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RSAC--A RADIOLOGICAL SAFETY ANALYSIS
COMPUTER PROGRAM

RELEASED FOR ANNOUNCEMENT
IN NUCLEAR SCIENCE ABSTRACTS

R. L. Coates and N. R. Horton

PHILLIPS
PETROLEUM
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ATOMIC ENERGY DIVISION

NATIONAL REACTOR TESTING STATION
US ATOMIC ENERGY COMMISSION

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BY

R. L. Coates

N. R. Horton

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ABSTRACT

This report describes an IBM 7040 computer program which is used to compute the potential radiological doses resulting from either a continuous or instantaneous release of radioactive fission products to the atmosphere. The program has been developed as part of the LOFT and the general nuclear safety programs to provide a generalized computer program for a complete parametric investigation of the radiological hazards. The doses considered are cloud gamma, deposition gamma, ingestion, and inhalation and are based upon the release of up to 200 isotopes, the relative abundance of each isotope being dependent upon the operating history of the nuclear reactor under consideration. Included are the mathematical models, conversion factors, assumptions, flow charts, program listings, and other data considered pertinent to the overall development of this program.

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I. INTRODUCTION

The selection of sites for nuclear power plants, as well as the design of the plants themselves, must take into consideration the potential radiological hazards which could exist in the event of a nuclear accident. To perform a rigorous radiological analysis by manual techniques is virtually impossible if consideration is given to the mathematics and expenditure of time involved. For this reason, a digital computer program having the capabilities desired for a complete parametric investigation of the radiological hazards has been developed by Phillips Petroleum Company as part of the LOFT and general nuclear safety programs. This program, the Radiological Safety Analysis Computer (RSAC) Program, has been developed with the intention that it should be capable of determining the hazards from any nuclear power plant or reactor system whose release of fission products can be approximated by either a continuous or instantaneous release. The program is written in SYMBOLIC LANGUAGE (MAP) for the IBM 7040 computer and is divided into the following five major categories:

- (1) Curie -- The fission product inventory generated for a given set of operating conditions
- (2) Cloud Gamma Dose -- The external gamma dose received as a consequence of exposure to airborne radioactive materials
- (3) Deposition Gamma Dose -- The external gamma dose received as a consequence of exposure to deposited fission products
- (4) Inhalation Dose -- The internal dose to eight critical organs received as a consequence of inhaling airborne radioactive materials
- (5) Ingestion Dose -- The internal dose to the thyroid received as a consequence of ingesting iodine contaminated milk.

II. APPLICATION

1. CURIE

The fission product inventory, for which 90 decay chains and up to five isotopes per chain are considered, is computed by the CURIE portion of the RSAC program for any combination of the following operating conditions:

- (1) Steady-State Operation -- Reactor operation at a given power level for a sustained period of time.
- (2) Transient Operation -- Reactor operation at a given power level for a short period of time.
- (3) Cyclic Operation -- Reactor operation at a given power level for a given period of time, followed by a specified shutdown period which is subsequently followed by another transient or steady-state operating history. This type of operation can be repeated as many times as desired.
- (4) Refueling -- Refueling is simulated by removal of a certain fraction of the fission product inventory which may have been generated by any of the above three types of operating histories. Following the refueling process a new inventory can be calculated which will be based upon the inventory remaining after refueling as well as the inventory generated by a new set of operating conditions.

The computed fission product inventory is then fractionated in any of the following three ways:

- (1) Percentage of the total inventory
- (2) Percentage of each of the following element groups
 - (a) Noble Gases
 - (b) Halogens
 - (c) Cesiums
 - (d) Solids
- (3) Percentage of particular elements (up to 100 elements) and then the percentage of the remaining elements.

The above fractionated inventory as well as the activity of up to 20 selected decay chains can be printed out as a function of decay time (maximum 25 decay times) in units of curies or MeV/sec. However, the number of decay times multiplied by the total number of isotopes cannot exceed 10,000. The fission product inventory can be saved on magnetic tape for future use if so desired.

2. DOSE CALCULATIONS

The magnitude of the radiological doses is dependent upon the fractionated inventory generated under the CURIE portion of the RSAC program as well as the conditions existing at the time of release. These conditions (leakage rate, diffusion, and depletion) govern the quantity of activity released to the atmosphere as well as the rate of downwind diffusion and cloud depletion. It is therefore necessary to enter as input parameters the values describing the meteorological conditions, leakage rate, deposition rate, and washout rate if washout is considered.

For each dose calculation, there can be as many as 25 downwind and 25 crosswind detector positions. For the external gamma dose (cloud gamma and deposition gamma) calculations, the gamma energies are broken into ten energy groups. The energy group to which each isotope is assigned is shown in Table I while the range covered by the particular groups is shown in Table II. Both Tables are located in the Appendix.

Additional parameters which must be entered as input variables are presented below for the different doses considered.

2.1 Inhalation Dose

The inhalation dose is the internal dose which may be received by as many as eight critical organs. The inhalation time and exposure time are entered as input parameters in units of seconds while the organs for consideration are entered in the following form, where $\emptyset$ is entered as a blank.

<u>Symbol</u>	<u>Organ</u>
BONE $\emptyset\emptyset$	Bone
KIDNEY	Kidney
LIVER $\emptyset$	Liver
LUNG $\emptyset\emptyset$	Lung
MUSCLE	Muscle
TESTES	Testes
THYROID	Thyroid
BODY $\emptyset\emptyset$	Total Body*

* Any name that is incorrect is assumed as Body.

Every isotope has the appropriate conversion factors assigned for each organ. When an inhalation dose for an organ is requested, the contributing elements along with their corresponding biological half-lives must be entered.

There are three types of output available from the inhalation calculation. These three are:

- (1) Total dose from all contributing elements at each downwind and crosswind position

- (2) The dose contribution from each element at each downwind position plus part (1)
- (3) The dose contribution from each element at each downwind and crosswind position plus part (1).

The method used to calculate the ingestion dose is to calculate the inhalation dose for the thyroid from two isotopes of iodine and multiply each by an appropriate factor which relates the dose from inhalation to the ingestion dose. This factor may be obtained from analytical or experimental data and is normally based on the consumption of one unit of milk per day for an infinite period of time. The isotopes of concern are designated by their mass number and element number (eg, I = 53); however, if more than two chains of this isotope satisfy these conditions, only the first two will be considered.

2.2 Cloud Gamma and Deposition Doses

For the cloud gamma dose, the time of exposure to the cloud in seconds is the only time involved. For the deposition dose, both the time of deposition and the time of exposure after deposition are needed. With both external doses, there must be Hermite weighting values and their corresponding points. The maximum number of points for the Hermite integration is 24.

2.3 Dose from an Instantaneous Release

For the instantaneous releases, the coefficients of the leakage rate are set to 100. The inhalation time for the inhalation dose, the deposition time for the deposition dose, and the exposure time for the cloud gamma dose are set to one second.

The degree of exposure to radioactive fission products is dependent upon the interrelation of such parameters as leakage rate, operating history, atmospheric conditions, type and quantity of fission products available for release, inhalation and ingestion rate, and length of exposure.

The mathematical models and conversion factors presented in the following sections show the interdependency of the above mentioned parameters. The intention of the authors is to present this report in such a manner that the reader can follow, in a stepwise sequence, the development of the models from the initial assumptions to the final results.

III. MATHEMATICAL MODELS

1. CURIE

The fission product inventory resulting from some given operating history is determined by the CURIE portion of the RSAC program. This section is divided into two parts; namely, fission product buildup and fission product decay.

1.1 Fission Product Buildup

The rate of buildup or fission product generation of the various isotopes of a decay chain is described by a set of simultaneous differential equations of the first order:

$$\frac{dQ_1}{dt'} = S_1 - \lambda_1 Q_1$$

$$\frac{dQ_2}{dt'} = S_2 - \lambda_2 Q_2 + \lambda_1 Q_1$$

$$\frac{dQ_i}{dt'} = S_i - \lambda_i Q_i + \lambda_{i-1} Q_{i-1}$$

where

Q_i = the number of atoms for the i th isotope of the decay chain (atoms)

λ_i = the decay constant for the i th isotope (sec^{-1})

t' = operating time (sec)

S_i = the source rate at which atoms are being produced by fission for the i th isotope (atoms/sec).

$$S_i = \text{CONV} \quad \text{POWER} \quad \text{Yieldm}_i$$

where

CONV = the conversion factor from power to fissions (fissions/watt-sec)

POWER = the reactor power in watts

Yieldm _{i} = the fission yield for the i th isotope of the decay chain (atoms/fission).

The general solution as formulated by Robinson^[1] for the contribution to the nth isotope from the mth isotope precursor is

$$Q_n(t) = S_m \sum_{i=m}^{n-1} \frac{\pi}{\lambda_i} (\lambda_i) \sum_{\substack{j=m \\ j \neq i}}^n \left[\frac{1 - e^{-\lambda_i t}}{\lambda_j - \lambda_i} \right]$$

where j is a dummy variable. By summing all the precursors of a particular isotope, the general solution for the total number of atoms for the kth isotope of the decay chain is obtained:

$$Q_k(t') = \sum_{m=1}^k S_m \sum_{i=m}^{k-1} \frac{\pi}{\lambda_i} (\lambda_i) \sum_{\substack{j=m \\ j \neq i}}^k \left[\frac{1 - e^{-\lambda_i t'}}{\lambda_j - \lambda_i} \right]$$

For convenience the linear operator, $E_k [Y_i(t)]$, is defined as follows:

$$E_k [Y_i(t)] = \sum_{m=1}^k S_m \sum_{i=m}^{k-1} \frac{\pi}{\lambda_i} (\lambda_i) \sum_{\substack{j=m \\ j \neq i}}^k \left[\frac{Y_i(t)}{\lambda_j - \lambda_i} \right]$$

The buildup equation can therefore be written in the following form:

$$Q_k(t') = E_k \left(\frac{1 - e^{-\lambda_i t'}}{\lambda_i} \right)$$

1.2 Fission Product Decay

The decay rate equations are similar to those of the buildup except the source rate is considered zero. The general solution for the decay equation is

$$N_k(t) = E_k(e^{-\lambda_i t})$$

where

$$E_k(e^{-\lambda_i t}) = \sum_{m=1}^k Q_m \sum_{i=m}^{k-1} \frac{\pi}{\lambda_i} (\lambda_i) \sum_{\substack{j=m \\ j \neq i}}^k \left[\frac{e^{-\lambda_i t}}{\lambda_j - \lambda_i} \right]$$

where

Q_m = the total number of atoms for the mth isotope immediately following reactor shutdown as defined above

$N_k(t)$ = the total number of atoms for the kth isotope of the decay chain

t = the time after reactor shutdown (sec).

2. CONCENTRATION FUNCTION [$C_k(x,y,z,t)$]

The rate of fission product release, dispersion, and depletion is described by the various equations making up the concentration function. The rate of fission product release to the external environment is dependent upon the integrity of the containment enclosure and, hence, directly related to the containment leakage. Once the fission products have been released from the containment building, their dispersion and depletion as a function of distance downwind is dependent upon the atmospheric conditions present as well as the settling velocities associated with the materials released.

2.1 Diffusion Equation [$\chi(x,y,z)$]

The rate of atmospheric diffusion is described by the following equation which was initially formulated by Sutton[2].

$$\chi(x,y,z) = \frac{2}{\pi C_y C_z \bar{u} x^{2-N}} \text{EXP} - \left(\frac{y^2}{C_y^2 x^{2-N_y}} + \frac{z^2}{C_z^2 x^{2-N_z}} \right)$$

where

$\chi(x,y,z)$ = atmospheric diffusion relative to the initial point of release (sec/m³)

C_y = horizontal diffusion coefficient (m ^{$N_y/2$})

C_z = vertical diffusion coefficient (m ^{$N_z/2$})

$\bar{u}$ = wind speed (m/sec)

z = height of release (m)

y = distance crosswind (m)

x = distance downwind (m)

N_z = stability parameter in the vertical direction

N_y = stability parameter in the horizontal direction

$N = (N_y + N_z)/2.$

2.2 Leakage Rate Function^[3] $[L(t-x/\bar{u})]$

As mentioned previously, the leakage rate function is the mathematical approximation to the actual containment vessel leakage rate. This function is written in the form of a series of exponential approximations and has the following form:

$$L(t-x/\bar{u}) = \sum_{j=1}^n K_j e^{-P_j(t-x/\bar{u})}$$

where

$L(t-x/\bar{u})$ = leakage rate function (sec⁻¹)

K_j = linear approximation to leakage rate curve (sec⁻¹)

P_j = leakage rate decay constant (sec⁻¹)

n = number of exponential approximations (max. 10)

$x/\bar{u}$ = time required to reach any downwind detector position (sec).

Values of K_j and P_j can be either positive or negative. If a constant leakage rate is assumed, P_j can be set equal to zero.

2.3 Cloud Depletion

Once the fission products have been released to the atmosphere, the possibility exists that these products may be removed by fallout. If moisture is present in the atmosphere, they may also be removed by washout. The rate of removal is dependent upon the particle size and chemical state of the released materials as well as the scavenging rate of the atmospheric moisture. To compensate for cloud depletion, Chamberlain's depletion model^[4], as presented below, is programmed into the RSAC code. It should be emphasized that if one wishes to neglect cloud depletion, this option is also available.

$$K(x) = \text{EXP} - \left\{ \Lambda \frac{x}{\bar{u}} + \frac{2V_{gk}}{\pi^{1/2} C_z \bar{u}} \int_0^x \frac{\text{EXP}}{x \frac{(2-N_z)}{2}} - \left[\frac{\text{sh}^2}{C_z^2 x \frac{(2-N_z)}{2}} \right] dx \right\}$$

where

$K(x)$ = cloud depletion factor

Λ = fraction of the cloud removal per sec by rain (sec⁻¹)

V_{gk} = deposition velocity of the kth isotope (m/sec).

The concentration function for the kth isotope is, therefore, a product of the source term $[N_k(t)]$ and the above three equations

$$C_{k}(x,y,z,t) = N_k(t) \quad X(x,y,z) \quad L(t-x/\bar{u}) \quad K(x)$$

where

$C_k(x,y,z,t)$ = concentration function (atoms/m³)

$$\chi(x,y,z) = \frac{2}{\pi C_y C_z \bar{u} x^{w1}} \text{EXP} \left(- \frac{y^2}{C_y^2 x^{w2}} - \frac{z^2}{C_z^2 x^{w3}} \right)$$

where

$$w1 = 2-N$$

$$w2 = 2-N_y$$

$$w3 = 2-N_z.$$

3. RADIOLOGICAL DOSES -- CONTINUOUS RELEASE

The radiological doses considered in the RSAC program are the cloud gamma dose, deposition gamma dose, inhalation dose, and ingestion dose. The computation of these doses is based upon the models previously presented (CURIE and the concentration function) as well as the models presented below.

3.1 Inhalation Dose

The inhalation dose is an internal exposure which is received as a consequence of inhaling airborne radioactive materials. Depending upon the isotopes inhaled, the organ or organs to be affected may be any of the following organs considered by the RSAC program.

<u>Organ</u>	<u>Maximum Number of Contributing Isotopes</u>
Bone	48
Kidney	39
Liver	42
Lung	58
Muscle	5
Testes	7
Thyroid	15
Total Body	58

The dose to each of the above organs is dependent upon the type and quantity of activity inhaled as well as the rate of biological decay following the inhalation period. To accurately determine the inhalation dose, it is necessary to divide the computation into two parts: the dose during inhalation and the dose following inhalation, the sum of the two being, therefore, the total inhalation dose.

3.11 Dose During Inhalation Period. The differential equation that determines the buildup of atoms in the particular organ due to a particular isotope during the inhalation period is:

$$\frac{d A_k(t)}{dt} = - \lambda_b A_k(t) - \lambda_k A_k(t) + BR F_a C_k(x, y, z, t) \quad (1)$$

where

$\frac{d A_k(t)}{dt}$ = the rate of change of concentration in a particular organ (atoms/sec)

$A_k(t)$ = the number of atoms in the organ

λ_b = the biological decay constant of the kth isotope (sec^{-1})

λ_k = the radiological decay constant of the kth isotope (sec^{-1})

BR = the breathing rate (m^3/sec)

F_a = the critical fraction reaching the organ.

Substitution of the appropriate values for $C_k(x, y, z, t)$ and integration of Equation (1) yields the following solution for $A_k(t)$:

$$A_k(t) = BR F_a K(x) X(x, y, z) e^{-(\lambda_b + \lambda_k)t} \int_0^t e^{(\lambda_b + \lambda_k)t} L(t - \frac{x}{u}) N_k(t) dt + CI$$

where CI equals the constant of integration.

