CURE(I,J),J=1,8)                    TAFI
C                                                                        TAFI
C     MORE TANKS IN H-AREA                                               TAFI
C                                                                        TAFI
  443 DO 444 I=25,28                                                     TAFI
C     TEST FOR PRINTING OF ADDITIONAL TANKS                              TAFI
      T1=0.0                                                             TAFI
      DO 4443 J=1,13                                                     TAFI
 4443 T1=T1+CURE(I,J)                                                    TAFI
      IF(T1)4444,444,4444                                                TAFI
 4444 WRITE OUTPUT TAPE NTOUT,621,I,(CURE(I,J),J=1,8)                    TAFI
  444 CONTINUE                                                           TAFI
C                                                                        TAFI
C     TOTALS FOR H-AREA TANKS                                            TAFI
C                                                                        TAFI
  445 WRITE OUTPUT TAPE NTOUT,622,(HTOT(J),J=1,8)                        TAFI
C                                                                        TAFI
      WRITE OUTPUT TAPE NTOUT,622,(DUM1(J),J=1,8)                        TAFI
      HDM=0.0                                                            TAFI
      DO 446 J=1,13                                                      TAFI
  446 HDM=HDM+CURE(34,J)                                                 TAFI
      IF(HDM)447,450,447                                                 TAFI
  447 WRITE OUTPUT TAPE NTOUT,625,(CURE(34,J),J=1,8)                     TAFI
  450 WRITE OUTPUT TAPE NTOUT,626                                        TAFI
C                                                                        TAFI
C                                                                        TAFI
C     PAGE 2 OF THE FINAL REPORT                                         TAFI
C                                                                        TAFI
      IPG=IPG+1                                                          TAFI
      WRITE OUTPUT TAPE NTOUT,619,IPG,(TAFI(J),J=1,3)                    TAFI
      WRITE OUTPUT TAPE NTOUT,623,(ANAM(J),J=9,13)                       TAFI
C                                                                        TAFI
      DO 451 I=1,8                                                       TAFI
  451 WRITE OUTPUT TAPE NTOUT,621,I,(CURE(I,J),J=9,13),TNKS(I),THT(I), TAFI
     1SUHT(I)                                                            TAFI
      DO 452 I=17,20                                                     TAFI
  452 WRITE OUTPUT TAPE NTOUT,621,I,(CURE(I,J),J=9,13),TNKS(I),THT(I), TAFI
     1SUHT(I)                                                            TAFI
C                                                                        TAFI
  453 DO 455 I=29,32                                                     TAFI
      T1=0.0                                                             TAFI
      DO 4541 J=1,13                                                     TAFI
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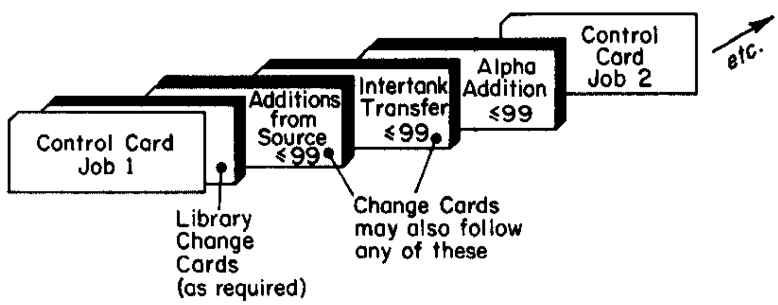
```
 4541 T1=T1+CURE(I,J)                                                      TAFI
      IF(T1)454,455,454                                                    TAFI
  454 WRITE OUTPUT TAPE NTOUT,621,I,(CURE(I,J),J=9,13),TNKS(I),THT(I),     TAFI
     1SUHT(I)                                                              TAFI
  455 CONTINUE                                                             TAFI
C
C     TOTALS FOR F-AREA                                                    TAFI
      WRITE OUTPUT TAPE NTOUT,622,(FTOT(J),J=9,13),GFT,FT1,FT2             TAFI
      IF(FDM)456,460,456                                                   TAFI
  456 WRITE OUTPUT TAPE NTOUT,625,(CURE(33,J),J=9,13),FDM,THT(33),         TAFI
     1SUHT(33)                                                             TAFI
  460 CONTINUE                                                             TAFI
C                                                                          TAFI
C     H-AREA TANKS                                                         TAFI
      DO 461 I=9,16                                                        TAFI
  461 WRITE OUTPUT TAPE NTOUT,621,I,(CURE(I,J),J=9,13),TNKS(I), THT(I),    TAFI
     1SUHT(I)                                                              TAFI
      DO 462 I=21,24
  462 WRITE OUTPUT TAPE NTOUT,621,I,(CURE(I,J),J=9,13),TNKS(I),THT(I),     TAFI
     1SUHT(I)                                                              TAFI
C                                                                          TAFI
      DO 465 I=25,28                                                       TAFI
      T1=0.0                                                               TAFI
      DO 463 J=1,13                                                        TAFI
  463 T1=T1+CURE(I,J)                                                      TAFI
      IF(T1)464,465,464                                                    TAFI
  464 WRITE OUTPUT TAPE NTOUT ,621,I,(CURE(I,J),J=9,13),TNKS(I),THT(I),
     1SUHT(I)                                                              TAFI
  465 CONTINUE                                                             TAFI
C
      WRITE OUTPUT TAPE NTOUT,622,(HTOT(J),J=9,13),GHT,HT1,HT2             TAFI
      WRITE OUTPUT TAPE NTOUT,622,(DUM1(J),J=9,13),GTO,GTHT,GTSU           TAFI
      IF(HDM)467,469,467                                                   TAFI
  467 WRITE OUTPUT TAPE NTOUT,625,(CURE(34,J),J=9,13),HDM,THT(34),         TAFI
     1SUHT(34)                                                             TAFI
C                                                                          TAFI
  469 CONTINUE
      WRITE OUTPUT TAPE NTOUT,626                                          TAFI
C                                                                          TAFI
C           PAGE 3                                                         TAFI
C                                                                          TAFI
  470 IPG=IPG+1                                                            TAFI
C                                                                          TAFI
      WRITE OUTPUT TAPE NTOUT,619,IPG,(TAFI(J),J=1,3)                      TAFI
      WRITE OUTPUT TAPE NTOUT,624                                          TAFI
C                                                                          TAFI
      DO 471 I=1,8                                                         TAFI
  471 WRITE OUTPUT TAPE NTOUT,621,I,(AOSS(I,J),J=1,4)                      TAFI
      DO 472 I=17,20                                                       TAFI
  472 WRITE OUTPUT TAPE NTOUT,621,I,(AOSS(I,J),J=1,4)                      TAFI
C                                                                          TAFI
      DO 475 I=29,32                                                       TAFI
      T1=0.0                                                               TAFI
      DO 473 J=1,4                                                         TAFI
  473 T1=T1 + AOSS(I,J)                                                    TAFI
      IF(T1)474,475,474                                                    TAFI
  474 WRITE OUTPUT TAPE NTOUT,621,I,(AOSS(I,J),J=1,4)                      TAFI
  475 CONTINUE                                                             TAFI
      WRITE OUTPUT TAPE NTOUT,627,(AGN(J),J=1,4)
C                                                                          TAFI
      T1=0.0                                                               TAFI
      DO476 J=1,4                                                          TAFI
  476 T1=T1+AOSS(33,J)                                                     TAFI
      IF(T1)477,478,477                                                    TAFI
  477 WRITE OUTPUT TAPE NTOUT,625,(AOSS(33,J),J=1,4)                       TAFI
C                                                                          TAFI
  478 DO 479 I=9,16                                                        TAFI
  479 WRITE OUTPUT TAPE NTOUT,621,I,(AOSS(I,J),J=1,4)                      TAFI
      DO 480 I=21,24                                                       TAFI
  480 WRITE OUTPUT TAPE NTOUT,621,I,(AOSS(I,J),J=1,4)                      TAFI
C                                                                          TAFI
      DO 484 I=25,28
      T1=0.0                                                               TAFI
      DO 481 J=1,4                                                         TAFI
  481 T1=T1+AOSS(I,J)                                                      TAFI
      IF(T1)483,484,483                                                    TAFI
  483 WRITE OUTPUT TAPE NTOUT,621,I,(AOSS(I,J),J=1,4)                      TAFI
  484 CONTINUE                                                             TAFI
C                                                                          TAFI
      WRITE OUTPUT TAPE NTOUT,622,(BGN(J),J=1,4)                           TAFI
      WRITE OUTPUT TAPE NTOUT,622, (TGN(J),J=1,4)                          TAFI
```

```
C                                                                        TAFI
      T1=0.0                                                             TAFI
      DO 485 J=1,4                                                       TAFI
  485 T1=T1+AOSS(34,J)                                                   TAFI
C                                                                        TAFI
      IF(T1)486,487,486                                                  TAFI
  486 WRITE OUTPUT TAPE NTOUT,625,(AOSS(34,J),J=1,4)                     TAFI
C                                                                        TAFI
  487 WRITE OUTPUT TAPE NTOUT,626                                        TAFI
C                                                                        TAFI
C                                                                        TAFI
      IF(LIB)495,490,490
C                                                                        TAFI
C     UPDATE THE LIBRARY TAPE                                            TAFI
C                                                                        TAFI
  490 NF2=NF1+1                                                          TAFI
C                                                                        TAFI
      WRITE TAPE NTLIB,NF2,YR2,TMT2,DA2,CURE,AOSS,CIS                    TAFI
C                                                                        TAFI
  495 RETURN
C                                                                        TAFI
  606 FORMAT(1H1,50X,17HSECRET WORK SHEET/ 50X,3A6,37X,5HPAGE  ,I2)      TAFI
C                                                                        TAFI
  608 FORMAT(I3,11X,1A6,18X,1A6,18X,1A6,18X,1A6/4X,8E12.4/14X,1A6,18X,1ATAFI
     16,18X,1A6,18X,1A6/4X,8E12.4/14X,1A6,18X,1A6,18X,1A6,18X,1A6/4X,8E1TAFI
     22.4/14X,1A6,18X,6HTOTALS/4X,4E12.4)                                TAFI
C                                                                        TAFI
  609 FORMAT(1H0,49X,17HSECRET WORK SHEET)                               TAFI
C
  616 FORMAT(30X, 54H PARTITION FACTORS AND HEAT (BTU/HR.) FOR EACH ISOT
     1OPE//1X,4HTANK,41X,8HISOTOPES//)
C
  617 FORMAT(11X,1A6,7X,1A6,6X,5(1A6,7X)/1X,I3,2X,7E13.4/11X,1A6,7X,1A6,
     16X,4(1A6,7X)/8X,6E13.4//)
C
  618 FORMAT(I2,4E9.4)                                                   TAFI
C                                                                        TAFI
C                                                                        TAFI
  619 FORMAT(1H1,80X,6HSECRET,20X,4HPAGE,I3//33X,45HCOMPUTED RADIOACTIVITAFI
     1TY CONTENT OF WASTE TANKS/46X,3A6//)                               TAFI
C                                                                        TAFI
  620 FORMAT(5X,4HTANK,6X,8( A6,7X)/6X,3HNO.,46X,6HCURIES)               TAFI
C                                                                        TAFI
  621 FORMAT(6X,I2,2X,8E13.4)                                            TAFI
C                                                                        TAFI
  622 FORMAT(10H0     TOTAL,8E13.4//)                                    TAFI
C                                                                        TAFI
  623 FORMAT(5X,4HTANK,6X,1A6,4(7X,1A6),8X,4HTANK,6X,21H HEAT OUTPUT, BT
     1U/HR./6X,3HNO.,32X,6HCURIES,34X,5HTOTAL,8X,5HTOTAL,6X,9HSUPERNATE)
C                                                                        TAFI
  624 FORMAT(27X,15HALPHA EMITTERS /5X,4HTANK,6X,6HU-238,7X,6HU-235,7X,  TAFI
     17HPU-239,4X,11HPU-238-239,/6X,3HNO.,4X,10HTHOUS. LB.,7X,3HKG.,10X,TAFI
     23HKG.,8X,6HCURIES)                                                 TAFI
C                                                                        TAFI
  625 FORMAT(10H DEEP MINE/4X,6HCAVERN,8E13.4//)                         TAFI
C                                                                        TAFI
  626 FORMAT(20X,6HSECRET)                                               TAFI
C
  627 FORMAT(10H0     TOTAL,4E13.4//)
C
C
      END(2,0,0,0,0)
```