Applying the boundary condition that $A_k(x/\bar{u}) = 0$ and solving for the integrating constant CI, the above equation reduces to Equation (2).

$$A_k(t) = F(x, y, z) \sum_{j=1}^n K_j E_k \left[f_i(x, t) \right] \quad (2)$$

where

$$F(x, y, z) = BR F_a K(x) X(x, y, z)$$

$$f_i(x, t) = \frac{e^{-(\lambda_b + \lambda_k)t}}{\lambda_b + \lambda_k - \lambda_i - P_j} \left[e^{(\lambda_b + \lambda_k - \lambda_i - P_j)t} + P_j \left(\frac{x}{u} \right) e^{(\lambda_b + \lambda_k - \lambda_i) \frac{x}{u}} \right] = \frac{e^{-\lambda_i \frac{x}{u}}}{\lambda_b + \lambda_k - \lambda_i - P_j} \left[e^{-(\lambda_i + P_j) \left(t - \frac{x}{u} \right)} - e^{-(\lambda_b + \lambda_k) \left(t - \frac{x}{u} \right)} \right]$$

The inhalation dose received from $x/\bar{u}$ to $TINHA + x/\bar{u}$ is obtained by multiplying Equation (2) by $\lambda_k \cdot CONV1$ and integrating over the appropriate time interval.

$$\int_{\frac{x}{\bar{u}}}^{TINHA + \frac{x}{\bar{u}}} DRI_k(x, y, z, t) dt = F(x, y, z) \lambda_k CONV1 \sum_{j=1}^n K_j E_k \left[\int_{\frac{x}{\bar{u}}}^{TINHA + \frac{x}{\bar{u}}} f_i(x, t) dt \right] \quad (3)$$

where

$DRI_k(x, y, z)$ = the dose rate (rad/sec)

$CONV1$ = the conversion factor from disintegrations to units of dose (rad/dis)

$TINHA$ = the inhalation period (sec).

Solving the integral:

$$\begin{aligned} \int_{\frac{x}{\bar{u}}}^{TINHA + \frac{x}{\bar{u}}} f_i(x, t) dt &= \frac{e^{-\lambda_i \frac{x}{\bar{u}}}}{\lambda_b + \lambda_k - \lambda_i - P_j} \left[\int_{\frac{x}{\bar{u}}}^{TINHA + \frac{x}{\bar{u}}} e^{-(\lambda_i + P_j)(t - \frac{x}{\bar{u}})} dt \right. \\ &\quad \left. - \int_{\frac{x}{\bar{u}}}^{TINHA + \frac{x}{\bar{u}}} e^{-(\lambda_b + \lambda_k)(t - \frac{x}{\bar{u}})} dt \right] = \frac{e^{-\lambda_i \frac{x}{\bar{u}}}}{\lambda_b + \lambda_k - \lambda_i - P_j} \\ &\quad \left[\frac{1 - e^{-(\lambda_i + P_j) TINHA}}{\lambda_i + P_j} - \frac{1 - e^{-(\lambda_b + \lambda_k) TINHA}}{\lambda_b + \lambda_k} \right] \\ &= EXPL_i(x) \end{aligned}$$

The total dose $DI_k(x, y, z)$ during the inhalation period is therefore:

$$DI_k(x, y, z) = F(x, y, z) \lambda_k CONV1 \sum_{j=1}^n K_j E_k [EXPL_i(x)] \quad (4)$$

3.12 Dose Following Inhalation Period. The following model is used to determine the dose received from the activity of a particular isotope remaining in a particular organ after the inhalation time.

$$\frac{d A_k'(t)}{dt} = - \lambda_k A_k'(t) - \lambda_b A_k'(t) \quad (5)$$

where

$dA_k'(t)/dt$ = the rate of change of isotope k (atoms/sec)

$A_k'(t)$ = the number of atoms in the organ at any time greater than $TINHA + x/\bar{u}$. (atoms)

Solving for $A_k'(t)$, the following equation is obtained:

$$A_k'(t) = C_1 e^{-(\lambda_b + \lambda_k)t}$$

where

C_1 = the constant of integration.

If the boundary condition that $A_k'(TINHA + x/\bar{u}) = A_k(TINHA + x/\bar{u})$ is applied, the general solution for $A_k'(t)$ is as follows:

$$A_k'(t) = A_k(TINHA + \frac{x}{\bar{u}}) e^{-(\lambda_b + \lambda_k)(t - TINHA - \frac{x}{\bar{u}})} \quad (6)$$

where

$$A_k(TINHA + \frac{x}{\bar{u}}) = F(x, y, z) \sum K_j E_k \left\{ \frac{e^{-\lambda_i \frac{x}{\bar{u}}}}{\lambda_b + \lambda_k - \lambda_i - P_j} \left[e^{-(\lambda_i + P_j)TINHA} - e^{-(\lambda_b + \lambda_k)TINHA} \right] \right\}.$$

The inhalation dose $DA_k(x, y, z)$ received from $(TINHA + x/\bar{u})$ to $(T + TINHA + x/\bar{u})$ is obtained by multiplying Equation (6) by $\lambda_k \cdot CONV1$ and integrating over the appropriate time interval.

$$\begin{aligned} \lambda_k CONV1 \int_{TINHA + \frac{x}{\bar{u}}}^{T + TINHA + \frac{x}{\bar{u}}} A_k'(t) dt &= \lambda_k CONV1 A_k(TINHA + \frac{x}{\bar{u}}) \int_{TINHA + \frac{x}{\bar{u}}}^{T + TINHA + \frac{x}{\bar{u}}} e^{-(\lambda_b + \lambda_k)(t - TINHA - \frac{x}{\bar{u}})} dt \\ &= \lambda_k CONV1 A_k(TINHA + \frac{x}{\bar{u}}) \left[\frac{1 - e^{-(\lambda_b + \lambda_k)T}}{\lambda_b + \lambda_k} \right] \\ &= DA_k(x, y, z) \end{aligned} \quad (7)$$

where T equals the exposure time following inhalation (sec).

3.13 Total Inhalation Dose from the kth Isotope. The total inhalation dose from the kth isotope will therefore be the sum of Equations (4) and (7).

$$\begin{aligned}
DT_k(x, y, z) &= DI_k(x, y, z) + DA_k(x, y, z) \\
&= F(x, y, z) \lambda_k \cdot CONV1 \sum_{j=1}^n K_j E_k [EXPL_i(x)] \\
&\quad + F(x, y, z) \lambda_k CONV1 \cdot \frac{1 - e^{-(\lambda_b + \lambda_k)T}}{\lambda_b + \lambda_k} \sum_{j=1}^n K_j \\
&\quad \cdot E_k \left\{ \frac{e^{-\lambda_i \frac{x}{u}}}{\lambda_b + \lambda_k - \lambda_i - P_j} \begin{bmatrix} e^{-(\lambda_i + P_j)TINHA} & e^{-(\lambda_b + \lambda_k)TINHA} \\ -e & -e \end{bmatrix} \right\} \quad (8)
\end{aligned}$$

Rearranging and combining like terms, Equation (8) is reduced to the following form:

$$DT_k(x, y, z) = F(x, y, z) \lambda_k CONV1 \sum_{j=1}^n K_j E_k [EXPH_i(x)]$$

where

$$\begin{aligned}
EXPH_i(x) &= EXPL_i(x) + \left[\frac{1 - e^{-(\lambda_b + \lambda_k)T}}{\lambda_b + \lambda_k} \right] \frac{e^{-\lambda_i \frac{x}{u}}}{\lambda_b + \lambda_k - \lambda_i - P_j} \\
&\quad \begin{bmatrix} e^{-(\lambda_i + P_j)TINHA} & e^{-(\lambda_b + \lambda_k)TINHA} \\ -e & -e \end{bmatrix} \\
&= \frac{e^{-\lambda_i \frac{x}{u}}}{\lambda_b + \lambda_k - \lambda_i - P_j} \left\{ \left[\frac{1 - e^{-(\lambda_i + P_j)TINHA}}{\lambda_i + P_j} \right. \right. \\
&\quad \left. \left. - \frac{1 - e^{-(\lambda_b + \lambda_k)TINHA}}{\lambda_b + \lambda_k} \right] + \left[\frac{1 - e^{-(\lambda_b + \lambda_k)T}}{\lambda_b + \lambda_k} \right] \right. \\
&\quad \left. \begin{bmatrix} e^{-(\lambda_i + P_j)TINHA} & e^{-(\lambda_b + \lambda_k)TINHA} \\ -e & -e \end{bmatrix} \right\} \quad (9)
\end{aligned}$$

The above expression presents the inhalation dose to one particular organ from one particular isotope; therefore, the total inhalation dose is determined by summing all the contributing isotopes for a particular organ.

3.2 Thyroid Ingestion Dose

The mathematical model for the thyroid ingestion dose is the same as the model used for the inhalation dose. This is because the method used to

calculate the ingestion dose is to calculate the inhalation dose for the thyroid from two isotopes of iodine and multiply each by an appropriate factor which relates the dose from inhalation to the ingestion dose.

3.3 Cloud Gamma Dose

The cloud gamma dose is an external radiation which is received as a consequence of exposure to airborne radioactive fission products. Unlike the inhalation dose, the cloud and deposition gamma doses can be received even though the recipient is not surrounded by radioactive materials. The mathematical models required to describe the cloud and deposition doses are therefore more complicated since it is necessary to perform integrations with respect to all space as well as with respect to time, the latter integration being all that is required in the inhalation dose computation.

If $\lambda_k C_k(x,y,z,t)$ is equal to the disintegration rate per cubic meter at the point (x,y,z) and time (t) , the total number of disintegrations occurring between $(x/\bar{u})$ and $(T + x/\bar{u})$ will be

$$\int_{\frac{x}{\bar{u}}}^{T + \frac{x}{\bar{u}}} \lambda_k C_k(x,y,z,t) dt$$

where T equals the period of exposure to the cloud (sec).

The dose from a point in space at (x,y,z) to a receptor located at a point (DIE, ELB, -sh) will be:

$$Dl = \left[f_k G_\ell(r) \int_{\frac{x}{\bar{u}}}^{T + \frac{x}{\bar{u}}} \lambda_k C_k(x,y,z,t) dt \right] dz dy dx \quad (10)$$

where

f_k = the number of photons of the k th isotope released per disintegration

$G_\ell(r)$ = the dose attenuation kernel for the ℓ th energy group and is defined as follows:

$$G_\ell(r) = \left\{ \frac{v_\ell e^{-\mu_\ell r}}{4\pi (r)^2} \left[1 + \mu_\ell r + \frac{(\mu_\ell r)^2}{7 E_\ell^{2.4}} \right] \right\}$$

where

v_ℓ = flux to dose conversion factor for the ℓ th energy group (rem - m²/γ)

μ_ℓ = linear absorption coefficient for air for the ℓ th energy group (m⁻¹)

E_ℓ = average gamma energy per photon for the ℓ th energy group (MeV/ γ)

r = distance from a source to the receptor and is equal to

$$\sqrt{(x - \text{DIE})^2 + (y - \text{ELB})^2 + (z + \text{sh})^2}$$

DIE = the distance to the downwind detector position (m)

ELB = the distance to the crosswind detector position (m)

sh = the release height or stack height (m).

The total dose received at the point (DIE, ELB, -sh) will be the sum of the dose contributions from each differential volume ($dz \, dy \, dx$) source contained in the cloud and is equal to:

$$D_k = \int_0^\infty \int_{-\infty}^\infty \int_{-\infty}^\infty f_k G_\ell(r) \left[\int_{\frac{x}{\bar{u}}}^{T + \frac{x}{\bar{u}}} \lambda_k C_k(x, y, z, t) \, dt \right] dz \, dy \, dx \quad (11)$$

Solution of this mathematical model is shown in the following equations.

Let

$$\int_{\frac{x}{\bar{u}}}^{T + \frac{x}{\bar{u}}} \lambda_k C_k(x, y, z, t) \, dt = \psi_k(x, y, z) \int_{\frac{x}{\bar{u}}}^{T + \frac{x}{\bar{u}}} \left[N_k(t) \cdot L\left(t - \frac{x}{\bar{u}}\right) \right] dt \quad (12)$$

where

$$\psi_k(x, y, z) = \lambda_k x(x, y, z) K(x)$$

And if

$$T_k(x) = \int_{\frac{x}{\bar{u}}}^{T + \frac{x}{\bar{u}}} \left[N_k(t) \cdot L\left(t - \frac{x}{\bar{u}}\right) \right] dt$$

then

$$T_k(x) = \int_{\frac{x}{\bar{u}}}^{T + \frac{x}{\bar{u}}} N_k(t) L\left(t - \frac{x}{\bar{u}}\right) dt = \int_{\frac{x}{\bar{u}}}^{T + \frac{x}{\bar{u}}} \left[E_k \left(e^{-\lambda_i t} \right) \sum_{j=1}^n K_j e^{-P_j\left(t - \frac{x}{\bar{u}}\right)} dt \right] \quad (13)$$

Rewriting Equation (13),

$$\int_{\frac{x}{u}}^T \left[E_k \left(e^{-\lambda_1 t} \sum_{j=1}^n K_j e^{-P_j(t - \frac{x}{u})} \right) \right] dt = \sum_{j=1}^n K_j \int_{\frac{x}{u}}^{T + \frac{x}{u}} \left[E_k \left(e^{-\lambda_1 t} e^{-P_j(t - \frac{x}{u})} \right) \right] dt.$$

Since E_k is a linear operator, the following operation is possible

$$\sum_{j=1}^n K_j \int_{\frac{x}{u}}^{T + \frac{x}{u}} \left[E_k \left(e^{-\lambda_1 t} e^{-P_j(t - \frac{x}{u})} \right) \right] dt = \sum_{j=1}^n K_j E_k \left[\int_{\frac{x}{u}}^{T + \frac{x}{u}} e^{-\lambda_1 t - P_j(t - \frac{x}{u})} dt \right].$$

Performing the integration, the following equation is obtained:

$$\sum_{j=1}^n K_j E_k \left[\int_{\frac{x}{u}}^{T + \frac{x}{u}} e^{-\lambda_1 t - P_j(t - \frac{x}{u})} dt \right] = \sum_{j=1}^n K_j E_k \left[\frac{e^{-\lambda_1 \frac{x}{u}} - e^{-\lambda_1(T + \frac{x}{u}) - P_j T}}{\lambda_1 + P_j} \right].$$

Let

$$GEXP_j(x) = \frac{e^{-\lambda_1 \frac{x}{u}} - e^{-\lambda_1(T + \frac{x}{u}) - P_j T}}{\lambda_1 + P_j} = \frac{e^{-\lambda_1 \frac{x}{u}}}{\lambda_1 + P_j} \left[1 - e^{-(\lambda_1 + P_j)T} \right]. \quad (14)$$

Therefore,

$$\int_{\frac{x}{u}}^{T + \frac{x}{u}} \lambda_k c_k(x, y, z, t) dt = \psi_k(x, y, z) \sum_{j=1}^n K_j E_k [GEXP_j(x)].$$

The total dose now equals

$$\begin{aligned}
 D_k &= \int_0^\infty \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} f_k G_\ell(r) \left\{ \psi_k(x, y, z) \sum_{j=1}^n K_j E_k [GEXP_j(x)] \right\} dz dy dx \\
 &= \sum_{j=1}^n K_j f_k \lambda_k \int_0^\infty K(x) E_k [GEXP_j(x)] \left[\int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} \chi(x, y, z) \right. \\
 &\quad \left. G_\ell(r) dz dy \right] dx .
 \end{aligned}$$

Next the integrals over y and z are solved.

Let

$$\begin{aligned}
 DK(x) &= \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} \chi(x, y, z) G_\ell(r) dz dy \\
 &= \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} \frac{e^{-\frac{y^2}{c_y^2 x^{w2}} - \frac{z^2}{c_z^2 x^{w3}}}}{\pi \bar{u} c_y c_z x^{w1}} \cdot G_\ell(r) dz dy .
 \end{aligned}$$

An analytical solution to the above equation is not possible; therefore, Hermite's numerical integration technique is used.

That is,

$$\int_{-\infty}^{+\infty} e^{-x^2} f(x) dx = \sum_{i=1}^n f(x_i) H_i .$$

Let

$$\Phi = \frac{y}{c_y x^{w2/2}} \quad \text{then } y = c_y x^{w2/2} \Phi \text{ and } dy = c_y x^{w2/2} d\Phi .$$

Let

$$\theta = \frac{z}{c_z x^{w3/2}} \quad \text{then } z = c_z x^{w3/2} \theta \text{ and } dz = c_z x^{w3/2} d\theta .$$

Then,

$$\int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} \frac{e^{-\frac{y^2}{c_y^2 x^{w2}} - \frac{z^2}{c_z^2 x^{w3}}}}{\pi \bar{u} c_y c_z x^{w1}} G_\ell(r) dz dy =$$

$$\frac{1}{\pi \bar{u}} \int_{-\infty}^{+\infty} e^{-\Phi^2} \int_{-\infty}^{+\infty} e^{-\theta^2} G_\ell(r) \frac{c_y c_z x^{(w2/2 + w3/2)}}{c_y c_z x^{w1}} d\theta d\Phi.$$

However,

$$x^{w2/2 + w3/2} = x^{w1}.$$

Therefore,

$$DK(x) = \frac{1}{\pi \bar{u}} \int_{-\infty}^{+\infty} e^{-\Phi^2} \left[\int_{-\infty}^{+\infty} e^{-\theta^2} G_\ell(r) d\theta \right] d\Phi$$

where

$$r = \sqrt{(x - DIE)^2 + (c_y x^{w2/2} \Phi - ELB)^2 + (c_z x^{w3/2} \theta + sh)^2}.$$

And in numerical form

$$DK(x) = \frac{1}{\pi \bar{u}} \sum_{i=1}^n \Pi_i \left[\sum_{j=1}^n \Pi_j G_\ell(R_{ij}) \right]$$

where

$$R_{ij} = \sqrt{(x - DIE)^2 + (c_y x^{w2/2} \Phi_i - ELB)^2 + (c_z x^{w3/2} \theta_j + sh)^2}.$$

In using Hermite's integration technique, the cloud gamma doses at distances greater than 10^4 meters appeared to decrease too rapidly with distance. From the behavior of the dose attenuation kernel, it was determined that the Hermite points did not truly represent the function; that is, at great distances very few points were giving nonzero values for the function. To solve this problem, an alternate technique was devised.