APPENDIX B - Input Data Formats and Sample Problem

The formats and contents of the input data cards are presented in the order in which they would appear in an actual job. Each job(s) requires one set of 13 Isotope Constant cards, one/isotope; a Control card for each job; and the appropriate number of data cards and/or change cards. The required order of the data deck is illustrated below.

Data Deck



A blank Control card indicates end-of-job(s). Isotope constant cards are not considered part of the data deck.

FIGURE 1

<u>Isotope Constants Card</u> - 13 required per job or set of jobs

FØRMAT(I2,4E9.4,1A6)

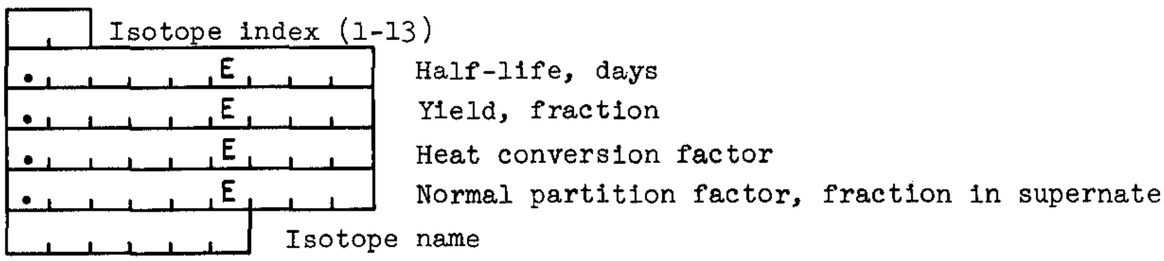
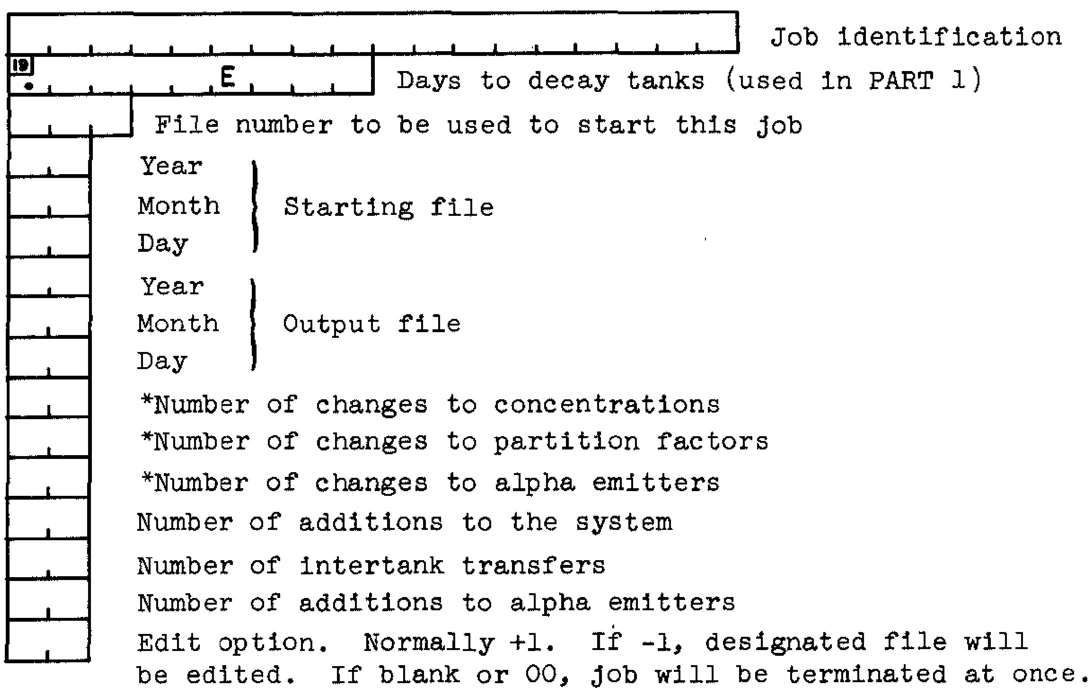


FIGURE 2

<u>Control Card</u> - 1 required per job

FØRMAT(3A6,E9.4,I3,6F2.0,7I2)

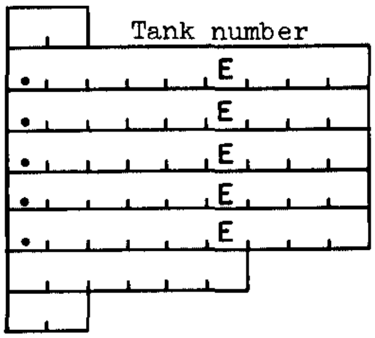


*If any of these are used, the cards to effect the changes must immediately follow this Control Card.

FIGURE 3

Addition(s) to the System Card - 1 required per addition in a job

FØRMAT(I2,5E9.4,1A6,I2)



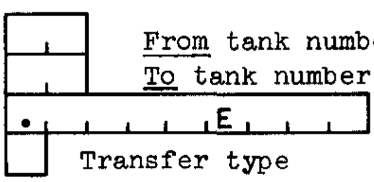
Tank number	Highly enriched	Purex
	Burnup	Tons of uranium
	Number of tubes	Megawatts/ton
	Irradiation time, days	
	Power conversion factor	Blank
	Days since discharge	
	Charge identification	
	Normally 00: *Otherwise change partition factors for this charge.	

*This card must then be followed by 2 cards that contain the desired partition factors for this charge.

FIGURE 4

Intertank Transfer Card(s) - 1 required per transfer in a job

FØRMAT(2I2,E9.4,I1)



From tank number

To tank number

Percent of supernate or sludge transferred

Transfer type

1 = Supernate using latest computed partition factors
2 = *Supernate using changed partition factors
3 = Sludge using (1.0-latest computed partition factors)
4 = *Sludge using changed partition factors

*This option requires 2 cards, immediately following this card, that contain the desired partition factors.

FIGURE 5

Addition(s) to Alpha Emitter Card - 1 required per addition in a job

FØRMAT(I2,4E9.4)

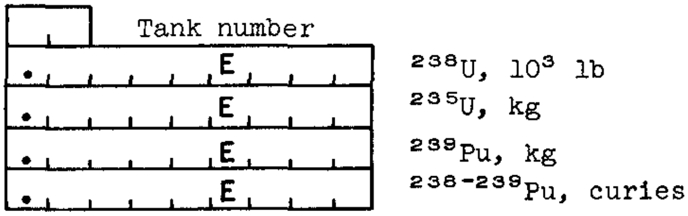
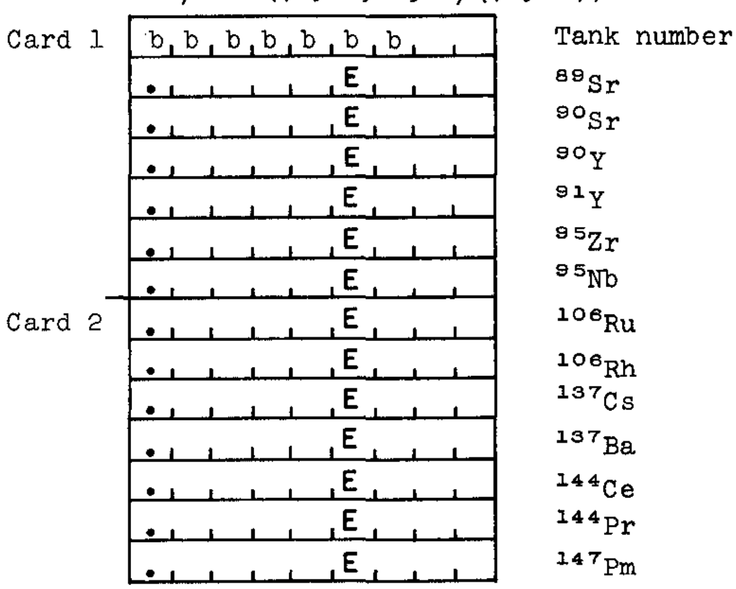


FIGURE 6

Change Cards - These 2 cards must immediately follow any option that calls for a change in concentration or partition factors

FØRMAT(7X,I2,6E9.4/(7E9.4))



SAMPLE PROBLEM

The data used in the sample are for a hypothetical problem and bear no relation to the actual tank situation.

The input cards and the printed output for a sample problem are shown in Tables B-1 and B-2. Change cards for the gamma concentrations in the tanks and tank partition factors were used to put isotopes into the tanks. As indicated on the control card this job consists of four additions from source, four intertank transfers, and two alpha emitter additions.

TABLE B - 1 - Sample Input

```
SAMPLE PROBLEM    3000E+0200000000006502200606000404024f        Control Card

        01.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04  ]  Gamma Concentration  ]  Changes to Tank Contents
 1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04
        03.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04
.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04
        17.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04
.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04
        10.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04
.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04
        12.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04
.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04
        22.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04
.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04.1000E+04

        12.2000E-01.2000E-01.2000E-01.2000E-01.2000E 00.2000E 00  ]  Partition Factors
.2000E 00.2000E 00.9500E 00.9500E 00.5000E-01.5000E-01.5000E-01
        10.2000E-01.2000E-01.2000E-01.2000E-01.2000E 00.2000E 00
.2000E 00.2000E 00.9500E 00.9500E 00.5000E-01.5000E-01.5000E-01
        03.2000E-01.2000E-01.2000E-01.2000E-01.2000E 00.2000E 00
.2000E 00.2000E 00.9500E 00.9500E 00.5000E-01.5000E-01.5000E-01
        22.2000E-01.2000E-01.2000E-01.2000E-01.2000E 00.2000E 00
.2000E 00.2000E 00.9500E 00.9500E 00.5000E-01.5000E-01.5000E-01
        17.2000E-01.2000E-01.2000E-01.2000E-01.2000E 00.2000E 00
.2000E 00.2000E 00.9500E 00.9500E 00.5000E-01.5000E-01.5000E-01
        01.2000E-01.2000E-01.2000E-01.2000E-01.2000E 00.2000E 00
.2000E 00.2000E 00.9500E 00.9500E 00.5000E-01.5000E-01.5000E-01

02.1000E+02.2000E+02.1600E+02.      E    .2000E+03DP JOB  ]  Transfers from Source
02.1000E+02.2000E+02.1600E+02.      E    .2000E+03DP JOB
02.1000E+02.2000E+02.1600E+02.      E    .2000E+03DP JOB
02.1000E+02.2000E+02.1600E+02.      E    .2000E+03DP JOB

0106.5000E+021                                                    ]  Intertank Transfers
0618.1000E+032
         .5000E+02.5000E+02.5000E+02.5000E+02.5000E+02.5000E+02  ]  Change Cards for Option 2
.5000E+02.5000E+02.5000E+02.5000E+02.5000E+02.5000E+02.5000E+02
1011.1000E+021
1221.2000E+021

01.5000E+01.1500E+01.1200E+01.1333E+04  ]  Alpha Emitter Additions
12.5000E+01.1500E+01.1200E+01.1333E+04
```

TABLE B-2 - Sample Output

```
CURIES IN TANKS BEFORE AND AFTER DECAY, IF LESS THAN 10 E-5 SET = 0.0.

TANK   BEFCRE        AFTER       BEFORE        AFTER       BEFORE        AFTER       BEFORE        AFTER

 1            SR-89                       SR-90                       Y-90                        Y-91
       0.1000E 04  0.6625E 03  0.1000E 04  0.9980E 03  0.1000E 04  0.9982E 03  0.1000E 04  0.6988E 03
              ZR-95                       NB-95                       RU-106                      RH-106
       0.1000E 04  0.7263E 03  0.1000E 04  0.9294E 03  0.1000E 04  0.9452E 03  0.1000E 04  0.9452E 03
              CS-137                      BA-137                      CE-144                      PR-144
       0.100CE 04  0.9981E 03  0.1000E 04  0.9183E 03  0.1000E 04  0.9284E 03  0.1000E 04  0.9285E 03
              PM-147                      TOTALS
       0.1000E 04  0.9787E 03  0.1300E 05  0.1166E 05

 3            SR-89                       SR-90                       Y-90                        Y-91
       0.1000E 04  0.6625E 03  0.1000E 04  0.9980E 03  0.1000E 04  0.9982E 03  0.1000E 04  0.6988E 03
              ZR-95                       NB-95                       RU-106                      RH-106
       0.100CE 04  0.7263E 03  0.1000E 04  0.9294E 03  0.1000E 04  0.9452E 03  0.1000E 04  0.9452E 03
              CS-137                      BA-137                      CE-144                      PR-144
       0.1000E 04  0.9981E 03  0.1000E 04  0.9183E 03  0.1000E 04  0.9284E 03  0.1000E 04  0.9285E 03
              PM-147                      TOTALS
       0.1000E 04  0.9787E 03  0.1300E 05  0.1166E 05

10            SR-89                       SR-90                       Y-90                        Y-91
       0.1000E 04  0.6625E 03  0.1000E 04  0.9980E 03  0.1000E 04  0.9982E 03  0.1000E 04  0.6988E 03
              ZR-95                       NB-95                       RU-106                      RH-106
       0.100CE 04  0.7263E 03  0.1000E 04  0.9294E 03  0.1000E 04  0.9452E 03  0.1000E 04  0.9452E 03
              CS-137                      BA-137                      CE-144                      PR-144
       0.100CE 04  0.9981E 03  0.1000E 04  0.9183E 03  0.1000E 04  0.9284E 03  0.1000E 04  0.9285E 03
              PM-147                      TOTALS
       0.1000E 04  0.9787E 03  0.1300E 05  0.1166E 05

12            SR-89                       SR-90                       Y-90                        Y-91
       0.100CE 04  0.6625E 03  0.1000E 04  0.9980E 03  0.1000E 04  0.9982E 03  0.1000E 04  0.6988E 03
              ZR-95                       NB-95                       RU-106                      RH-106
       0.1000E 04  0.7263E 03  0.1000E 04  0.9294E 03  0.1000E 04  0.9452E 03  0.1000E 04  0.9452E 03
              CS-137                      BA-137                      CE-144                      PR-144
       0.100CE 04  0.9981E 03  0.1000E 04  0.9183E 03  0.1000E 04  0.9284E 03  0.1000E 04  0.9285E 03
              PM-147                      TOTALS
       0.100CE 04  0.9787E 03  0.1300E 05  0.1166E 05

17            SR-89                       SR-90                       Y-90                        Y-91
       0.10CCE 04  0.6625E 03  0.1000E 04  0.9980E 03  0.1000E 04  0.9982E 03  0.1000E 04  0.6988E 03
              ZR-95                       NB-95                       RU-106                      RH-106
       0.100CE 04  0.7263E 03  0.1000E 04  0.9294E 03  0.1000E 04  0.9452E 03  0.1000E 04  0.9452E 03
              CS-137                      BA-137                      CE-144                      PR-144
       0.10C0E 04  0.9981E 03  0.1000E 04  0.9183E 03  0.1000E 04  0.9284E 03  0.1000E 04  0.9285E 03
              PM-147                      TOTALS
       0.1000E 04  0.9787E 03  0.1300E 05  0.1166E 05

22            SR-89                       SR-90                       Y-90                        Y-91
       0.1000E 04  0.6625E 03  0.1000E 04  0.9980E 03  0.1000E 04  0.9982E 03  0.1000E 04  0.6988E 03
              ZR-95                       NB-95                       RU-106                      RH-106
       0.1000E 04  0.7263E 03  0.1000E 04  0.9294E 03  0.1000E 04  0.9452E 03  0.1000E 04  0.9452E 03
              CS-137                      BA-137                      CE-144                      PR-144
       0.100CE 04  0.9981E 03  0.1000E 04  0.9183E 03  0.1000E 04  0.9284E 03  0.1000E 04  0.9285E 03
              PM-147                      TOTALS
       0.1000E 04  0.9787E 03  0.1300E 05  0.1166E 05
```