The following set of equations shows that only points within a thousand meters of the detector position need be considered.

If $c_y^2 DIE^{w2} \geq 10^6$ m and $|y - ELB| \leq 10^3$ m, then the value of $-\frac{(y - ELB)^2}{c_y^2 x^{w2}}$

varies from 0.36 to 1.0. Making the assumption that

$$e^{-\frac{(y-ELB)^2}{C_y^2 x^{w2}}} = 1.0 \quad \text{implies that}$$

$$\frac{1}{\pi \bar{u}} \int_{-1}^{+1} e^{-\Phi^2} \int_{-1}^{+1} e^{-\theta^2} G_\ell(r) d\theta d\Phi < \frac{1}{\pi \bar{u}} \int_{-1}^{+1} \int_{-1}^{+1} G_\ell(r) d\theta d\Phi$$

For $|\Phi|$ and $|\theta|$ greater than 1, $G_\ell(r)$ is sufficiently small so it can be neglected. This is shown below.

Since

$$r = \sqrt{(x-DIE)^2 + (y-ELB)^2 + (z+sh)^2} \quad \text{where} \quad |y-ELB| > 10^3 \text{ meters}$$

$$\therefore r \geq 10^3$$

and

$$G_\ell(r) = \frac{v_\ell}{4\pi r^2} \left[1 + \mu_\ell r + \frac{(\mu_\ell r)^2}{7E_\ell^{2.4}} \right] e^{-\mu_\ell r}$$

$$G_\ell(r) \leq \frac{v_\ell 10^{-6}}{4\pi} \left[1 + 10^3 \mu_\ell + \frac{10^6 (\mu_\ell^2)}{7E_\ell^{2.4}} \right] e^{-10^3 \mu_\ell}$$

for $\mu < 5 \times 10^{-2}$ and $E > 0.01$

$$G_\ell(r) \leq v_\ell \frac{10^{-6}}{12.56636} (1 + 50 + 2.254 \times 10^7) e^{-50}$$

$$G_\ell(r) \leq v_\ell 3.86 \times 10^{-22}$$

Since

$$v_\ell \leq 1.6 \times 10^{-13}$$

$$G_\ell(r) < 6.2 \times 10^{-35} \text{ for } r \geq 10^3.$$

Since one is normally interested in a conservative estimate of the dose, the mathematical model used at greater distances is as follows:

$$\frac{1}{\pi \bar{u}} \int_{-1}^{+1} \int_{-1}^{+1} G_\ell(r) d\theta d\Phi = \frac{1}{\pi \bar{u}} \int_{-10^3}^{10^3} \int_{-10^3}^{10^3} G_\ell(r) \frac{dz dy}{C_y C_z x^{w1}}$$

Changing to polar coordinates,

$$y - ELB = \rho \cos \theta$$

$$z + sh = \rho \sin \theta$$

$$r = \sqrt{(x-DIE)^2 + \rho^2}$$

$$dz \, dy = \rho \, d\rho \, d\theta$$

$$\frac{1}{\pi \bar{u} C_y C_z x^{w1}} \int_{-10^3}^{+10^3} \int_{-10^3}^{+10^3} G_\ell(r) \, dz \, dy = \frac{1}{\pi \bar{u} C_y C_z x^{w1}} \int_0^{10^3} \int_0^{2\pi} G_\ell(r) \rho \, d\rho \, d\theta = \frac{2}{\pi C_y C_z x^{w1}} \int_0^{10^3} G_\ell(r) \rho \, d\rho$$

where

$$r = \sqrt{(x-DIE)^2 + \rho^2}$$

However, looking at the exponential

$$y = ELB + \rho \cos \theta \quad z = -sh + \rho \sin \theta$$

$$e^{-\frac{y^2}{C_y^2 DIE^{w2}}} = e^{-\frac{ELB^2}{C_y^2 DIE^{w2}}} + \frac{2ELB\rho \cos \theta + \rho^2 \cos^2 \theta}{C_y^2 DIE^{w2}} \approx e^{-\frac{ELB^2}{C_y^2 DIE^{w2}}} \quad \text{for } |ELB| < 500$$

Similarly,

$$DK(x) = \frac{2c}{C_y C_z \bar{u} x^{w1}} \left(-\frac{ELB^2}{C_y^2 DIE^{w2}} - \frac{sh^2}{C_z^2 DIE^{w3}} \right) \int_0^{10^3} G_\ell(r) \rho \, d\rho$$

where

$$e^{-\frac{z^2}{C_z^2 DIE^{w3}}} \approx e^{-\frac{sh^2}{C_z^2 DIE^{w3}}} \quad \text{for } |sh| < 500$$

Solving the integral over x,

$$D_k = \sum_{j=1}^n K_j f_k \lambda_k \int_0^{\infty} K(x) E_k [GEXP_j(x)] DK(x) dx .$$

Again for $(x - DIE) \geq 1000$, the $G_{\ell}(r)$ term in $DK(x)$ is very small, and the limits can be from $(DIE - 1000)$ to $(DIE + 1000)$, except for $DIE < 1000$ for which case the limits are from 0 to $DIE + 1000$.

$$D_k = \sum_{j=1}^n K_j f_k \lambda_k \int_{\substack{DIE-1000 \\ \text{or} \\ 0 \text{ for } DIE < 1000}}^{DIE+1000} K(x) E_k [GEXP_j(x)] DK(x) dx$$

The total cloud gamma dose = $\sum_{\text{all } k} D_k$.

3.4 Deposition Gamma Dose

The deposition gamma dose is an external radiation which is received as a consequence of exposure to deposited fission products. The degree of exposure is dependent upon the type and quantity of activity deposited as well as the length of exposure. The quantity of a particular isotope on the ground at any given time is dependent not only upon its airborne concentration, deposition rate, and deposition time, but it is also dependent upon the concentration and deposition rates of its precursors. For this reason the mathematical models describing the deposition dose are divided into two parts: (a) dose during deposition and (b) dose following deposition.

3.41 Dose During the Deposition Period. The deposition rate on a surface z is defined by the following expression:

$$Dr_{f_k}(x, y, z, t) = V_{gk} C_k(x, y, z, t)$$

where V_{gk} equals the deposition velocity of the k th isotope (m/sec). The deposition rate from fallout on the ground is then $Dr_{f_k}(x, y, z_0, t)$ where $z_0 = -sh$. The deposition rate from washout is:

$$Dr_{w_k}(x, y, t) = \Lambda \int_0^{\infty} C_k(x, y, z, t) dz$$

where Λ equals the proportion of cloud removed per second by washout. Thus, the total deposition rate is:

$$\begin{aligned} Dr_{t_k}(x, y, t) &= Dr_{f_k}(x, y, z_0, t) + Dr_{w_k}(x, y, t) \\ &= K(x) L(t - \frac{x}{u}) N_k(t) \left[V_{gk} X(x, y, z_0) + \Lambda \int_0^{\infty} X(x, y, z) dz \right] . \end{aligned} \quad (15)$$

Solving the integral over z :

$$\Lambda \int_0^\infty \chi(x, y, z) dz = \frac{\Lambda e^{-\frac{y^2}{c_y^2 x^{w2}}}}{\pi^{1/2} c_y \bar{u} x^{w2/2}}$$

Rewriting Equation (15), the following equation is obtained:

$$\begin{aligned} Dr_{t_k}(x, y, t) = K(x) L\left(t - \frac{x}{\bar{u}}\right) N_k(t) & \left[\frac{2V_{gk} e^{-\frac{y^2}{c_y^2 x^{w2}} - \frac{(sh)^2}{c_z^2 x^{w3}}}}{\pi c_y c_z \bar{u} x^{w1}} \right. \\ & \left. + \frac{\Lambda e^{-\frac{y^2}{c_y^2 x^{w2}}}}{\pi^{1/2} c_y \bar{u} x^{w2/2}} \right] = K(x) L\left(t - \frac{x}{\bar{u}}\right) N_k(t) \left[\frac{e^{-\frac{y^2}{c_y^2 x^{w2}}}}{\pi^{1/2} c_y x^{w2/2}} \right. \\ & \left. \left(\frac{\Lambda}{\bar{u}} + \frac{2V_{gk}}{\pi^{1/2} c_z x^{w3/2} \bar{u}} e^{-\frac{sh^2}{c_z^2 x^{w3}}} \right) \right]. \end{aligned}$$

Let

$$\chi(x, y) = \frac{e^{-\frac{y^2}{c_y^2 x^{w2}}}}{\pi^{1/2} c_y x^{w2/2}}$$

then

$$Dr_{t_k}(x, y, t) = K(x) L\left(t - \frac{x}{\bar{u}}\right) N_k(t) \chi(x, y) \left\{ \left(\frac{\Lambda}{\bar{u}} \right) + \left[\frac{2V_{gk} e^{-\frac{(sh)^2}{c_z^2 x^{w3}}}}{\pi^{1/2} c_z x^{w3/2} \bar{u}} \right] \right\}. \quad (16)$$

Let $A_k(t)$ be the number of atoms at the point (x, y) in an area $dy dx$ during the deposition time. The rate of buildup of the various isotopes on the ground can therefore be described by a set of simultaneous differential equations of the first order:

$$\frac{dA_1(t)}{dt} = \lambda_1 A_1(t) + Dr_{t_1}(x, y, t) dx dy$$

$$\frac{d A_2(t)}{dt} = \lambda_2 A_2(t) + \lambda_1 A_1(t) + Dr_{t_2}(x,y,t) dx dy$$

$$\frac{d A_k(t)}{dt} = - \lambda_k A_k(t) + \lambda_{k-1} A_{k-1}(t) + Dr_{t_k}(x,y,t) dx dy. \quad (17)$$

Let

$$\phi_k(x,y) = K(x) \chi(x,y) \left[\frac{\Lambda}{\bar{u}} + \frac{\frac{2V}{\pi^{1/2}} e^{\frac{(sh)^2}{C_z^2 x^{w3}}} g_k}{C_z^{1/2} x^{w3/2} \bar{u}} \right] dx dy$$

then

$$Dr_{t_k}(x,y,t) dx dy = \phi_k(x,y) N_k(t) L(t - \frac{x}{\bar{u}})$$

and

$$\frac{d A_k(t)}{dt} = - \lambda_k A_k(t) + \lambda_{k-1} A_{k-1}(t) + \phi_k(x,y) N_k(t) L(t - \frac{x}{\bar{u}}) \quad (18)$$

Taking the Laplace Transformation of Equation (18) and applying the boundary condition that

$$L(t - x/\bar{u}) = 0.0 \text{ for } 0 \leq t \leq x/\bar{u}$$

and

$$A_k(t) = 0.0 \text{ for } 0 \leq t \leq x/\bar{u}.$$

Equation (19) is determined

$$s \bar{A}_k(s) = - \lambda_k \bar{A}_k(s) + \lambda_{k-1} \bar{A}_{k-1}(s) + \phi_k(x,y) \bar{\psi}_k(s) \quad (19)$$

where

$$A_k(s) = \ell[A_k(t)], \quad \psi_k(s) = \ell[N_k(t) L(t - x/\bar{u})]$$

ℓ = Laplace operator.

The following equation is obtained by solving Equation (19) for $\bar{A}_k(s)$

$$\bar{A}_k(s) = \lambda_{k-1} \bar{A}_{k-1}(s) \frac{1}{s + \lambda_k} + \phi_k(x,y) \bar{\psi}_k(s) \frac{1}{s + \lambda_k} \quad (20)$$

By substituting

$$\bar{A}_{k-1}(s) \left(\frac{1}{s + \lambda_k} \right) = \ell \left[\int_0^t A_{k-1}(v) e^{-\lambda_k(t-v)} dv \right]$$

$$\bar{\psi}_k(s) \left(\frac{1}{s + \lambda_k} \right) = \ell \left[\int_0^t N_k(v) L(v - x/\bar{u}) e^{-\lambda_k(t-v)} dv \right]$$

where v is a dummy variable, into Equation (20) the following solution for $A_k(t)$ is obtained

$$A_k(t) = \lambda_{k-1} \int_0^t A_{k-1}(v) e^{-\lambda_k(t-v)} dv + \phi_k(x, y) \int_0^t N_k(v) L(v - x/\bar{u}) e^{-\lambda_k(t-v)} dv \quad (21)$$

However, applying the boundary condition that

$$\lambda_{k-1} \int_0^{x/\bar{u}} A_{k-1}(v) e^{-\lambda_k(t-v)} dv + \int_0^{x/\bar{u}} \phi_k(x, y) N_k(v) L(v - x/\bar{u}) e^{-\lambda_k(t-v)} dv = 0.0$$

to Equation (21), the following equation is obtained

$$A_k(t) = \lambda_{k-1} \int_{x/\bar{u}}^t A_{k-1}(v) e^{-\lambda_k(t-v)} dv + \phi_k(x, y) \int_{x/\bar{u}}^t N_k(v) L(v - x/\bar{u}) e^{-\lambda_k(t-v)} dv$$

Let

$$G_k^k(t) = \phi_k(x, y) \int_{x/\bar{u}}^t N_k(v) L(v - x/\bar{u}) e^{-\lambda_k(t-v)} dv \quad (22)$$

and

$$F_{k-1}^k(t) = \lambda_{k-1} \int_{x/\bar{u}}^t A_{k-1}(v) e^{-\lambda_k(t-v)} dv$$

Then

$$A_k(t) = G_k^k(t) + F_{k-1}^k(t)$$

which implies that

$$A_{k-1}(t) = G_{k-1}^{k-1}(t) + F_{k-2}^{k-1}(t)$$

and

$$\begin{aligned} F_{k-1}^k(t) &= \lambda_{k-1} \int_{x/\bar{u}}^t \left[G_{k-1}^{k-1}(v) + F_{k-2}^{k-1}(v) \right] e^{-\lambda_k(t-v)} dv \\ &= \lambda_{k-1} \int_{x/\bar{u}}^t G_{k-1}^{k-1}(v) e^{-\lambda_k(t-v)} dv + \lambda_{k-1} \int_{x/\bar{u}}^t F_{k-2}^{k-1}(v) e^{-\lambda_k(t-v)} dv . \end{aligned}$$

Let

$$G_{k-1}^k(t) = \lambda_{k-1} \int_{x/\bar{u}}^t G_{k-1}^{k-1}(v) e^{-\lambda_k(t-v)} dv \quad (23)$$

which implies that

$$F_{k-1}^k(t) = G_{k-1}^k(t) + \lambda_{k-1} \int_{x/\bar{u}}^t F_{k-2}^{k-1}(v) e^{-\lambda_k(t-v)} dv$$

and

$$F_{k-2}^{k-1}(t) = G_{k-2}^{k-1}(t) + \lambda_{k-2} \int_{x/\bar{u}}^t F_{k-3}^{k-2}(v) e^{-\lambda_{k-1}(t-v)} dv$$

and

$$\begin{aligned} F_{k-1}^k(t) &= G_{k-1}^k(t) + \lambda_{k-1} \int_{x/\bar{u}}^t G_{k-2}^{k-1}(v) e^{-\lambda_k(t-v)} dv \\ &+ \lambda_{k-1} \int_{x/\bar{u}}^t \lambda_{k-2} \left[\int_{x/\bar{u}}^v F_{k-3}^{k-2}(\eta) e^{-\lambda_{k-1}(v-\eta)} d\eta \right] e^{-\lambda_k(t-v)} dv . \end{aligned}$$

However,

$$\begin{aligned}
 G_{k-2}^k(t) &= \lambda_{k-1} \int_{x/\bar{u}}^t G_{k-2}^{k-1}(v) e^{-\lambda_k(t-v)} dv \\
 &= \lambda_{k-1} \int_{x/\bar{u}}^t \left[\lambda_{k-2} \int_{x/\bar{u}}^v G_{k-2}^{k-2}(\eta) e^{-\lambda_{k-1}(v-\eta)} d\eta \right] \\
 &\quad e^{-\lambda_k(t-v)} dv .
 \end{aligned} \tag{24}$$

Since $F_{p-1}^p(t) = 0.0$, if p is the first isotope of the chain, the general solution for $A_k(t)$ is therefore

$$A_k(t) = \sum_{p=1}^k G_p^k(t) .$$

In solving for $G_p^k(t)$, the solution for $G_k^k(t)$ must be obtained from Equation (22). Therefore,

$$\begin{aligned}
 G_k^k(t) &= \phi_k(x, y) \int_{x/\bar{u}}^t N_k(v) L(v-x/\bar{u}) e^{-\lambda_k(t-v)} dv \\
 &= \phi_k(x, y) \sum_{j=1}^n K_j \int_{x/\bar{u}}^t E_k(e^{-\lambda_1 v}) \cdot e^{-P_j(v-x/\bar{u})} \cdot e^{-\lambda_1(t-v)} dv \\
 &= \sum_{j=1}^n K_j \phi_k(x, y) E_k \left[e^{-\lambda_k(t-x/\bar{u})} \cdot e^{-\lambda_1 x/\bar{u}} \int_{x/\bar{u}}^t e^{(\lambda_k - \lambda_1 - P_j)(v-x/\bar{u})} dv \right] .
 \end{aligned}$$

If $P_j \neq 0$,

$$G_k^k(t) = \sum_{j=1}^n K_j \phi_k(x, y) E_k \left\{ e^{-\lambda_1 x/\bar{u}} \left[\frac{e^{-(\lambda_1 + P_j)(t-x/\bar{u})}}{(\lambda_k - \lambda_1 - P_j)} - \frac{e^{-\lambda_k(t-x/\bar{u})}}{(\lambda_k - \lambda_1 - P_j)} \right] \right\} .$$

The special case when $P_j = 0$ (ie, constant leakage rate) is covered later on.