SAMPLE PROBLEM

```
                                      TRANSFERS FROM SOURCE
TANK    CURIES     PART. FACT.    CURIES   PART. FACT.   CURIES    PART. FACT.    CURIES    PART. FACT.


INPUT   2 .1C00E 02 .2000E 02 .1600E 02 .         .2C00E 03 DP JOB OPTION NO. 0 P= .2000E 03
 2              SR-89                   SR-90                    Y-90                    Y-91
     0.1032E 06  0.2000E-01  0.1048E 05  0.2000E-01  0.1049E 05  0.2000E-01  0.1464E 06  0.2000E-01
                ZR-95                   NB-95                   RU-106                  RH-106
     0.1960E 06  0.2000E-00  0.4246E 06  0.2000E-00  0.1313E 05  0.2000E-00  0.1313E 05  0.2000E-00
              CS-137                  BA-137                  CE-144                  PR-144
     0.1045E 05  0.9500E 00  0.9612E 04  0.9500E 00  0.2414E 06  0.5000E-01  0.2414E 06  0.5000E-01
              PM-147                  TOTALS
     0.4006E 05  0.5000E-01  0.1460E 07  0.1460E 07

INPUT   2 .1C00E 02 .2000E 02 .1600E 02 .         .2C00E 03 DP JOB OPTION NO. 0 P= .2000E 03
 2              SR-89                   SR-90                    Y-90                    Y-91
     0.1032E 06  0.2000E-01  0.1048E 05  0.2000E-01  0.1049E 05  0.2000E-01  0.1464E 06  0.2000E-01
                ZR-95                   NB-95                   RU-106                  RH-106
     0.1960E 06  0.2000E-00  0.4246E 06  0.2000E-00  0.1313E 05  0.2000E-00  0.1313E 05  0.2000E-00
              CS-137                  BA-137                  CE-144                  PR-144
     0.1045E 05  0.9500E 00  0.9612E 04  0.9500E 00  0.2414E 06  0.5000E-01  0.2414E 06  0.5000E-01
              PM-147                  TOTALS
     0.4006E 05  0.5000E-01  0.1460E 07  0.2921E 07

INPUT   2 .1C00E 02 .2000E 02 .1600E 02 .         .2C00E 03 DP JOB OPTION NO. 0 P= .2000E 03
 2              SR-89                   SR-90                    Y-90                    Y-91
     0.1032E 06  0.2000E-01  0.1048E 05  0.2000E-01  0.1049E 05  0.2000E-01  0.1464E 06  0.2000E-01
                ZR-95                   NB-95                   RU-106                  RH-106
     0.1960E 06  0.2000E-00  0.4246E 06  0.2000E-00  0.1313E 05  0.2000E-00  0.1313E 05  0.2000E-00
              CS-137                  BA-137                  CE-144                  PR-144
     0.1045E 05  0.9500E 00  0.9612E 04  0.9500E 00  0.2414E 06  0.5000E-01  0.2414E 06  0.5000E-01
              PM-147                  TOTALS
     0.4006E 05  0.5000E-01  0.1460E 07  0.4381E 07

INPUT   2 .1C00E 02 .2000E 02 .1600E 02 .         .2C00E 03 DP JOB OPTION NO. 0 P= .2000E 03
 2              SR-89                   SR-90                    Y-90                    Y-91
     0.1032E 06  0.2000E-01  0.1048E 05  0.2000E-01  0.1049E 05  0.2000E-01  0.1464E 06  0.2000E-01
                ZR-95                   NB-95                   RU-106                  RH-106
     0.1960E 06  0.2000E-00  0.4246E 06  0.2000E-00  0.1313E 05  0.2000E-00  0.1313E 05  0.2000E-00
              CS-137                  BA-137                  CE-144                  PR-144
     0.1045E 05  0.9500E 00  0.9612E 04  0.9500E 00  0.2414E 06  0.5000E-01  0.2414E 06  0.5000E-01
              PM-147                  TOTALS
     0.4006E 05  0.5000E-01  0.1460E 07  0.5842E 07
```

SAMPLE PROBLEM

```
                                    INTERTANK TRANSFERS
     AVAILABLE   TRANSFERED   AVAILABLE  TRANSFERED   AVAILABLE  TRANSFERED   AVAILABLE  TRANSFERED


INPUT DATA, FROM  1 TO  6 PERCENT MOVED  50.00 OPTION NO. 1

 1            SR-89                     SR-90                     Y-90                      Y-91
     0.6625E 03  0.6625E 01  0.9980E 03  0.9980E 01  0.9982E 03  0.9982E 01  0.6988E 03  0.6988E 01
              ZR-95                     NB-95                     RU-106                    RH-106
     0.7263E 03  0.7263E 02  0.9294E 03  0.9294E 02  0.9452E 03  0.9452E 02  0.9452E 03  0.9452E 02
             CS-137                    BA-137                    CE-144                    PR-144
     0.9981E 03  0.4741E 03  0.9183E 03  0.4362E 03  0.9284E 03  0.2321E 02  0.9285E 03  0.2321E 02
             PM-147                    TOTALS
     0.9787E 03  0.2447E 02  0.1166E 05  0.1369E 04

PARTITION FACTOR CHANGES FOR TANK  1 EACH ISOTOPE BEFORE AND AFTER THE TRANSFER
     0.2000E-01  0.1010E-01  0.2000E-01  0.1010E-01  0.2000E-01  0.1010E-01  0.2000E-01  0.1010E-01
     0.2000E-00  0.1111E-00  0.2000E-00  0.1111E-00  0.2000E-00  0.1111E-00  0.2000E-00  0.1111E-00
     0.9500E 00  0.9048E 00  0.9500E 00  0.9048E 00  0.5000E-01  0.2564E-01  0.5000E-01  0.2564E-01
     0.5000E-01  0.2564E-01

PARTITION FACTOR CHANGES FOR TANK  6 EACH ISOTOPE BEFORE AND AFTER THE TRANSFER
     0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01
     0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01
     0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01
     0.          0.1000E 01

INPUT DATA, FROM  6 TO 18 PERCENT MOVED 100.00 OPTION NO. 2

 2            SR-89                     SR-90                     Y-90                      Y-91
     0.6625E 01  0.6625E 01  0.9980E 01  0.9980E 01  0.9982E 01  0.9982E 01  0.6988E 01  0.6988E 01
              ZR-95                     NB-95                     RU-106                    RH-106
     0.7263E 02  0.7263E 02  0.9294E 02  0.9294E 02  0.9452E 02  0.9452E 02  0.9452E 02  0.9452E 02
             CS-137                    BA-137                    CE-144                    PR-144
     0.4741E 03  0.4741E 03  0.4362E 03  0.4362E 03  0.2321E 02  0.2321E 02  0.2321E 02  0.2321E 02
             PM-147                    TOTALS
     0.2447E 02  0.2447E 02  0.1369E 04  0.1369E 04

PARTITION FACTOR CHANGES FOR TANK  6 EACH ISOTOPE BEFORE AND AFTER THE TRANSFER
     0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01
     0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01
     0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01  0.1000E 01
     0.1000E 01  0.1000E 01

PARTITION FACTOR CHANGES FOR TANK 18 EACH ISOTOPE BEFORE AND AFTER THE TRANSFER
     0.          0.5000E 02  0.          0.5000E 02  0.          0.5000E 02  0.          0.5000E 02
     0.          0.5000E 02  0.          0.5000E 02  0.          0.5000E 02  0.          0.5000E 02
     0.          0.5000E 02  0.          0.5000E 02  0.          0.5000E 02  0.          0.5000E 02
     0.          0.5000E 02
```