Solving Equation (23) for $G_{k-1}^k(t)$,

$$\begin{aligned}
 G_{k-1}^k(t) &= \lambda_{k-1} \int_{x/\bar{u}}^t \sum_{j=1}^n K_j \phi_{k-1}(x, y) E_{k-1} \left\{ e^{-\lambda_i x/\bar{u}} \left[\frac{e^{-(\lambda_i + P_j)(v-x/\bar{u})}}{(\lambda_{k-1} - \lambda_i - P_j)} \right. \right. \\
 &\quad \left. \left. - \frac{e^{-\lambda_{k-1}(v-x/\bar{u})}}{(\lambda_{k-1} - \lambda_i - P_j)} \right] \right\} e^{-\lambda_k(t-v)} dv \\
 &= \sum_{j=1}^n K_j \phi_{k-1}(x, y) \lambda_{k-1} E_{k-1} \left\{ e^{-\lambda_i x/\bar{u}} \cdot e^{-\lambda_k(t-x/\bar{u})} \right. \\
 &\quad \left. \left[\int_{x/\bar{u}}^t \frac{e^{(\lambda_k - \lambda_i - P_j)(v-x/\bar{u})}}{(\lambda_{k-1} - \lambda_i - P_j)} dv - \int_{x/\bar{u}}^t \frac{e^{(\lambda_k - \lambda_{k-1})(v-x/\bar{u})}}{(\lambda_{k-1} - \lambda_i - P_j)} dv \right] \right\}.
 \end{aligned}$$

Therefore,

$$\begin{aligned}
 G_{k-1}^k(t) &= \sum_{j=1}^n K_j \phi_{k-1}(x, y) \lambda_{k-1} E_{k-1} \left\{ e^{-\lambda_i x/\bar{u}} \left[\frac{e^{-(\lambda_i + P_j)(t-x/\bar{u})}}{\pi \prod_{\ell=k-1}^k (\lambda_\ell - \lambda_i - P_j)} \right. \right. \\
 &\quad \left. \left. - \frac{e^{-\lambda_k(t-x/\bar{u})}}{\pi \prod_{\ell=k-1}^k (\lambda_\ell - \lambda_i - P_j)} - \frac{e^{-\lambda_{k-1}(t-x/\bar{u})}}{(\lambda_{k-1} - \lambda_i - P_j)(\lambda_k - \lambda_{k-1})} \right. \right. \\
 &\quad \left. \left. + \frac{e^{-\lambda_k(t-x/\bar{u})}}{(\lambda_{k-1} - \lambda_i - P_j)(\lambda_k - \lambda_{k-1})} \right] \right\}.
 \end{aligned}$$

However,

$$\frac{1}{\pi \prod_{\ell=k-1}^k (\lambda_\ell - \lambda_i - P_j)} - \frac{1}{(\lambda_{k-1} - \lambda_i - P_j)(\lambda_k - \lambda_{k-1})} = \frac{1}{(\lambda_k - \lambda_i - P_j)(\lambda_{k-1} - \lambda_k)}.$$

Thus,

$$G_{k-1}^k(t) = \sum_{j=1}^n K_j \phi_{k-1}(x, y) \prod_{\ell=k-1}^{k-1} \frac{1}{\pi} (\lambda_\ell) E_{k-1} \left\{ e^{-\lambda_i x/u} \left[\frac{e^{-(\lambda_i + P_j)(t-x/\bar{u})}}{\frac{k}{\pi} (\lambda_\ell - \lambda_i - P_j)} \right. \right. \\ \left. \left. - \sum_{m=k-1}^k \frac{e^{-\lambda_m(t-x/\bar{u})}}{(\lambda_m - \lambda_i - P_j) \prod_{\substack{\ell=k-1 \\ \ell \neq m}}^k (\lambda_\ell - \lambda_m)} \right] \right\}$$

or, in general,

$$G_p^k(t) = \sum_{j=1}^n K_j \phi_p(x, y) \prod_{\ell=p}^{k-1} \frac{1}{\pi} (\lambda_\ell) E_p \left\{ e^{-\lambda_i x/\bar{u}} \left[\frac{e^{-(\lambda_i + P_j)(t-x/\bar{u})}}{\frac{k}{\pi} (\lambda_\ell - \lambda_i - P_j)} \right. \right. \\ \left. \left. - \sum_{m=p}^k \frac{e^{-\lambda_m(t-x/\bar{u})}}{(\lambda_m - \lambda_i - P_j) \prod_{\substack{\ell=p \\ \ell \neq m}}^k (\lambda_\ell - \lambda_m)} \right] \right\} \quad (25)$$

Let

$$G_{pi}^k(t-x/\bar{u}) = \left[\prod_{\ell=p}^{k-1} \frac{1}{\pi} (\lambda_\ell) \right] e^{-\lambda_i x/\bar{u}} \left[\frac{e^{-(\lambda_i + P_j)(t-x/\bar{u})}}{\frac{k}{\pi} (\lambda_\ell - \lambda_i - P_j)} \right. \\ \left. - \sum_{m=p}^k \frac{e^{-\lambda_m(t-x/\bar{u})}}{(\lambda_m - \lambda_i - P_j) \prod_{\substack{\ell=p \\ \ell \neq m}}^k (\lambda_\ell - \lambda_m)} \right]$$

Then,

$$G_p^k(t) = \sum_{j=1}^n K_j E_p \left[G_{pi}^k(t-x/\bar{u}) \phi_p(x, y) \right]$$

and

$$A_k(t) = \sum_{j=1}^n K_j \sum_{p=1}^n E_p \left[G_{pi}^k(t-x/\bar{u}) \phi_p(x,y) \right] \quad (26)$$

The total number of disintegrations taking place during the deposition time at the point (x, y) is:

$$DA_k(x,y) dx dy = \int_{x/\bar{u}}^{TDEPOS+x/\bar{u}} \lambda_k A_k(t) dt \quad (27)$$

and the dose during this time is:

$$D_{d_k} = f_k \int_0^\infty \int_{-\infty}^{+\infty} G_\ell(r) DA_k(x,y) dx dy \quad (28)$$

3.42 Dose Following Deposition. Let $AL_k(t')$ be the number of atoms at the point (x, y) in an area $dy dx$ after the deposition time.

Then,

$$\frac{d AL_k(t')}{dt} = -\lambda_k AL_k(t') + \lambda_{k-1} AL_{k-1}(t') \quad (29)$$

where

$$AL_{k-1}(t') = 0.0 \text{ if } k = 1.$$

The solution of Equation (29) is the same as the decay equation (ie, $N_k(t) = E_k [e^{-\lambda_i t}]$).

Thus,

$$AL_k(t') = E_k \left(e^{-\lambda_i t'} \right) \quad (30)$$

where

$Q_m(0) = A_m(TDEPOS + x/\bar{u})$ = the total number of atoms for the mth isotope deposited on the ground immediately following the time of deposition

$$t' = t - TDEPOS - x/\bar{u}.$$

The total number of disintegrations taking place after the deposition time at the point (x, y) is

$$DAL_k(x,y) dx dy = \int_{TDEPOS + x/\bar{u}}^{T + TDEPOS + x/\bar{u}} \lambda_k AL_k(t') dt' \quad (31)$$

where T equals the exposure time in seconds.

The dose following the deposition period is

$$D_{a_k} = f_k \int_0^\infty \int_{-\infty}^\infty G_\ell(r) DAL_k(x,y) dx dy \quad (32)$$

Therefore, the total deposition dose is

$$D_{t_k} = D_{d_k} + D_{a_k}$$

or

$$D_{t_k} = f_k \int_0^\infty \int_{-\infty}^\infty G_\ell(r) \left[DA_k(x,y) + DAL_k(x,y) \right] dx dy \quad (33)$$

Let

$$F_k(x,y) = \left[DA_k(x,y) + DAL_k(x,y) \right] dx dy \quad (34)$$

Solving Equation (34) for $F_k(x,y)$

$$\begin{aligned} F_k(x,y) &= \int_{x/\bar{u}}^{TDEPOS + x/\bar{u}} \lambda_k A_k(t) dt + \int_{TDEPOS + x/\bar{u}}^{T + TDEPOS + x/\bar{u}} \lambda_k AL_k(t') dt' \\ &= \lambda_k \sum_{j=1}^n \sum_{p=1}^k E_p \left[\phi_p(x,y) \int_{x/\bar{u}}^{TDEPOS + x/\bar{u}} G_{pi}^k(t-x/\bar{u}) dt \right] \\ &\quad + \lambda_k E_k \left[\int_{TDEPOS + x/\bar{u}}^{T + TDEPOS + x/\bar{u}} e^{-\lambda_i(t - TDEPOS - x/\bar{u})} dt \right] \end{aligned}$$

Let

$$\begin{aligned} MEXPT_i &= \int_{TDEPOS + x/\bar{u}}^{T + TDEPOS + x/\bar{u}} e^{-\lambda_i(t - TDEPOS - x/\bar{u})} dt \\ &= \frac{1 - e^{-\lambda_i T}}{\lambda_i} \end{aligned}$$

and substitute

$$\phi_p(x, y) = \psi_p(x) \chi(x, y) dx dy .$$

The following equation is obtained:

$$F_k(x, y) = \lambda_k \left\{ \chi(x, y) dx dy \sum_{j=1}^n K_j \sum_{p=1}^k E_p \left[\psi_p(x) \int_{x/\bar{u}}^{TDEPOS + x/\bar{u}} G_{pi}^k(t-x/\bar{u}) dt \right] \right. \\ \left. + \sum_{m=1}^k A_m(TDEPOS + x/\bar{u}) \left[\prod_{\ell=m}^{k-1} (\lambda_i) \right] \sum_{i=m}^k \left[\frac{MEXPT_i}{\prod_{\substack{j=m \\ j \neq i}}^k (\lambda_j - \lambda_i)} \right] \right\} .$$

And by expanding $A_m(TDEPOS + x/\bar{u})$, the following equation is obtained:

$$F_k(x, y) = \lambda_k \left(\chi(x, y) dx dy \sum_{j=1}^n K_j \sum_{p=1}^k E_p \left[\psi_p(x) \int_{x/u}^{TDEPOS + x/\bar{u}} G_{pi}^k(t-x/\bar{u}) dt \right] \right. \\ \left. + \sum_{m=1}^k \left\{ \sum_{j=1}^n K_j \sum_{p=1}^m E_p \left[\chi(x, y) dx dy \psi_p(x) G_{pi}^k(TDEPOS) \right] \right\} \right. \\ \left. \left[\prod_{i=m}^{k-1} (\lambda_i) \right] \sum_{i=m}^k \left[\frac{MEXPT_i}{\prod_{\substack{j=m \\ j \neq i}}^k (\lambda_j - \lambda_i)} \right] \right) .$$

By factoring out $\chi(x, y) dx dy$ and $\sum_{j=1}^n K_j$,

$$F_k(x, y) = \lambda_k \chi(x, y) dx dy \sum_{j=1}^n K_j \left(\sum_{p=1}^k E_p \left[\psi_p(x) \int_{x/\bar{u}}^{TDEPOS + x/\bar{u}} G_{pi}^k(t-x/\bar{u}) dt \right] \right. \\ \left. + \sum_{m=1}^k \left\{ \sum_{p=1}^m E_p \left[\psi_p(x) G_{pi}^k(TDEPOS) \right] \right\} \left[\prod_{i=m}^{k-1} (\lambda_i) \right] \sum_{i=m}^k \left[\frac{MEXPT_i}{\prod_{\substack{j=m \\ j \neq i}}^k (\lambda_j - \lambda_i)} \right] \right) .$$

Let

$$\text{EXP}_k(x) = \sum_{p=1}^k E_p \left[\psi_p(x) \bar{G}_{pi}^k(x) \right] + E_k(\text{MEXPT}_i)$$

where

$$\begin{aligned} \bar{G}_{pi}^k(x) &= \int_{x/\bar{u}}^{\text{TDEPOS} + x/\bar{u}} G_{pi}^k(t-x/\bar{u}) dt \\ &= \left[\frac{k-1}{\pi} (\lambda_\ell) \right] e^{-\lambda_i x/\bar{u}} \left[\int_{x/\bar{u}}^{\text{TDEPOS} + x/\bar{u}} \frac{e^{-(\lambda_i + P_j)(t-x/\bar{u})}}{\frac{k}{\pi} (\lambda_\ell - \lambda_i - P_j)} dt \right. \\ &\quad \left. - \sum_{m=p}^k \int_{x/\bar{u}}^{\text{TDEPOS} + x/\bar{u}} \frac{e^{-\lambda_m(t-x/\bar{u})}}{(\lambda_m - \lambda_i - P_j) \frac{k}{\pi} (\lambda_\ell - \lambda_m)} dt \right] \end{aligned}$$

$$\begin{aligned} \bar{G}_{pi}^k(x) &= \left[\frac{k-1}{\pi} (\lambda_\ell) \right] e^{-\lambda_i x/\bar{u}} \left\{ \frac{1 - e^{-(\lambda_i + P_j)\text{TDEPOS}}}{\frac{k}{\pi} (\lambda_\ell - \lambda_i - P_j)} \right. \\ &\quad \left. - \sum_{m=p}^k \left[\frac{1 - e^{-\lambda_m \text{TDEPOS}}}{\lambda_m (\lambda_m - \lambda_i - P_j) \frac{k}{\pi} (\lambda_\ell - \lambda_m)} \right] \right\} \end{aligned}$$

and

$$E_k(\text{MEXPT}_i) = \sum_{m=1}^k \left\{ \sum_{p=1}^m E_p \left[\psi_p(x) G_{pi}^k(\text{TDEPOS}) \right] \right\} \left[\frac{k-1}{\pi} (\lambda_i) \right] \sum_{i=m}^k \left[\frac{\text{MEXPT}_i}{\frac{k}{\pi} (\lambda_j - \lambda_i)} \right]$$

Then,

$$F_k(x, y) = \sum_{j=1}^n K_j \lambda_k \chi(x, y) \text{EXP}_k(x) \, dx \, dy .$$

Therefore,

$$\begin{aligned} D_{t_k} &= f_k \int_0^\infty \int_{-\infty}^{+\infty} \sum_{j=1}^n K_j G_\ell(r) \lambda_k \chi(x, y) \text{EXP}_k(x) \, dx \, dy \\ &= \sum_{j=1}^n K_j f_k \lambda_k \int_0^\infty \text{EXP}_k(x) \left[\int_{-\infty}^{+\infty} \chi(x, y) G_\ell(r) \, dy \right] \, dx . \end{aligned}$$

Next, the integral over y is solved.

Let

$$\begin{aligned} \eta(x) &= \int_{-\infty}^{+\infty} \chi(x, y) G_\ell(r) \, dy \\ &\quad - \frac{y^2}{C_y^2 x^{w2/2}} \\ &= \int_{-\infty}^{+\infty} \frac{e^{-\frac{y^2}{C_y^2 x^{w2/2}}}}{\pi^{1/2} C_y x^{w2/2}} G_\ell(r) \, dy . \end{aligned}$$

Let

$$\Phi = \frac{y}{C_y x^{w2/2}} \quad \text{then } y = C_y x^{w2/2} \Phi \text{ and } dy = C_y x^{w2/2} d\Phi .$$

Then,

$$\frac{1}{\pi^{1/2}} \int_{-\infty}^{+\infty} \frac{e^{-\frac{y^2}{C_y^2 x^{w2/2}}}}{C_y x^{w2/2}} G_\ell(r) \, dy = \frac{1}{\pi^{1/2}} \int_{-\infty}^{+\infty} e^{-\Phi^2} G_\ell(r) \frac{C_y x^{w2/2}}{C_y x^{w2/2}} \, d\Phi .$$

Therefore,

$$\eta(x) = \frac{1}{\pi^{1/2}} \int_{-\infty}^{+\infty} e^{-\Phi^2} G_\ell(r) \, d\Phi$$

where

$$r = \sqrt{(x - \text{DIE})^2 + (C_y x^{w2/2} \Phi - \text{ELB})^2} .$$

And in numerical form,

$$\eta(x) = \frac{1}{\pi^{1/2}} \sum_{i=1}^n H_i G_{\ell}(R_i)$$

where

$$R_i = \sqrt{(x-DIE)^2 + (C_y x^{w2/2} \Phi_i - ELB)^2}$$

For distances of DIE greater than 10^4 meters, the same technique as in cloud gamma is employed:

$$\eta(x) = \frac{e^{-\frac{ELB^2}{C_y^2 DIE^{w2}}}}{\pi^{1/2} C_y x^{w2/2}} \int_{ELB-1000}^{ELB+1000} G_{\ell}(r) dy$$

Then

$$D_{t_k} = \sum_{j=1}^n K_j f_k \lambda_k \int_0^{\infty} EPX_k(x) [\eta(x)] dx$$

Then by changing the limits of integration over x in the same manner as in cloud gamma,

$$D_{t_k} = \sum_{j=1}^n K_j f_k \lambda_k \int_{\substack{DIE-1000 \\ \text{or} \\ 0 \text{ for } DIE \leq 1000}}^{DIE+1000} EPX_k(x) [\eta(x)] dx$$

The total deposition gamma dose = $\sum_{\text{all } k} D_{t_k}$.

The above model is based on the assumption that $P_j \neq 0$; however, if a constant leakage rate is desired, P_j must be zero. The following analysis is for the special case of $P_j = 0$.

If $P_j = 0$, then

$$Dr_{t_k}(x, y, t) = 0 \quad 0 \leq t \leq x/\bar{u}$$

$$= \sum_{j=1}^n K_j \phi_k(x, y) E_k(e^{-\lambda_1 t}) \quad t > x/\bar{u}$$

The set of simultaneous differential equations of the first order are the same as when $P_j \neq 0$. Solving for $A_1(t)$ by using the Laplace Transform, the following equation is obtained:

$$A_1(s) = \frac{\bar{D}_1(x, y, s)}{(s + \lambda_1)} - \frac{A_1(0)}{s + \lambda_1}$$

However, $A_1(0) = 0.0$.

Therefore,

$$\begin{aligned} A_1(t) &= \int_{x/\bar{u}}^t Dr_{t,1}(x, y, v) e^{-\lambda_1(t-v)} dv \\ &= \int_{x/\bar{u}}^t \sum_{j=1}^n K_j \phi_1(x, y) E_1 \left[e^{-\lambda_1 v} e^{-\lambda_1(t-v)} \right] dv \\ &= \sum_{j=1}^n K_j \phi_1(x, y) E_1 \left(e^{-\lambda_1 t} \int_{x/\bar{u}}^t dv \right) \text{ since } i = 1 \\ &= \sum_{j=1}^n K_j E_1 \left[\phi_1(x, y) e^{-\lambda_1 t} (t - x/\bar{u}) \right]. \end{aligned}$$

Let

$$A_k(t) = E_k \left[\phi_i(x, y) e^{-\lambda_i t} \right] (t - x/\bar{u}) + B_k(t) \quad (35)$$

where $B_k(t)$ equals the function that describes the number of atoms of the k th isotope that has buildup from the precursors of the k th isotope that has already been deposited. Thus $B_1(t)$ equals 0.0.

Substituting for $A_k(t)$ in the general equation,

$$\begin{aligned} \frac{d}{dt} \left\{ E_k \left[\phi_i(x, y) (t - x/\bar{u}) e^{-\lambda_i t} \right] + B_k(t) \right\} &= -\lambda_k \left\{ E_k \left[\phi_i(x, y) \right. \right. \\ &\quad \left. \left. (t - x/\bar{u}) e^{-\lambda_i t} \right] + B_k(t) \right\} + \lambda_{k-1} \left\{ E_{k-1} \left[\phi_i(x, y) (t - x/\bar{u}) e^{-\lambda_i t} \right] \right. \\ &\quad \left. + B_{k-1}(t) \right\} + E_k \left[\phi_k(x, y) e^{-\lambda_i t} \right] \end{aligned}$$

which is equal to

$$\begin{aligned}
& E_k \left[\phi_i(x, y) e^{-\lambda_i t} \right] - E_k \left[\phi_i(x, y) (t - x/\bar{u}) (\lambda_i) e^{-\lambda_i t} \right] + \frac{dB_k(t)}{dt} \\
& = -\lambda_k E_k \left[\phi_i(x, y) (t - x/\bar{u}) e^{-\lambda_i t} \right] - \lambda_k B_k(t) + \lambda_{k-1} E_{k-1} \\
& \quad \left[\phi_i(x, y) (t - x/\bar{u}) e^{-\lambda_i t} \right] + \lambda_{k-1} B_{k-1}(t) + E_k \left[\phi_k(x, y) e^{-\lambda_i t} \right]. \quad (36)
\end{aligned}$$

However,

$$\begin{aligned}
& - E_k \left[\phi_i(x, y) (t - x/\bar{u}) (\lambda_i) e^{-\lambda_i t} \right] = -\lambda_k E_k \left[\phi_i(x, y) (t - x/\bar{u}) e^{-\lambda_i t} \right] \\
& + \lambda_{k-1} E_{k-1} \left[\phi_i(x, y) (t - x/\bar{u}) e^{-\lambda_i t} \right]. \quad (37)
\end{aligned}$$

In showing that Equation (37) is true, let

$$\begin{aligned}
& (t - x/\bar{u}) \left\{ \lambda_k E_k \left[\phi_i(x, y) e^{-\lambda_i t} \right] - E_k \left[\phi_i(x, y) \lambda_i e^{-\lambda_i t} \right] \right\} \\
& = (t - x/\bar{u}) \lambda_{k-1} E_{k-1} \left[\phi_i(x, y) e^{-\lambda_i t} \right].
\end{aligned}$$

If $[t - x/\bar{u}]$ is multiplied out and like terms are combined,

$$E_k \left[\phi_i(x, y) e^{-\lambda_i t} (\lambda_k - \lambda_i) \right] = \lambda_{k-1} E_{k-1} \left[\phi_i(x, y) e^{-\lambda_i t} \right]. \quad (38)$$

Rewriting Equation (38) without the operator E_k ,

$$\begin{aligned}
& \lambda_{k-1} E_{k-1} \left[\phi_i(x, y) e^{-\lambda_i t} \right] \\
& = \sum_{m=1}^k N_m(o) \frac{k-1}{\pi} (\lambda_i) \sum_{i=m}^k \left[\frac{\phi_i(x, y) (\lambda_k - \lambda_i) e^{-\lambda_i t}}{\frac{k}{\pi} (\lambda_j - \lambda_i)} \right] \\
& = \lambda_{k-1} \sum_{m=1}^{k-1} N_m(o) \frac{k-2}{\pi} (\lambda_i) \sum_{i=m}^k \left[\frac{\phi_i(x, y) (\lambda_k - \lambda_i) e^{-\lambda_i t}}{\frac{k}{\pi} (\lambda_j - \lambda_i)} \right]
\end{aligned}$$

$$+ \lambda_{k-1} N_k \phi_k(x, y) (\lambda_k - \lambda_k) e^{-\lambda_k t}.$$

However, in the first term of the second summation, when $i = k$, the quantity of $(\lambda_k - \lambda_i)$ equals zero. Also, the second term equals zero. Thus,

$$\lambda_{k-1} E_{k-1} \left[\phi_i(x, y) e^{-\lambda_i t} \right] = \lambda_{k-1} \sum_{m=1}^{k-1} N_m(o) \prod_{i=m}^{k-2} (\lambda_i) \sum_{i=m}^{k-1}$$

$$\left[\frac{\phi_k(x, y) (\lambda_k - \lambda_k) e^{-\lambda_i t}}{\prod_{\substack{j=m \\ j \neq i}}^k (\lambda_j - \lambda_i)} \right]$$

but
$$\frac{\lambda_k - \lambda_i}{\prod_{\substack{j=m \\ j \neq i}}^k (\lambda_j - \lambda_i)} = \frac{1}{\prod_{\substack{j=m \\ j \neq i}}^{k-1} (\lambda_j - \lambda_i)} \quad \text{for } i \neq k$$

and

$$\lambda_{k-1} E_{k-1} \left[\phi_i(x, y) e^{-\lambda_i t} \right] = \lambda_{k-1} \sum_{m=1}^{k-1} N_m(o) \prod_{i=m}^{k-2} (\lambda_i) \sum_{i=m}^{k-1}$$

$$\left[\frac{\phi_i(x, y) e^{-\lambda_i t}}{\prod_{\substack{j=m \\ j \neq i}}^{k-1} (\lambda_j - \lambda_i)} \right] = \lambda_{k-1} E_{k-1} \left[\phi_i(x, y) e^{-\lambda_i t} \right].$$

Thus Equation (38) is true, and Equation (37) reduces to the following form:

$$E_k \left[\phi_i(x, y) e^{-\lambda_i t} \right] + \frac{dB_k(t)}{dt} = -\lambda_k B_k(t) + \lambda_{k-1} B_{k-1}(t) + E_k \left[\phi_k(x, y) e^{-\lambda_i t} \right]$$

or

$$\frac{dB_k(t)}{dt} = -\lambda_k B_k(t) + \lambda_{k-1} B_{k-1}(t) + E_k \left\{ \left[\phi_k(x, y) - \phi_i(x, y) \right] e^{-\lambda_i t} \right\}. \quad (39)$$

Solving Equation (39) by taking the Laplace Transform,

$$\bar{B}_k(s) = \frac{\lambda_{k-1} \bar{B}_{k-1}(s)}{s + \lambda_k} + E_k \left\{ \frac{[\phi_k(x, y) - \phi_i(x, y)]}{(s + \lambda_i)(s + \lambda_k)} \right\} - \frac{B_k(0)}{s + \lambda_k}.$$

However, $B_k(t)$ equals 0.0 for $0 \leq t \leq x/u$.

Hence, $B_k(0)$ equals 0.0.

Solving for $B_k(t)$,

$$B_k(t) = \ell^{-1} \left[\lambda_{k-1} \frac{B_{k-1}(s)}{s + \lambda_k} \right] + \ell^{-1} \left(E_k \left\{ \frac{[\phi_k(x, y) - \phi_i(x, y)]}{(s + \lambda_k)(s + \lambda_i)} \right\} \right)$$

where ℓ^{-1} denotes inverse Laplace Transform.

Let

$$\frac{\bar{G}_k^{(k)}(s)}{(s + \lambda_k)} = \left(E_k \left\{ \frac{[\phi_k(x, y) - \phi_i(x, y)]}{(s + \lambda_k)(s + \lambda_i)} \right\} \right)$$

and

$$f_{k-1}^k(s) = \left[\lambda_{k-1} \frac{\bar{B}_{k-1}(s)}{(s + \lambda_k)} \right]$$

Then,

$$B_k(s) = f_{k-1}^k(s) + \frac{\bar{G}_k^{(k)}(s)}{(s + \lambda_k)}$$

and thus

$$\bar{B}_{k-1}(s) = f_{k-2}^{k-1}(s) + \frac{\bar{G}_{k-1}^{(k-1)}(s)}{(s + \lambda_{k-1})}$$

and

$$f_{k-1}^k(s) = \lambda_{k-1} \left[\frac{f_{k-2}^{k-1}(s)}{(s + \lambda_k)} + \frac{\bar{G}_{k-2}^{(k-1)}(s)}{(s + \lambda_k)(s + \lambda_{k-1})} \right]$$

and

$$f_{k-2}^{k-1}(s) = \lambda_{k-2} \left[\frac{f_{k-3}^{k-2}(s)}{(s + \lambda_{k-1})} + \frac{\bar{G}_{k-2}^{(k-2)}(s)}{(s + \lambda_{k-1})(s + \lambda_{k-2})} \right]$$

Therefore,

$$f_{k-1}^k(s) = \lambda_{k-1} \lambda_{k-2} \frac{f_{k-3}^{k-2}(s)}{(s+\lambda_k)(s+\lambda_{k-1})} + \lambda_{k-1} \lambda_{k-2} \frac{\bar{G}_{k-2}^{k-2}(s)}{(s+\lambda_k)(s+\lambda_{k-1})(s+\lambda_{k-2})} \\ + \frac{\lambda_{k-1} \bar{G}_{k-2}^{k-1}(s)}{(s+\lambda_k)(s-\lambda_{k-1})}$$

and

$$f_{k-3}^{k-2}(s) = \lambda_{k-3} \lambda_{k-4} \frac{f_{k-5}^{k-4}(s)}{(s+\lambda_{k-2})(s+\lambda_{k-3})} + \lambda_{k-3} \lambda_{k-4} \frac{\bar{G}_{k-4}^{k-4}(s)}{(s+\lambda_{k-2})(s+\lambda_{k-3})(s+\lambda_{k-4})} \\ + \lambda_{k-3} \frac{\bar{G}_{k-3}^{k-3}(s)}{(s+\lambda_{k-2})(s+\lambda_{k-3})}$$

which implies that

$$f_{k-1}^k(s) = \frac{(\lambda_{k-1} \lambda_{k-2} \lambda_{k-3} \lambda_{k-4}) f_{k-5}^{k-4}(s)}{(s+\lambda_k)(s+\lambda_{k-1})(s+\lambda_{k-2})(s+\lambda_{k-3})} \\ + \frac{(\lambda_{k-1} \lambda_{k-2} \lambda_{k-3} \lambda_{k-4}) \bar{G}_{k-4}^{k-4}(s)}{(s+\lambda_k)(s+\lambda_{k-1})(s+\lambda_{k-2})(s+\lambda_{k-3})(s+\lambda_{k-4})} \\ + \frac{(\lambda_{k-1} \lambda_{k-2} \lambda_{k-3}) \bar{G}_{k-3}^{k-3}(s)}{(s+\lambda_k)(s+\lambda_{k-1})(s+\lambda_{k-2})(s+\lambda_{k-3})} \\ + \frac{(\lambda_{k-1} \lambda_{k-2}) \bar{G}_{k-2}^{k-2}(s)}{(s+\lambda_k)(s+\lambda_{k-1})(s+\lambda_{k-2})} + \frac{\lambda_{k-1} \bar{G}_{k-1}^{k-1}(s)}{(s+\lambda_k)(s+\lambda_{k-1})}$$

Since $f_0^1(s) = 0.0$, this implies that

$$f_{k-1}^k(s) = \sum_{m=1}^{k-1} \left[\begin{matrix} k-1 \\ \pi \\ i=m \end{matrix} (\lambda_i) \right] \frac{\bar{G}_m^m(s)}{\prod_{j=m}^k (s+\lambda_j)}$$

and

$$\bar{B}_k(s) = \sum_{m=1}^k \left[\begin{matrix} k-1 \\ \pi \\ \ell=m \end{matrix} (\lambda_\ell) \right] \frac{\bar{G}_m^m(s)}{\prod_{j=m}^k (s+\lambda_j)}.$$

However,

$$\bar{G}_m^m(s) = E_m \left(\frac{\phi_m(x, y) - \phi_i(x, y)}{(s+\lambda_i)} \right),$$

and then

$$\bar{B}_k(s) = \sum_{m=1}^k \left[\begin{matrix} k-1 \\ \pi \\ \ell=m \end{matrix} (\lambda_\ell) \right] E_m \left[\frac{\phi_m(x, y) - \phi_i(x, y)}{(s+\lambda_i) \prod_{j=m}^k (s+\lambda_j)} \right]$$

since $i \leq m$. And if $i = m$, then $\phi_m(x, y) - \phi_i(x, y) = 0.0$.