SAMPLE PROBLEM

```
                                   INTERTANK TRANSFERS
    AVAILABLE    TRANSFERED   AVAILABLE  TRANSFERED   AVAILABLE  TRANSFERED   AVAILABLE  TRANSFERED


INPUT DATA, FROM 10 TC 11 PERCENT MOVED  10.00 OPTION NO. 1

 3          SR-89                   SR-90                   Y-90                    Y-91
    0.6625E 03  0.1325E 01  0.9980E 03  0.1996E 01  0.9982E 03  0.1996E 01  0.6988E 03  0.1398E 01
            ZR-95                   NB-95                   RU-106                  RH-106
    0.7263E 03  0.1453E 02  0.9294E 03  0.1859E 02  0.9452E 03  0.1890E 02  0.9452E 03  0.1890E 02
            CS-137                  BA-137                  CE-144                  PR-144
    0.9981E 03  0.9482E 02  0.9183E 03  0.8723E 02  0.9284E 03  0.4642E 01  0.9285E 03  0.4642E 01
            PM-147                  TOTALS
    0.9787E 03  0.4893E 01  0.1166E 05  0.2739E 03

PARTITION FACTOR CHANGES FOR TANK 10 EACH ISOTOPE BEFORE AND AFTER THE TRANSFER
    0.2000E-01  0.1804E-01  0.2000E-01  0.1804E-01  0.2000E-01  0.1804E-01  0.2000E-01  0.1804E-01
    0.2000E-00  0.1837E-00  0.2000E-00  0.1837E-00  0.2000E-00  0.1837E-00  0.2000E-00  0.1837E-00
    0.9500E 00  0.9448E 00  0.9500E 00  0.9448E 00  0.5000E-01  0.4523E-01  0.5000E-01  0.4523E-01
    0.5000E-01  0.4523E-01

PARTITION FACTOR CHANGES FOR TANK 11 EACH ISOTOPE BEFORE AND AFTER THE TRANSFER
    0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01
    0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01
    0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01
    0.          0.1000E 01

INPUT DATA, FROM 12 TC 21 PERCENT MOVED  20.00 OPTION NO. 1

 4          SR-89                   SR-90                   Y-90                    Y-91
    0.6625E 03  0.2650E 01  0.9980E 03  0.3992E 01  0.9982E 03  0.3993E 01  0.6988E 03  0.2795E 01
            ZR-95                   NB-95                   RU-106                  RH-106
    0.7263E 03  0.2905E 02  0.9294E 03  0.3718E 02  0.9452E 03  0.3781E 02  0.9452E 03  0.3781E 02
            CS-137                  BA-137                  CE-144                  PR-144
    0.9981E 03  0.1896E 03  0.9183E 03  0.1745E 03  0.9284E 03  0.9284E 01  0.9285E 03  0.9285E 01
            PM-147                  TOTALS
    0.9787E 03  0.9787E 01  0.1166E 05  0.5477E 03

PARTITION FACTOR CHANGES FOR TANK 12 EACH ISOTOPE BEFORE AND AFTER THE TRANSFER
    0.2000E-01  0.1606E-01  0.2000E-01  0.1606E-01  0.2000E-01  0.1606E-01  0.2000E-01  0.1606E-01
    0.2000E-00  0.1667E-00  0.2000E-00  0.1667E-00  0.2000E-00  0.1667E-00  0.2000E-00  0.1667E-00
    0.9500E 00  0.9383E 00  0.9500E 00  0.9383E 00  0.5000E-01  0.4040E-01  0.5000E-01  0.4040E-01
    0.5000E-01  0.4040E-01

PARTITION FACTOR CHANGES FOR TANK 21 EACH ISOTOPE BEFORE AND AFTER THE TRANSFER
    0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01
    0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01
    0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01  0.          0.1000E 01
    0.          0.1000E 01
```