The following equation is obtained:

$$B_k(t) = \sum_{m=1}^k \left[\begin{matrix} k-1 \\ \pi \\ \ell=m \end{matrix} (\lambda_\ell) \right] E_m \left\{ \left[\phi_m(x, y) - \phi_i(x, y) \right] e^{-\lambda_i x / \bar{u}} \left[\frac{e^{-\lambda_i (t-x/\bar{u})}}{\prod_{\ell=m}^k (\lambda_\ell - \lambda_i)} \right. \right. \\ \left. \left. + \sum_{\substack{j=m \\ j \neq \ell}}^k \frac{e^{-\lambda_\ell (t-x/\bar{u})}}{(\lambda_i - \lambda_\ell) \prod_{j=m}^k (\lambda_j - \lambda_\ell)} \right] \right\}.$$

Therefore,

$$A_k(t) = E_k \left[\phi_i(x, y) e^{-\lambda_i t} (t-x/\bar{u}) \right] + \sum_{m=1}^k E_m \left\{ \left[\phi_m(x, y) - \phi_i(x, y) \right] \right. \\ \left. \left[\begin{matrix} k-1 \\ \pi \\ \ell=m \end{matrix} (\lambda_\ell) \right] e^{-\lambda_i x / \bar{u}} \left[\frac{e^{-\lambda_i (t-x/\bar{u})}}{\prod_{\ell=m}^k (\lambda_\ell - \lambda_i)} + \sum_{\substack{j=m \\ j \neq \ell}}^k \frac{e^{-\lambda_\ell (t-x/\bar{u})}}{(\lambda_i - \lambda_\ell) \prod_{j=m}^k (\lambda_j - \lambda_\ell)} \right] \right\}.$$

(40)

The analysis for $P_j = 0$ proceeds the same as the analysis for $P_j \neq 0$, except that

$$\begin{aligned}
 \text{EPX}_k(x) = & E_k \left[\int_{x/\bar{u}}^{\text{TDEPOS} + x/\bar{u}} \psi_i(x) e^{-\lambda_i t} (t-x/\bar{u}) dt \right] \\
 & + \sum_{m=1}^k E_m \left\{ \left[\psi_m(x) - \psi_i(x) \right] \left[\pi_{\ell=m}^{k-1}(\lambda_\ell) \right] e^{-\lambda_i x/\bar{u}} \right. \\
 & \left[\int_{x/\bar{u}}^{\text{TDEPOS} + x/\bar{u}} \frac{e^{-\lambda_i(t-x/\bar{u})}}{\frac{k}{\pi(\lambda_\ell - \lambda_i)}} dt + \sum_{\ell=m}^k \int_{x/\bar{u}}^{\text{TDEPOS} + x/\bar{u}} \frac{e^{-\lambda_\ell(t-x/\bar{u})}}{(\lambda_i - \lambda_\ell) \frac{k}{\pi(\lambda_j - \lambda_\ell)}} dt \right] \\
 & \left. + E_k(\text{MEXPT}_i) \right\}
 \end{aligned}$$

where $A_m(\text{TDEPOS} + x/\bar{u})$ corresponds to $A_k(t)$ for $P_j = 0$.

Then,

$$\begin{aligned}
 \text{EPX}_k(x) = & E_k \left[\psi_i(x) \frac{e^{-\lambda_i x/\bar{u}}}{\lambda_i} \left(\frac{1 - e^{-\lambda_i \text{TDEPOS}}}{\lambda_i} - \text{TDEPOS} e^{-\lambda_i \text{TDEPOS}} \right) \right] \\
 & + \sum_{m=1}^k E_m \left\{ \left[\psi_m(x) - \psi_i(x) \right] \left[\pi_{\ell=m}^{k-1}(\lambda_i) \right] e^{-\lambda_i x/\bar{u}} \right. \\
 & \left. \left[\frac{1 - e^{-\lambda_i \text{TDEPOS}}}{\lambda_i \frac{k}{\pi(\lambda_\ell - \lambda_i)}} + \sum_{\ell=m}^k \frac{1 - e^{-\lambda_i \text{TDEPOS}}}{(\lambda_\ell)(\lambda_i - \lambda_\ell) \frac{k}{\pi(\lambda_j - \lambda_\ell)}} \right] \right\} + E_k(\text{MEXPT}_i) .
 \end{aligned}$$

4. RADIOLOGICAL DOSES -- INSTANTANEOUS RELEASE

The mathematical models presented in the previous section have applied to a continuous release of radioactive fission products. In most cases involving a nuclear accident, the release of materials to the atmosphere will occur over a long period of time (ie, time greater than one-half hour). However, for the case involving an uncontained reactor system, the possibility exists that the release of materials may take place during a very short period of time.

For the instantaneous release, the same mathematical models presented for the continuous release were used except for $L(t-x/\bar{u})$ which was changed to

$$L(t-x/\bar{u}) = 100 e^{-100(t-x/\bar{u})}$$

because

$$\int_{x/\bar{u}}^{T + x/\bar{u}} L(t-x/\bar{u}) dt = 1 - e^{-100(T)} \approx 1.0 \quad (T \geq 1.0) .$$

The following comparisons will show that this is a good approximation for the inhalation dose, the cloud gamma dose, and the deposition dose. Since the ingestion dose is obtained by multiplying the inhalation dose by a multiplication factor, the comparison for the inhalation dose will also be used for the ingestion dose.

4.1 Inhalation Dose

The total dose due to inhalation for a continuous release is:

$$D_t = X(x, y, z) \quad BR \quad K(x) \quad CONV1 \quad F_a \quad \lambda_k \quad \sum_{j=1}^n K_j E_k \quad |f_i(x)|$$

where

$$f_i(x) = \frac{e^{-\lambda_i \frac{x}{\bar{u}}}}{\lambda_k + \lambda_b - \lambda_i - P_j} \left(\left\{ \frac{[1 - e^{-(\lambda_i + P_j) TINHA}]}{\lambda_i + P_j} - \frac{[1 - e^{-(\lambda_b + \lambda_k) TINHA}]}{\lambda_b + \lambda_k} \right\} + \left[\frac{1 - e^{-(\lambda_b + \lambda_k) T}}{(\lambda_b + \lambda_k)} \right] \left[e^{-(\lambda_i + P_j) TINHA} - e^{-(\lambda_b + \lambda_k) TINHA} \right] \right) .$$

For an instantaneous release, let

T = exposure time following inhalation and be equal to 50 years^[6]

$P_j = K_j = 100$ and $TINHA > 1.0$.

Then,

$$\lambda_k + \lambda_b - \lambda_i - P_j \doteq -100.0 \text{ and } \lambda_i + P_j \doteq 100.$$

Therefore,

$$\begin{aligned} f_i(x) &= \frac{e^{-\lambda_i \frac{x}{\bar{u}}}}{-100} \left\{ \left[\frac{1}{+100} - \frac{1 - e^{-(\lambda_k + \lambda_b) \text{TINHA}}}{\lambda_b + \lambda_k} \right] \right. \\ &\quad \left. + \left[\frac{1}{\lambda_b + \lambda_k} \right] \left[0 - e^{-(\lambda_b + \lambda_k) \text{TINHA}} \right] \right\} \\ f_i(x) &\doteq \frac{e^{-\lambda_i \frac{x}{\bar{u}}}}{100} \left[-\frac{1}{100} + \frac{1}{\lambda_b + \lambda_k} - \frac{e^{-(\lambda_k + \lambda_b) \text{TINHA}}}{\lambda_b + \lambda_k} + \frac{e^{-(\lambda_k + \lambda_b) \text{TINHA}}}{\lambda_b + \lambda_k} \right] \\ f_i(x) &\doteq \frac{e^{-\lambda_i \frac{x}{\bar{u}}}}{100} \left(\frac{1}{\lambda_b + \lambda_k} - \frac{1}{100} \right). \end{aligned} \quad (41)$$

Since λ_b and λ_k are always less than 1, Equation (41) can be written as follows:

$$f_i(x) \doteq \frac{e^{-\lambda_i x/\bar{u}}}{100} \left(\frac{1}{\lambda_b + \lambda_k} \right).$$

Therefore, D_t instantaneous release is

$$\begin{aligned} &= X(x, y, z) \quad \text{BR} \quad K(x) \quad \text{CONV1} \quad F_a \quad \lambda_k (100) E_k \left[f_i(x) \right] \\ &= X(x, y, z) \quad \text{BR} \quad K(x) \quad \text{CONV1} \quad F_a \left(\frac{1}{\lambda_b + \lambda_k} \right) \lambda_k E_k \left(e^{-\lambda_i \frac{x}{\bar{u}}} \right) \\ X(x, y, z) &= \frac{2 e^{-\frac{y^2}{C_y^2 x^2 w^2}} - \frac{z^2}{C_z^2 x^2 w^3}}{\pi C_y C_z \bar{u} x^{w1}} \end{aligned}$$

and letting

$$\lambda_k E_k \left(e^{-\lambda_i \frac{x}{\bar{u}}} \right) = Q_k \left(\frac{x}{\bar{u}} \right) \quad \text{dis/sec or curies} \times (3.7 \times 10^{10})$$

and

$$y = \text{ELB}, z = -sh.$$

The total inhalation dose for the instantaneous release from the kth isotope is

$$D_t = \frac{2K(x)Q_k(x/\bar{u}) e^{-\frac{sh^2}{C_z^2 x^3} - \frac{\text{ELB}^2}{C_y^2 x^3}}}{\pi C_y C_z \bar{u} x^{wl}} \cdot \frac{(BR F_a) \text{CONV1}}{\lambda_b + \lambda_k}.$$

4.2. Thyroid Ingestion Dose

Since the models for the inhalation and ingestion doses are the same, the comparisons for the instantaneous release are also the same.

4.3. Cloud Gamma Dose

The total cloud gamma dose for continuous release is:

$$D_k = \sum_{j=1}^n K_j f_k \lambda_k \int_0^\infty K(x) E_k \text{GEXP}_j(x) \left[\int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} x(x,y,z) G_{\ell}(r) dz dy \right] dx.$$

For an instantaneous release, let

$$P_j = K_j = 100, \quad \lambda_i + P_j \approx 100$$

and let

$$T \geq 1.0.$$

Then,

$$\text{GEXP}_j(x) = \frac{e^{-\lambda_i \frac{x}{\bar{u}}}}{100} \left(1 - e^{-100T} \right) \approx \frac{e^{-\lambda_i \frac{x}{\bar{u}}}}{100}$$

and D_k instantaneous

$$= 100 \cdot f_k \lambda_k \int_0^\infty K(x) E_k \frac{e^{-\lambda_i \frac{x}{\bar{u}}}}{100} \left[\int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} x(x,y,z) G_{\ell}(r) dz dy \right] dx.$$

Let

$$\lambda_k E_k (e^{-\lambda_i \frac{x}{\bar{u}}}) = Q_k \left(\frac{x}{\bar{u}} \right).$$

Then D_k instantaneous

$$= f_k \int_0^{+\infty} K(x) Q_k \left(\frac{x}{\bar{u}} \right) \int_{-\infty}^{+\infty} \int_{-\infty}^{+\infty} \chi(x, y, z) G_\ell(r) dz dy dx.$$

4.4 Deposition Gamma Dose

Similarly in deposition as in cloud

$$EPX_k(x) = \sum_{p=1}^k E_p \left[\psi_p(x) G_{pi}^k(x) \right] + E_k(MEXPT_i)$$

where

$$G_{pi}^k(x) = \left[\begin{matrix} k-1 \\ \pi \\ \ell=p \end{matrix} (\lambda_i) \right] e^{-\lambda_i x / \bar{u}} \left\{ \frac{1 - e^{-(\lambda_i + P_j)TDEPOS}}{\frac{k}{(\lambda_i + P_j) \pi (\lambda_\ell - \lambda_i - P_j)}} - \sum_{m=p}^k \left[\frac{1 - e^{-\lambda_m TDEPOS}}{\frac{k}{\lambda_m (\lambda_m - \lambda_i - P_j) \pi (\lambda_\ell - \lambda_m)}} \right] \right\}$$

and

$$E_k(MEXPT_i) = \sum_{m=1}^k \sum_{p=1}^m E_m \left[\psi_p(x) G_{pi}^k(TDEPOS) \right] \left[\begin{matrix} k-1 \\ \pi \\ i=m \end{matrix} (\lambda_i) \right] \cdot \sum_{i=m}^k \left[\frac{MEXPT_i}{\frac{k}{\pi (\lambda_j - \lambda_i)}} \right]_{\substack{j=m \\ j \neq i}}$$

where

$$G_{pi}^k(TDEPOS) = \left[\begin{matrix} k-1 \\ \pi \\ \ell=p \end{matrix} (\lambda_\ell) \right] e^{-\lambda x / \bar{u}} \left\{ \frac{e^{-(\lambda_i + P_j)TDEPOS}}{\frac{k}{\pi (\lambda_\ell - \lambda_i - P_j)}} - \sum_{m=p}^k \left[\frac{e^{-\lambda_m TDEPOS}}{\frac{k}{(\lambda_m - \lambda_i - P_j) \pi (\lambda_\ell - \lambda_m)}} \right] \right\}.$$

For an instantaneous release, let

$$P_j = K_j = 100$$

$$TDEPOS = 1.0 \text{ sec}$$

$$\psi_m(x) = K(x) \left[\left(\frac{\Lambda}{\bar{u}} \right) + \left(\frac{2Vg_m e^{-\frac{sh^2}{C_z^2 x^3}}}{\pi^{1/2} C_z \bar{u} x^{3/2}} \right) \right]$$

Let $e^{-\lambda_m} = 1.0$ for all values of m

$$\lambda_\ell - \lambda_i - \Gamma_j = -\Gamma_j \quad \text{all values of } \ell \text{ and } i.$$

Then,

$$G_{pi}^k(x) = \frac{k-1}{\pi} (\lambda_i) e^{-\lambda_i x/\bar{u}} \left[\frac{1}{P_j \pi (-P_j)} - 0 \right]$$

$$= e^{-\lambda_i x/\bar{u}} \frac{\pi (\lambda_\ell)}{(-1)^{k-p+1} P_j^{k-p+2}} \approx 0.0$$

and

$$G_{pi}^m(TDEPOS) = \frac{m-1}{\pi} (\lambda_\ell) e^{-\lambda_i x/\bar{u}} \left\{ 0 - \sum_{\mu=p}^m \left[\frac{1}{-P_j \pi (\lambda_\ell - \lambda_\mu)} \right] \right\}$$

$$= \frac{m-1}{\pi} \frac{(\lambda_\ell) e^{-\lambda_i x/\bar{u}}}{P_j} \left[\sum_{\substack{\mu=p \\ \ell \neq \mu}}^m \frac{1}{\pi (\lambda_\ell - \lambda_\mu)} \right]$$

However,

$$\sum_{\substack{\mu=p \\ \ell \neq \mu}}^m \frac{1}{\pi (\lambda_\ell - \lambda_\mu)} = \begin{cases} 1 & \text{if } p = m \\ 0 & \text{if } p \neq m \end{cases}$$

Therefore,

$$G_{pi}^m (\text{TDEPOS}) = \frac{e^{-\lambda_i x/\bar{u}}}{P_j}.$$

Then,

$$\begin{aligned} \text{EPX}_k(x) &= E_k(\text{MEXPT}_i) \\ &= \sum_{m=1}^k \left\{ E_m \left[\psi_m(x) \frac{e^{-\lambda_i x/\bar{u}}}{P_j} \right] \left[\frac{k-1}{\pi} (\lambda_i) \right] \sum_{\substack{i=m \\ j=m \\ j \neq i}}^k \left[\frac{\text{MEXPT}_i}{\frac{k}{\pi} (\lambda_j - \lambda_i)} \right] \right\}. \end{aligned}$$

However,

$$E_m(e^{-\lambda_i x/\bar{u}}) = N_m(x/\bar{u}).$$

Thus,

$$\text{EPX}_k(x) = \sum_{m=1}^k N_m(x/\bar{u}) \left[\frac{k-1}{\pi} (\lambda_i) \right] \sum_{\substack{i=m \\ j=m \\ j \neq i}}^k \left[\frac{\text{MEXPT}_i}{\frac{k}{\pi} (\lambda_j - \lambda_i)} \right]$$

$$\begin{aligned} &\left\{ \frac{K(x)}{P_j} \left[\left(\frac{\Lambda}{\bar{u}} \right) + \left(\frac{2V}{\pi^{1/2}} \frac{e^{C_z^2 x w^3}}{C_z \bar{u} x^{w3/2}} \right) \right] \right\} \\ &= E_k \left[\text{MEXPT}_i \right] \left\{ \frac{K(x)}{P_j} \left[\left(\frac{\Lambda}{\bar{u}} \right) + \left(\frac{2V}{\pi^{1/2}} \frac{e^{C_z^2 x w^3}}{C_z \bar{u} x^{w3/2}} \right) \right] \right\} \\ &= \left\{ \frac{K(x)}{P_j} \left[\left(\frac{\Lambda}{\bar{u}} \right) + \left(\frac{2V}{\pi^{1/2}} \frac{e^{C_z^2 x w^3}}{C_z \bar{u} x^{w3/2}} \right) \right] \right\} \int_{\text{TDEPOS} + x/\bar{u}}^{T + \text{TDEPOS} + x/\bar{u}} E_k[e^{-\lambda_i t}] dt \\ &= \left\{ \frac{K(x)}{P_j} \left[\left(\frac{\Lambda}{\bar{u}} \right) + \left(\frac{2V}{\pi^{1/2}} \frac{e^{C_z^2 x w^3}}{C_z \bar{u} x^{w3/2}} \right) \right] \right\} \int_{x/\bar{u}}^{T + x/\bar{u}} E_k(e^{-\lambda_i t}) dt. \end{aligned}$$

Then,

$$\lambda_k \text{ EPX}_k(x) = \left\{ \frac{K(x)}{P_j} \left[\left(\frac{\Lambda}{\bar{u}} \right) + \left(\frac{2V e^{-\frac{\text{sh}^2}{C_z^2 x^{w3}}}}{\pi^{1/2} C_z \bar{u} x^{w3/3}} \right) \right] \right\} \int_{x/\bar{u}}^{T + x/\bar{u}} \lambda_k E_k(e^{-\lambda_i t}) dt.$$

But,

$$Q_k(t) = \lambda_k E_k [e^{-\lambda_i(t-x/\bar{u})}]$$

Then the deposition dose from an instantaneous release is

$$D_{t_k} = \frac{K_j}{P_j} f_k \int_0^\infty K(x) \left[\left(\frac{\Lambda}{\bar{u}} \right) + \left(\frac{2V e^{-\frac{\text{sh}^2}{C_z^2 x^{w3}}}}{\pi^{1/2} C_z \bar{u} x^{3/2}} \right) \right] \int_0^T Q_k(t) dt \left[\int_{-\infty}^{+\infty} \chi(x,y) G_\ell(r) dy \right] dx$$

$$D_{t_k} = f_k \int_0^\infty K(x) \left[\left(\frac{\Lambda}{\bar{u}} \right) + \left(\frac{2V e^{-\frac{\text{sh}^2}{C_z^2 x^{w3}}}}{\pi^{1/2} C_z \bar{u} x^{3/2}} \right) \right] \left[\int_{-\infty}^{+\infty} \chi(x,y) G_\ell(r) dy \right] dx \int_0^T Q_k(t) dt$$

IV. PROGRAM LIMITATIONS

The limitations to the RSAC program for each problem are:

- (1) The maximum number of decay chains which can be considered is 100.
- (2) The maximum number of isotopes which can be considered is 450 unless a deposition gamma dose is required, then it is only 330.
- (3) The maximum number of downwind and crosswind positions is 25 each.
- (4) If fractionation by elements is chosen, the maximum number of elements which can be fractionated is 20.
- (5) The effects of neutron activation are neglected, but if the effects are known, the fission yields may be increased to include these effects.

If a greater number of downwind or crosswind positions is desired, another problem will be required on the same run. However, if a greater number of decay chains or a greater number of isotopes is desired, a new problem will be required, and the doses from this new problem can be added manually to the doses from the first problem since the doses from each decay chain are independent.

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APPENDIX

1. CONVERSION FACTORS

The conversion factors introduced in the preceding sections and those factors which relate the total number of disintegrations to the total dose are presented below. These factors have been divided into internal dose conversion factors and external gamma dose conversion factors.

1.1 External Dose

The external gamma dose is the absorption by the body of a gamma ray or photon. With the disintegration of the gamma emitting nuclides, there are photons released of varying gamma energies which contribute to the dose. The calculation of the gamma dose for each of the different energies would involve a prohibitive amount of calculation time. These gamma energies have, therefore, been divided into ten energy groups of different ranges from 0.0 to 6.0 MeV/ γ , and each group has been assigned an average gamma energy per photon. The conversion factors in Table II have been based on the average gamma energy per photon of the group.

In Table I the energy group designations and the average number of photons per disintegration are entered for each isotope considered in the RSAC program. Also listed in Table I is the total gamma energy in MeV per disintegration which is needed for the output of the fission product inventory in MeV/sec.

1.2 Internal Dose

The conversion factor, C_f , presented in Table III relates the total number of disintegrations occurring in a particular organ to the dose which that organ will receive as a consequence of the inhaled decaying radioactive materials. This factor is derived from the following equation:

$$C_f = F_a \text{ CONV1}$$

$$\text{CONV1} = \frac{C_1}{M C_2} \cdot E$$

where

CONV1 = conversion factor (rad/disintegration)

F_a = the fraction of the inhaled radionuclide reaching the organ of reference^[6]

C_1 = conversion factor (1.6×10^{-6} ergs/g-MeV)^[6]

C_2 = conversion factor (100 ergs/g-rad)^[6]

$E = \sum E F(RBE) N$ = the effective energy absorbed per disintegration (MeV/dis)^[6]

M = the mass of the organ of reference^[6], where the masses of the various organs are:

<u>Organ</u>	<u>Mass(g)</u>
Bone	7.0×10^3
Kidney	3.0×10^2
Liver	1.7×10^3
Lung	1.0×10^3
Muscle	3.0×10^4
Testes	4.0×10^1
Thyroid	2.0×10^1
Total Body	7.0×10^4

The other variable presented in Table III is the biological half life of the radionuclide in the organ of reference and has units of days; however, the variable used in the inhalation calculation is the biological decay constant which has units of inverse seconds.

The factors relating the ingestion dose to the inhalation dose are obtained from experimental or theoretical results and are dependent upon such variables as deposition velocity and the amount of materials consumed by the dairy cattle as well as the rate of consumption and are, therefore, related directly to the area in which the animal is grazing. It is, therefore, necessary for each individual using the RSAC program to supply the factors which adequately describe the conditions under which an ingestion dose could be received.

TABLE I

ISOTOPES AND CONVERSION FACTORS USED IN EXTERNAL DOSE CALCULATIONS

Isotope	Reference	Mass Number	Total Gamma Energy (MeV/dis)	Average Gamma Energy/Photon (MeV/ γ)	Average Number of Photons/dis	Gamma Energy Group
Zn	[a]	72	9.1×10^{-1}	9.1×10^{-1}	1	7
Zn	[a]	73	0	0	0	10
Ga	[a]	72	2.7×10^0	1.3×10^0	2	8
Ga	[a]	73	6.8×10^{-2}	3.4×10^{-2}	2	2
Ge	[c]	75	2.9×10^{-1}	2.5×10^{-1}	1.2	4
Ge	[a]	77m	3.8×10^{-1}	1.9×10^{-1}	2	4
Ge	[a]	77	8.9×10^{-1}	4.5×10^{-1}	2	5
Ge	[a]	78	0	0	0	10
As	[a]	77	1.0×10^{-2}	3.3×10^{-1}	0.03	5
As	[a]	78	8.0×10^{-1}	2.7×10^{-1}	3	4
As	[b]	79	9.6×10^{-2}	9.6×10^{-2}	1	3
As	[a]	81	0	0	0	0
Se	[a]	79m	9.6×10^{-2}	9.6×10^{-2}	1	3
Se	[a]	79	0	0	0	10
Se	[a]	81m	1.0×10^{-1}	1.0×10^{-1}	1	4
Se	[a]	81	0	0	0	10
Se	[c]	83m	2.0×10^0	1.3×10^0	1.5	8
Se	[a]	83	3.1×10^0	7.8×10^{-1}	4	6
Se	[a]	84	0	0	0	10
Se	[a]	85	0	0	0	10
Se	[a]	87	0	0	0	10
Br	[a]	82	3.6×10^0	1.2×10^0	3	8
Br	[a]	83	5.1×10^{-2}	5.1×10^{-2}	1	3
Br	[b]	84m	2.1×10^0	1.0×10^0	2	8
Br	[a]	84	2.4×10^0	1.2×10^0	2	8
Br	[a]	85	0	0	0	10
Br	[a]	87	3.8×10^0	5.4×10^0	0.7	9
Br	[a]	88	0	0	0	10
Br	[a]	89	0	0	0	10
Br	[a]	90	0	0	0	10
Kr	[a]	83m	4.2×10^{-2}	2.1×10^{-2}	2	1
Kr	[a]	85m	1.8×10^{-1}	1.8×10^{-1}	1	4
Kr	[b]	85	5.2×10^{-3}	5.2×10^{-1}	0.01	6
Kr	[a]	87	5.6×10^{-1}	1.2×10^0	0.05	8
Kr	[a]	88	2.1×10^0	1.3×10^0	1.6	8
Kr	[a]	89	0	0	0	10
Kr	[a]	90	0	0	0	10
Kr	[a]	91	0	0	0	10
Kr	[a]	92	0	0	0	10
Kr	[a]	93	0	0	0	10

TABLE I (Contd.)

ISOTOPES AND CONVERSION FACTORS USED IN EXTERNAL DOSE CALCULATIONS

Isotope	Reference	Mass Number	Total Gamma Energy (MeV/dis)	Average Gamma Energy/Photon (MeV/ γ)	Average Number of Photons/dis	Gamma Energy Group
Kr	[a]	94	0	0	0	10
Kr	[a]	95	0	0	0	10
Rb	[a]	86	1.3×10^{-1}	1.1×10^0	0.12	8
Rb	[a]	87	0	0	0	10
Rb	[a]	88	4.7×10^{-1}	1.7×10^0	0.28	8
Rb	[c]	89	3.1×10^0	1.3×10^0	2.4	8
Rb	[a]	90	0	0	0	10
Rb	[a]	91	0	0	0	10
Rb	[a]	92	0	0	0	10
Rb	[a]	93	0	0	0	10
Rb	[a]	94	0	0	0	10
Sr	[a]	89	0	0	0	10
Sr	[a]	90	0	0	0	10
Sr	[a]	91	8.5×10^{-1}	8.3×10^{-1}	1	7
Sr	[b]	92	1.3×10^0	1.3×10^0	1	8
Sr	[a]	93	0	0	0	10
Sr	[a]	94	0	0	0	10
Sr	[a]	95	0	0	0	10
Sr	[a]	97	0	0	0	10
Y	[c]	90	5.6×10^{-3}	1.4×10^0	0.004	8
Y	[a]	91m	5.5×10^{-1}	5.5×10^{-1}	1	6
Y	[b]	91	3.6×10^{-3}	1.2×10^0	0.003	8
Y	[c]	92	4.2×10^{-1}	8.2×10^{-1}	0.51	7
Y	[a]	93	7.0×10^{-1}	7.0×10^{-1}	1	6
Y	[a]	94	1.4×10^0	1.4×10^0	1	8
Y	[a]	95	0	0	0	10
Y	[a]	97	0	0	0	10
Zr	[b]	93	7.0×10^{-3}	2.9×10^{-2}	0.24	1
Zr	[a]	95	7.3×10^{-1}	7.3×10^{-1}	1	6
Zr	[a]	97	7.5×10^{-1}	7.5×10^{-1}	1	6
Zr	[a]	99	0	0	0	10
Nb	[a]	95	7.5×10^{-1}	7.5×10^{-1}	1	6
Nb	[a]	96	2.4×10^0	7.7×10^{-1}	3.1	6
Nb	[a]	97m	7.5×10^{-1}	7.5×10^{-1}	1	6
Nb	[a]	97	6.7×10^{-1}	6.7×10^{-1}	1	6
Nb	[a]	98	0	0	0	10
Nb	[a]	99	0	0	0	10
Nb	[a]	100	0	0	0	10
Nb	[a]	101	0	0	0	10

TABLE I (Contd.)

ISOTOPES AND CONVERSION FACTORS USED IN EXTERNAL DOSE CALCULATIONS

Isotope	Reference	Mass Number	Total Gamma Energy (MeV/dis)	Average Gamma Energy/Photon (MeV/ γ)	Average Number of Photons/dis	Gamma Energy Group
Mo	[a]	99	2.4×10^{-1}	2.4×10^{-1}	1	4
Mo	[a]	101	8.6×10^{-1}	5.1×10^{-1}	1.7	6
Mo	[a]	102	0	0	0	10
Mo	[a]	104	0	0	0	10
Mo	[a]	105	0	0	0	10
Tc	[a]	99m	1.4×10^{-1}	1.4×10^{-1}	1	4
Tc	[a]	99	0	0	0	10
Tc	[a]	101	3.0×10^{-1}	3.0×10^{-1}	1	4
Tc	[a]	102	0	0	0	10
Tc	[a]	103	0	0	0	10
Tc	[g]	104	7.0×10^{-1}	7.0×10^{-1}	1	6
Tc	[a]	105	0	0	0	10
Tc	[a]	107	0	0	0	10
Ru	[a]	103	4.7×10^{-1}	5.0×10^{-1}	0.94	2
Ru	[a]	105	7.3×10^{-1}	7.3×10^{-1}	1	6
Ru	[c]	106	2.5×10^{-1}	6.0×10^{-1}	0.38	6
Ru	[g]	107	7.0×10^{-1}	7.0×10^{-1}	1	6
Rh	[a]	103m	4.0×10^{-2}	4.0×10^{-2}	1	2
Rh	[a]	105m	1.3×10^{-1}	1.3×10^{-1}	1	4
Rh	[a]	105	3.2×10^{-2}	3.2×10^{-1}	1	5
Rh	[a]	106	2.5×10^{-1}	5.9×10^{-1}	0.42	6
Rh	[c]	107	4.0×10^{-1}	3.3×10^{-1}	1.2	5
Rh	[c]	109m	0	0	0	10
Rh	[c]	109	0	0	0	10
Pd	[c]	107	0	0	0	10
Pd	[b]	109	8.8×10^{-2}	8.8×10^{-2}	1	3
Pd	[b]	111	7.0×10^{-2}	7.0×10^{-2}	1	3
Pd	[a]	112	1.8×10^{-2}	1.8×10^{-2}	1	1
Pd	[a]	113	0	0	0	10
Pd	[a]	114	0	0	0	10
Ag	[a]	109m	8.8×10^{-2}	8.8×10^{-2}	1	3
Ag	[b]	111m	7.0×10^{-2}	7.0×10^{-2}	1	3
Ag	[a]	111	3.0×10^{-2}	3.3×10^{-1}	0.91	5
Ag	[c]	112	1.6×10^0	1.0×10^0	1.6	8
Ag	[g]	113	7.0×10^{-1}	7.0×10^{-1}	1	6
Ag	[g]	114	7.0×10^{-1}	7.0×10^{-1}	1	6
Ag	[g]	115m	0	0	0	10
Ag	[g]	115	7.0×10^{-1}	7.0×10^{-1}	1	6
Cd	[a]	115	5.6×10^{-1}	1.3×10^0	0.42	8
Cd	[a]	117m	7.9×10^{-1}	8.8×10^{-1}	0.9	7

TABLE I (Contd.)

ISOTOPES AND CONVERSION FACTORS USED IN EXTERNAL DOSE CALCULATIONS

Isotope	Reference	Mass Number	Total Gamma Energy (MeV/dis)	Average Gamma Energy/Probe (MeV/y)	Average Number of Photons/dis	Gamma Energy Group
Cd	[b]	117	4.2×10^{-1}	4.2×10^{-1}	1	5
Cd	[b]	118	0	0	0	10
Cd	[b]	119	0	0	0	10
In	[b]	115m	3.4×10^{-1}	3.6×10^{-1}	0.95	5
In	[a]	117m	1.9×10^{-1}	1.9×10^{-1}	1	4
In	[a]	118	0	0	0	10
In	[a]	119	0	0	0	10
Sn	[a]	121	0	0	0	10
Sn	[b]	123m	2.2×10^{-2}	1.1×10^0	0.2	8
Sn	[b]	123	1.6×10^{-1}	1.6×10^{-1}	1	4
Sn	[a]	125	9.5×10^{-2}	1.9×10^{-1}	0.5	4
Sn	[a]	126	0	0	0	10
Sn	[a]	127	0	0	0	10
Sn	[c]	128	4.0×10^{-1}	4.0×10^{-1}	1	5
Sn	[b]	130	0	0	0	10
Sn	[b]	132	0	0	0	10
Sb	[a]	125	4.6×10^{-1}	4.6×10^{-1}	1	5
Sb	[c]	126m	4.6×10^{-1}	4.6×10^{-1}	1	5
Sb	[c]	126	4.6×10^{-1}	4.6×10^{-1}	1	5
Sb	[a]	127	7.2×10^{-1}	7.2×10^{-1}	1	6
Sb	[g]	128m	7.0×10^{-1}	7.0×10^{-1}	1	6
Sb	[g]	129	7.0×10^{-1}	7.0×10^{-1}	1	6
Sb	[a]	130	0	0	0	10
Sb	[a]	131	0	0	0	10
Sb	[a]	132	0	0	0	10
Sb	[a]	133	0	0	0	10
Sb	[a]	134	0	0	0	10
Te	[b]	125m	1.5×10^{-1}	7.5×10^{-2}	2	3
Te	[b]	127m	8.9×10^{-2}	8.9×10^{-2}	1	3
Te	[c]	127	4.0×10^{-3}	3.9×10^{-1}	0.01	5
Te	[b]	129m	1.1×10^{-1}	1.1×10^{-1}	1	4
Te	[c]	129	8.4×10^{-1}	8.7×10^{-1}	0.97	7
Te	[a]	131m	1.8×10^{-1}	1.8×10^{-1}	1	4
Te	[a]	131	4.8×10^{-1}	3.3×10^{-1}	1.5	5
Te	[b]	132	2.8×10^{-1}	1.4×10^{-1}	2	4
Te	[a]	133m	4.0×10^{-1}	4.0×10^{-1}	1	5
Te	[a]	133	1.3×10^0	7.7×10^{-1}	1.7	6
Te	[a]	134	0	0	0	10
Te	[a]	135	0	0	0	10
I	[b]	129	3.9×10^{-2}	3.9×10^{-2}	1	2
I	[a]	131	3.9×10^{-1}	4.0×10^{-1}	0.98	5

TABLE I (Contd.)