SAMPLE PROBLEM
PARTITION FACTORS AND HEAT (BTU/HR.) FOR EACH ISOTOPE

TANK	ISOTOPES						
	SR-89	SR-90	Y-90	Y-91	ZR-95	NB-95	RU-106
1	0.1010E-01	0.1010E-01	0.1010E-01	0.1010E-01	0.1111E-00	0.1111E-00	0.1111E-00
	RH-106	CS-137	BA-137	CE-144	PR-144	PM-147	
	0.1111E-00	0.9048E 00	0.9048E 00	0.2564E-01	0.2564E-01	0.2564E-01	
	SR-89	SR-90	Y-90	Y-91	ZR-95	NB-95	RU-106
1	0.6428E 01	0.3359E 01	0.1799E 02	0.7056E 01	0.1111E 02	0.1338E 02	0.1701E-00
	RH-106	CS-137	BA-137	CE-144	PR-144	PM-147	
	0.2875E 02	0.1782E 01	0.7038E 01	0.1992E 01	0.2281E 02	0.1183E 01	
	SR-89	SR-90	Y-90	Y-91	ZR-95	NB-95	RU-106
2	0.2000E-01	0.2000E-01	0.2000E-01	0.2000E-01	0.2000E-00	0.2000E-00	0.2000E-00
	RH-106	CS-137	BA-137	CE-144	PR-144	PM-147	
	0.2000E-00	0.9500E 00	0.9500E 00	0.5000E-01	0.5000E-01	0.5000E-01	
	SR-89	SR-90	Y-90	Y-91	ZR-95	NB-95	RU-106
2	0.4045E 04	0.1426E 03	0.7633E 03	0.5974E 04	0.1333E 05	0.2718E 05	0.1051E 02
	RH-106	CS-137	BA-137	CE-144	PR-144	PM-147	
	0.1776E 04	0.1421E 03	0.5614E 03	0.2124E 04	0.2433E 05	0.1987E 03	
	SR-89	SR-90	Y-90	Y-91	ZR-95	NB-95	RU-106
3	0.2000E-01	0.2000E-01	0.2000E-01	0.2000E-01	0.2000E-00	0.2000E-00	0.2000E-00
	RH-106	CS-137	BA-137	CE-144	PR-144	PM-147	
	0.2000E-00	0.9500E 00	0.9500E 00	0.5000E-01	0.5000E-01	0.5000E-01	
	SR-89	SR-90	Y-90	Y-91	ZR-95	NB-95	RU-106
3	0.6493E 01	0.3393E 01	0.1817E 02	0.7127E 01	0.1235E 02	0.1487E 02	0.1890E-00
	RH-106	CS-137	BA-137	CE-144	PR-144	PM-147	
	0.3195E 02	0.3394E 01	0.1341E 02	0.2043E 01	0.2340E 02	0.1214E 01	
	SR-89	SR-90	Y-90	Y-91	ZR-95	NB-95	RU-106
6	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01
	RH-106	CS-137	BA-137	CE-144	PR-144	PM-147	
	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	
	SR-89	SR-90	Y-90	Y-91	ZR-95	NB-95	RU-106
6	0.1168E-08	0.8106E-09	0.4339E-08	0.1216E-08	0.3242E-07	0.3052E-07	0.3815E-09
	RH-106	CS-137	BA-137	CE-144	PR-144	PM-147	
	0.6447E-07	0.2594E-07	0.1114E-06	0.1049E-08	0.1202E-07	0.5913E-09	
	SR-89	SR-90	Y-90	Y-91	ZR-95	NB-95	RU-106
10	0.1804E-01	0.1804E-01	0.1804E-01	0.1804E-01	0.1837E-00	0.1837E-00	0.1837E-00
	RH-106	CS-137	BA-137	CE-144	PR-144	PM-147	
	0.1837E-00	0.9448E 00	0.9448E 00	0.4523E-01	0.4523E-01	0.4523E-01	
	SR-89	SR-90	Y-90	Y-91	ZR-95	NB-95	RU-106
10	0.6480E 01	0.3386E 01	0.1813E 02	0.7113E 01	0.1210E 02	0.1457E 02	0.1853E-00
	RH-106	CS-137	BA-137	CE-144	PR-144	PM-147	
	0.3131E 02	0.3071E 01	0.1213E 02	0.2032E 01	0.2328E 02	0.1207E 01	

SAMPLE PROBLEM
PARTITION FACTORS AND HEAT (BTU/HR.) FOR EACH ISOTOPE

TANK	SR-89	SR-90	Y-90	Y-91	ZR-95	NB-95	RU-106	RH-106	CS-137	BA-137	CE-144	PR-144	PM-147
11	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01
11	0.1299E-01	0.6786E-02	0.3634E-01	0.1425E-01	0.2469E-00	0.2974E-00	0.3781E-02	0.6390E 00	0.3224E-00	0.1274E 01	0.1021E-01	0.1170E-00	0.6068E-02
12	0.1606E-01	0.1606E-01	0.1606E-01	0.1606E-01	0.1667E-00	0.1667E-00	0.1667E-00	0.1667E-00	0.9383E 00	0.9383E 00	0.4040E-01	0.4040E-01	0.4040E-01
12	0.6467E 01	0.3380E 01	0.1810E 02	0.7099E 01	0.1185E 02	0.1428E 02	0.1815E-00	0.3067E 02	0.2749E 01	0.1086E 02	0.2022E 01	0.2316E 02	0.1201E 01
17	0.2000E-01	0.2000E-01	0.2000E-01	0.2000E-01	0.2000E-00	0.2000E-00	0.2000E-00	0.2000E-00	0.9500E 00	0.9500E 00	0.5000E-01	0.5000E-01	0.5000E-01
17	0.6493E 01	0.3393E 01	0.1817E 02	0.7127E 01	0.1235E 02	0.1487E 02	0.1890E-00	0.3195E 02	0.3394E 01	0.1341E 02	0.2043E 01	0.2340E 02	0.1214E 01
18	0.5000E 02	0.5000E 02	0.5000E 02	0.5000E 02	0.5000E 02	0.5000E 02	0.5000E 02	0.5000E 02	0.5000E 02	0.5000E 02	0.5000E 02	0.5000E 02	0.5000E 02
18	0.6493E-01	0.3393E-01	0.1817E-00	0.7127E-01	0.1235E 01	0.1487E 01	0.1890E-01	0.3195E 01	0.1612E 01	0.6368E 01	0.5106E-01	0.5849E 00	0.3034E-01
21	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01	0.1000E 01
21	0.2597E-01	0.1357E-01	0.7267E-01	0.2851E-01	0.4939E-00	0.5948E 00	0.7562E-02	0.1278E 01	0.6448E 00	0.2547E 01	0.2043E-01	0.2340E-00	0.1214E-01
22	0.2000E-01	0.2000E-01	0.2000E-01	0.2000E-01	0.2000E-00	0.2000E-00	0.2000E-00	0.2000E-00	0.9500E 00	0.9500E 00	0.5000E-01	0.5000E-01	0.5000E-01
22	0.6493E 01	0.3393E 01	0.1817E 02	0.7127E 01	0.1235E 02	0.1487E 02	0.1890E-00	0.3195E 02	0.3394E 01	0.1341E 02	0.2043E 01	0.2340E 02	0.1214E 01

COMPUTED RADIOACTIVITY CONTENT OF WASTE TANKS
SAMPLE PROBLEM

TANK NO.	SR-89	SR-90	Y-90	Y-91 CURIES	ZR-95	NB-95	RU-106	RH-106
1	0.6559E 03	0.9880E 03	0.9882E 03	0.6918E 03	0.6536E 03	0.8365E 03	0.8507E 03	0.8507E 03
2	0.4127E 06	0.4193E 05	0.4194E 05	0.5857E 06	0.7839E 06	0.1699E 07	0.5254E 05	0.5254E 05
3	0.6625E 03	0.9980E 03	0.9982E 03	0.6988E 03	0.7263E 03	0.9294E 03	0.9452E 03	0.9452E 03
4	0.	0.	0.	0.	0.	0.	0.	0.
5	0.	0.	0.	0.	0.	0.	0.	0.
6	0.1192E-06	0.2384E-06	0.2384E-06	0.1192E-06	0.1907E-05	0.1907E-05	0.1907E-05	0.1907E-05
7	0.	0.	0.	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.	0.	0.
17	0.6625E 03	0.9980E 03	0.9982E 03	0.6988E 03	0.7263E 03	0.9294E 03	0.9452E 03	0.9452E 03
18	0.6625E 01	0.9980E 01	0.9982E 01	0.6988E 01	0.7263E 02	0.9294E 02	0.9452E 02	0.9452E 02
19	0.	0.	0.	0.	0.	0.	0.	0.
20	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL	0.4147E 06	0.4493E 05	0.4494E 05	0.5878E 06	0.7861E 06	0.1701E 07	0.5538E 05	0.5538E 05
9	0.	0.	0.	0.	0.	0.	0.	0.
10	0.6612E 03	0.9960E 03	0.9962E 03	0.6974E 03	0.7117E 03	0.9108E 03	0.9263E 03	0.9263E 03
11	0.1325E 01	0.1996E 01	0.1996E 01	0.1398E 01	0.1453E 02	0.1859E 02	0.1890E 02	0.1890E 02
12	0.6599E 03	0.9940E 03	0.9942E 03	0.6960E 03	0.6972E 03	0.8923E 03	0.9074E 03	0.9074E 03
13	0.	0.	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	0.	0.	0.	0.	0.
16	0.	0.	0.	0.	0.	0.	0.	0.
21	0.2650E 01	0.3992E 01	0.3993E 01	0.2795E 01	0.2905E 02	0.3718E 02	0.3781E 02	0.3781E 02
22	0.6625E 03	0.9980E 03	0.9982E 03	0.6988E 03	0.7263E 03	0.9294E 03	0.9452E 03	0.9452E 03
23	0.	0.	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL	0.1988E 04	0.2994E 04	0.2995E 04	0.2096E 04	0.2179E 04	0.2788E 04	0.2836E 04	0.2836E 04
TOTAL	0.4167E 06	0.4792E 05	0.4793E 05	0.5899E 06	0.7883E 06	0.1704E 07	0.5821E 05	0.5821E 05

COMPUTED RADIOACTIVITY CONTENT OF WASTE TANKS
SAMPLE PROBLEM

TANK NO.	CS-137	BA-137	CE-144 CURIES	PR-144	PM-147	TANK TOTAL	HEAT OUTPUT, BTU/HR. TOTAL	SUPERNATE
1	0.5240E 03	0.4821E 03	0.9052E 03	0.9053E 03	0.9542E 03	0.1029E 05	0.1231E 03	0.1493E 02
2	0.4179E 05	0.3845E 05	0.9656E 06	0.9657E 06	0.1603E 06	0.5842E 07	0.8058E 05	0.1068E 05
3	0.9981E 03	0.9183E 03	0.9284E 03	0.9285E 03	0.9787E 03	0.1166E 05	0.1380E 03	0.2987E 02
4	0.	0.	0.	0.	0.	0.	0.	0.
5	0.	0.	0.	0.	0.	0.	0.	0.
6	0.7629E-05	0.7629E-05	0.4768E-06	0.4768E-06	0.4768E-06	0.2503E-04	0.2863E-06	0.2863E-06
7	0.	0.	0.	0.	0.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.	0.	0.
17	0.9981E 03	0.9183E 03	0.9284E 03	0.9285E 03	0.9787E 03	0.1166E 05	0.1380E 03	0.2987E 02
18	0.4741E 03	0.4362E 03	0.2321E 02	0.2321E 02	0.2447E 02	0.1369E 04	0.1493E 02	0.7467E 03
19	0.	0.	0.	0.	0.	0.	0.	0.
20	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL	0.4479E 05	0.4120E 05	0.9684E 06	0.9685E 06	0.1632E 06	0.5877E 07	0.8099E 05	0.1150E 05
9	0.	0.	0.	0.	0.	0.	0.	0.
10	0.9033E 03	0.8310E 03	0.9238E 03	0.9238E 03	0.9738E 03	0.1138E 05	0.1350E 03	0.2688E 02
11	0.9482E 02	0.8723E 02	0.4642E 01	0.4642E 01	0.4893E 01	0.2739E 03	0.2987E 01	0.2987E 01
12	0.8085E 03	0.7438E 03	0.9192E 03	0.9192E 03	0.9689E 03	0.1111E 05	0.1320E 03	0.2389E 02
13	0.	0.	0.	0.	0.	0.	0.	0.
14	0.	0.	0.	0.	0.	0.	0.	0.
15	0.	0.	0.	0.	0.	0.	0.	0.
16	0.	0.	0.	0.	0.	0.	0.	0.
21	0.1896E 03	0.1745E 03	0.9284E 01	0.9285E 01	0.9787E 01	0.5477E 03	0.5973E 01	0.5973E 01
22	0.9981E 03	0.9183E 03	0.9284E 03	0.9285E 03	0.9787E 03	0.1166E 05	0.1380E 03	0.2987E 02
23	0.	0.	0.	0.	0.	0.	0.	0.
24	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL	0.2994E 04	0.2755E 04	0.2785E 04	0.2785E 04	0.2936E 04	0.3497E 05	0.4140E 03	0.8960E 02
TOTAL	0.4778E 05	0.4396E 05	0.9712E 06	0.9712E 06	0.1661E 06	0.5912E 07	0.8140E 05	0.1159E 05

COMPUTED RADIOACTIVITY CONTENT OF WASTE TANKS
SAMPLE PROBLEM

TANK NO.	ALPHA EMITTERS U-238, THOUS. LB.	U-235, KG.	PU-239, KG.	PU-238-239, CURIES
1	0.5000E 01	0.1500E 01	0.1200E 01	0.1333E 04
2	0.	0.	0.	0.
3	0.	0.	0.	0.
4	0.	0.	0.	0.
5	0.	0.	0.	0.
6	0.	0.	0.	0.
7	0.	0.	0.	0.
8	0.	0.	0.	0.
17	0.	0.	0.	0.
18	0.	0.	0.	0.
19	0.	0.	0.	0.
20	0.	0.	0.	0.
TOTAL	0.5000E 01	0.1500E 01	0.1200E 01	0.1333E 04
9	0.	0.	0.	0.
10	0.	0.	0.	0.
11	0.	0.	0.	0.
12	0.5000E 01	0.1500E 01	0.1200E 01	0.1333E 04
13	0.	0.	0.	0.
14	0.	0.	0.	0.
15	0.	0.	0.	0.
16	0.	0.	0.	0.
21	0.	0.	0.	0.
22	0.	0.	0.	0.
23	0.	0.	0.	0.
24	0.	0.	0.	0.
TOTAL	0.5000E 01	0.1500E 01	0.1200E 01	0.1333E 04
TOTAL	0.1000E 02	0.3000E 01	0.2400E 01	0.2666E 04

SAMPLE PROBLEM

SUMMARY SHEET FOR THIS JOB.

TANKS DECAYED FOR 30. DAYS
FILE NUMBER 0 WITH THIS DATE 0./ 0./ 0. WAS USED AS THE STARTING POINT
FILE NUMBER 1 WITH THIS DATE 65./ 2./20. SHOULD BE USED AS THE STARTING POINT FOR THE NEXT JOB.
THE CURIES IN THE LIBRARY FILE WERE CHANGED 6 TIMES
THE PARTITION FACTORS WERE CHANGED 6 TIMES
THE ALPHA EMITTERS WERE CHANGED 0 TIMES
THERE WERE 4 CHARGES ADDED TO THE SYSTEM
THERE WERE 4 INTERTANK TRANSFERS
THERE WERE 2 ADDITIONS TO THE ALPHA EMITTERS