ISOTOPES AND CONVERSION FACTORS USED IN EXTERNAL DOSE CALCULATIONS

Isotope	Reference	Mass Number	Total Gamma Energy (MeV/dis)	Average Gamma Energy Probe (MeV/y)	Average Number of Photons/dis	Gamma Energy Group
I	[a]	132	2.0×10^0	7.9×10^{-1}	2.5	6
I	[a]	133	5.6×10^{-1}	5.6×10^{-1}	1	6
I	[a]	134	1.3×10^0	1.3×10^0	1	8
I	[a]	135	1.5×10^0	1.5×10^0	1	8
I	[g]	136	7.0×10^{-1}	7.0×10^{-1}	1	6
I	[a]	137	0	0	0	10
I	[a]	138	0	0	0	10
I	[a]	139	0	0	0	10
Xe	[a]	133	8.0×10^{-2}	8.1×10^{-2}	1	3
Xe	[a]	135m	5.2×10^{-1}	5.2×10^{-1}	1	6
Xe	[a]	135	2.7×10^{-1}	2.7×10^{-1}	1	4
Xe	[a]	137	0	0	0	10
Xe	[c]	138	1.0×10^0	5.0×10^{-1}	0.2	5
Xe	[a]	139	0	0	0	10
Xe	[a]	140	0	0	0	10
Xe	[a]	141	0	0	0	10
Xe	[a]	142	0	0	0	10
Cs	[a]	135	0	0	0	10
Cs	[b]	137	6.1×10^{-1}	6.6×10^{-1}	0.92	6
Cs	[b]	138	1.8×10^0	1.3×10^0	1.4	8
Cs	[b]	139	0	0	0	10
Cs	[b]	140	0	0	0	10
Cs	[b]	141	0	0	0	10
Cs	[b]	142	0	0	0	10
Cs	[b]	143	0	0	0	10
Cs	[b]	144	0	0	0	10
Ba	[b]	137m	6.6×10^{-1}	6.6×10^{-1}	1	6
Ba	[a]	139	3.8×10^{-1}	4.5×10^{-1}	0.84	5
Ba	[a]	140	2.4×10^{-1}	1.6×10^{-1}	1.5	4
Ba	[g]	141	7.0×10^{-1}	7.0×10^{-1}	1	6
Ba	[g]	142	7.0×10^{-1}	7.0×10^{-1}	1	6
Ba	[a]	143	0	0	0	10
Ba	[a]	144	0	0	0	10
La	[a]	140	2.1×10^0	1.2×10^0	1.8	8
La	[b]	141	2.7×10^{-2}	1.4×10^0	0.02	8
La	[a]	142	6.6×10^{-1}	6.6×10^{-1}	1	6
La	[b]	143	0	0	0	10
La	[b]	144	0	0	0	10
Ce	[b]	141	1.0×10^{-1}	1.5×10^{-1}	0.70	4
Ce	[a]	143	3.3×10^{-1}	3.3×10^{-1}	1	5

TABLE I (Contd.)

ISOTOPES AND CONVERSION FACTORS USED IN EXTERNAL DOSE CALCULATIONS

Isotope	Reference	Mass Number	Total Gamma Energy (MeV·dis)	Average Gamma Energy/Probe (MeV/γ)	Average Number of Photons/dis	Gamma Energy Group
Ce	[a]	144	4.3×10^{-2}	8.6×10^{-2}	0.5	3
Ce	[b]	145	0	0	0	10
Ce	[a]	146	3.3×10^{-1}	2.4×10^{-1}	1.4	4
Pr	[b]	143	0	0	0	10
Pr	[b]	144	3.3×10^{-2}	1.1×10^0	0.03	8
Pr	[g]	145	7.0×10^{-1}	7.0×10^{-1}	1	6
Pr	[c]	146	6.3×10^{-1}	5.1×10^{-1}	1.2	6
Nd	[a]	147	2.4×10^{-1}	2.4×10^{-1}	1	4
Nd	[c]	149	2.0×10^{-1}	2.0×10^{-1}	1	4
Nd	[a]	151	9.1×10^{-1}	3.0×10^{-1}	3	5
Pm	[a]	147	0	0	0	10
Pm	[a]	149	2.9×10^{-1}	2.9×10^{-1}	1	4
Pm	[a]	151	5.0×10^{-1}	2.5×10^{-1}	2	4
Sm	[a]	151	1.9×10^{-2}	1.9×10^{-2}	1	1
Sm	[a]	153	1.5×10^{-1}	1.5×10^{-1}	1	4
Sm	[h]	155	1.1×10^{-1}	1.1×10^{-1}	1	4
Sm	[b]	156	0	0	0	10
Eu	[a]	155	7.0×10^{-1}	1.4×10^{-1}	5	4
Eu	[a]	156	1.2×10^0	2.0×10^0	0.6	9
Eu	[a]	157	8.0×10^{-1}	4.0×10^{-1}	2	5
Eu	[b]	158	0	0	0	10
Gd	[a]	159	4.6×10^{-1}	2.3×10^{-1}	2	4

a -- ORNL 2127, Part 1, Vol 1, "Uranium-235 Fission-Product Production as a Function of Thermal Neutron Flux, Irradiation Time, and Decay Time". J. O. Blomeke and Mary F. Todd.

b -- 1960 Nucleonics, Vol 18, No. 11 "Table of Radioactive Nuclide". John F. Stehn.

c -- "Nuclear Data Sheets" of the Nuclear Data Project of the National Academy of Sciences -- National Research Council provided 1958 - 1965 Data.

g -- Assumed average value.

TABLE II

GAMMA ENERGY RANGE AND CONVERSION
FACTORS USED IN EXTERNAL DOSE CALCULATIONS

Gamma Energy Group	Gamma Energy Range Covered (MeV/ γ)	Average Gamma Energy Considered (MeV/ γ)	Total ^[a] Absorption Coefficient for Air (m ⁻¹)	Energy ^[b] Absorption Coefficient for Tissue (m ⁻¹)	Conversion Factor ^[c] (rem-m ²)
1	0.020 to 0.030	0.025	4.95×10^{-2}	2.70×10^1	1.080×10^{-14}
2	0.030 to 0.050	0.040	2.64×10^{-2}	7.50×10^0	4.800×10^{-15}
3	0.050 to 0.100	0.075	1.87×10^{-2}	2.80×10^0	3.360×10^{-15}
4	0.100 to 0.300	0.200	1.37×10^{-2}	2.90×10^0	9.280×10^{-15}
5	0.300 to 0.500	0.400	1.04×10^{-2}	3.20×10^0	2.048×10^{-14}
6	0.500 to 0.800	0.650	8.46×10^{-3}	3.20×10^0	3.328×10^{-14}
7	0.800 to 1.000	0.900	7.36×10^{-3}	3.05×10^0	4.392×10^{-14}
8	1.000 to 2.000	0.500	5.60×10^{-3}	2.70×10^0	6.480×10^{-14}
9	2.000 to 6.000	3.700	3.40×10^{-3}	2.10×10^0	1.243×10^{-13}
10	0.0	0.0	0.0	0.0	0.0

[a] Based on the density of air, $1.099 \times 10^3 \frac{\text{g}}{\text{m}^3}$.

[b] Based on the density of tissue, $1.0 \times 10^6 \frac{\text{g}}{\text{m}^3}$.

[c] Conversion factor = (A) (B) (C)

where

A = energy absorption coefficient for tissue (m⁻¹)

$$B = 1.6 \times 10^{-6} \frac{\text{ergs g-rad (m}^3\text{)}}{\text{MeV } 100 \text{ ergs } 1 \times 10^6 \text{ g}} = 1.6 \times 10^{-14} \frac{\text{rad-m}^3}{\text{MeV}}$$

C = average gamma energy considered (MeV/ γ).

TABLE III
PARAMETERS AND CONVERSION FACTORS
FOR INHALATION DOSE CALCULATIONS

Isotope	Organ Affected							
	Bone				Kidney			
	T_b	F_a	E	C_f	T_b	F_a	E	C_f
Ga-72	1.2×10^1	7.5×10^{-2}	2.6×10^0	2.1×10^{-12}	9.0×10^0	5.0×10^{-3}	8.9×10^{-1}	2.4×10^{-13}
As-77					5.5×10^2	2.7×10^{-3}	2.4×10^{-1}	3.5×10^{-14}
Br-82								
Rb-86								
Rb-87								
Sr-89	1.8×10^4	2.8×10^{-1}	2.8×10^0	1.8×10^{-12}				
Sr-90	1.8×10^4	1.2×10^{-1}	5.5×10^0	1.5×10^{-12}				
Sr-91	1.8×10^4	2.8×10^{-1}	6.4×10^0	4.1×10^{-12}				
Sr-92	1.8×10^4	2.8×10^{-1}	8.0×10^0	5.1×10^{-12}				
Y-90	1.8×10^4	1.9×10^{-1}	4.4×10^0	1.9×10^{-12}				
Y-91m	1.8×10^4	1.9×10^{-1}	3.0×10^0	1.3×10^{-12}				
Y-91	1.8×10^4	1.9×10^{-1}	2.9×10^0	1.3×10^{-12}				
Y-92	1.8×10^4	1.9×10^{-1}	6.9×10^0	3.0×10^{-12}				
Y-93	1.8×10^4	1.9×10^{-1}	6.5×10^0	2.8×10^{-12}				
Zr-93	1.0×10^3	9.0×10^{-2}	1.1×10^{-1}	2.3×10^{-14}	9.0×10^2	5.0×10^{-3}	2.4×10^{-2}	6.4×10^{-15}
Zr-95	1.0×10^3	9.0×10^{-2}	1.1×10^0	2.3×10^{-13}	9.0×10^2	5.0×10^{-3}	4.6×10^{-1}	1.2×10^{-13}
Zr-97	1.0×10^3	9.0×10^{-2}	6.2×10^0	1.3×10^{-12}	9.0×10^2	5.0×10^{-3}	1.5×10^0	4.0×10^{-13}
Nb-95	1.0×10^3	1.0×10^{-1}	3.7×10^{-1}	8.5×10^{-14}	7.6×10^2	5.0×10^{-3}	2.0×10^{-1}	5.3×10^{-14}
Nb-97	1.0×10^3	1.0×10^{-1}	2.4×10^0	5.5×10^{-13}	7.6×10^2	5.0×10^{-3}	6.0×10^{-1}	1.6×10^{-13}
Mo-99					3.0×10^0	5.0×10^{-2}	4.1×10^{-1}	1.1×10^{-12}
Tc-99m	2.5×10^1	1.0×10^{-3}	2.0×10^{-2}	4.6×10^{-17}	2.0×10^1	5.0×10^{-3}	2.5×10^{-2}	6.5×10^{-15}
Tc-99	2.5×10^1	1.0×10^{-3}	4.7×10^{-1}	1.1×10^{-16}	2.0×10^1	5.0×10^{-3}	9.4×10^{-2}	2.5×10^{-14}
Ru-103	1.6×10^1	2.0×10^{-2}	6.2×10^{-1}	2.8×10^{-14}	2.5×10^0	5.0×10^{-2}	2.2×10^{-1}	5.9×10^{-13}
Ru-105	1.6×10^1	2.0×10^{-2}	3.5×10^0	1.6×10^{-13}	2.5×10^0	5.0×10^{-2}	8.4×10^{-1}	2.2×10^{-12}
Ru-106	1.6×10^1	2.0×10^{-2}	6.5×10^0	3.0×10^{-13}	2.5×10^0	5.0×10^{-2}	1.3×10^0	3.5×10^{-12}
Rh-105	1.7×10^1	2.0×10^{-2}	9.5×10^{-1}	4.4×10^{-14}	2.8×10^1	1.0×10^{-2}	1.9×10^{-1}	1.1×10^{-13}
Pd-109					3.0×10^1	3.0×10^{-2}	4.2×10^{-1}	6.7×10^{-13}
Ag-111	3.0×10^1	1.3×10^{-2}	1.8×10^0	5.4×10^{-14}	1.0×10^1	5.0×10^{-3}	3.7×10^{-1}	9.9×10^{-14}
Cd-115					3.0×10^2	2.5×10^{-2}	5.6×10^{-1}	7.5×10^{-13}
In-115	5.7×10^1	4.0×10^{-2}	8.5×10^{-1}	7.8×10^{-14}	6.0×10^1	1.0×10^{-2}	1.7×10^{-1}	9.1×10^{-14}
Sn-125	1.0×10^2	8.0×10^{-2}	4.8×10^0	8.8×10^{-13}				
Sb-125	1.0×10^2	3.0×10^{-2}	6.9×10^{-1}	4.7×10^{-14}				
Te-127m	3.0×10^1	3.4×10^{-2}	1.5×10^0	1.2×10^{-13}	3.0×10^1	3.0×10^{-2}	3.2×10^{-1}	5.1×10^{-13}
Te-127	3.0×10^1	3.4×10^{-2}	1.2×10^0	9.3×10^{-14}	3.0×10^1	3.0×10^{-2}	2.4×10^{-1}	3.8×10^{-13}
Te-129m	3.0×10^1	3.4×10^{-2}	3.2×10^0	2.5×10^{-13}	3.0×10^1	3.0×10^{-2}	7.8×10^{-1}	1.2×10^{-12}

TABLE III (Contd.)
PARAMETERS AND CONVERSION FACTORS
FOR INHALATION DOSE CALCULATIONS

Isotope	Organ Affected							
	Bone				Kidney			
	T_b	F_a	E	C_f	T_b	F_a	E	C_f
Te-129	3.0×10^1	3.4×10^{-2}	2.8×10^0	2.2×10^{-13}	3.0×10^1	3.0×10^{-2}	6.8×10^{-1}	1.1×10^{-12}
Te-131m	3.0×10^1	3.4×10^{-2}	2.6×10^0	2.0×10^{-13}	3.0×10^1	3.0×10^{-2}	8.1×10^{-1}	1.3×10^{-12}
Te-132	3.0×10^1	3.4×10^{-2}	3.1×10^0	2.4×10^{-13}	3.0×10^1	3.0×10^{-2}	9.6×10^{-1}	1.5×10^{-12}
I-129	1.4×10^1	5.3×10^{-2}	3.0×10^{-1}	3.6×10^{-14}	7.0×10^0	3.0×10^{-2}	7.7×10^{-2}	1.2×10^{-13}
I-131	1.4×10^1	5.3×10^{-2}	1.0×10^0	1.2×10^{-13}	7.0×10^0	3.0×10^{-2}	2.7×10^{-1}	4.3×10^{-13}
I-132	1.4×10^1	5.3×10^{-2}	2.7×10^0	3.3×10^{-13}	7.0×10^0	3.0×10^{-2}	8.6×10^{-1}	1.4×10^{-13}
I-133								
I-134								
I-135								
Cs-135	1.4×10^2	3.0×10^{-2}	3.3×10^{-1}	2.3×10^{-14}	4.2×10^1	7.5×10^{-3}	6.6×10^{-2}	2.6×10^{-14}
Cs-137	1.4×10^2	3.0×10^{-2}	1.4×10^0	9.6×10^{-14}	4.2×10^1	7.5×10^{-3}	3.7×10^{-1}	1.5×10^{-13}
Ba-140	6.5×10^1	1.9×10^{-1}	4.2×10^0	1.8×10^{-12}	8.5×10^0	2.8×10^{-5}	1.2×10^0	1.8×10^{-15}
La-140	1.0×10^3	1.0×10^{-1}	2.7×10^0	6.2×10^{-13}				
Ce-141	1.5×10^3	7.5×10^{-2}	8.1×10^{-1}	1.4×10^{-13}	5.6×10^2	5.0×10^{-3}	1.8×10^{-1}	4.8×10^{-14}
Ce-143	1.5×10^3	7.5×10^{-2}	3.8×10^0	6.5×10^{-13}	5.6×10^2	5.0×10^{-3}	8.2×10^{-1}	2.2×10^{-13}
Ce-144	1.5×10^3	7.5×10^{-2}	6.3×10^0	1.1×10^{-12}	5.6×10^2	5.0×10^{-3}	1.3×10^0	3.5×10^{-13}
Pr-143	1.5×10^3	1.0×10^{-1}	1.6×10^0	3.7×10^{-13}	7.5×10^2	5.0×10^{-3}	3.2×10^{-1}	8.5×10^{-14}
Nd-147	1.5×10^3	9.0×10^{-2}	1.4×10^0	2.9×10^{-13}	6.6×10^2	1.0×10^{-2}	3.1×10^{-1}	1.7×10^{-13}
Nd-149	1.5×10^3	9.0×10^{-2}	4.7×10^0	9.7×10^{-13}	6.6×10^2	1.0×10^{-2}	9.7×10^{-1}	5.2×10^{-13}
Pm-147	1.5×10^3	9.0×10^{-2}	3.5×10^{-1}	7.2×10^{-14}	6.6×10^2	5.0×10^{-3}	6.9×10^{-2}	1.8×10^{-15}
Sm-153	1.5×10^3	9.0×10^{-2}	1.1×10^0	2.3×10^{-13}	6.6×10^2	5.0×10^{-3}	2.5×10^{-1}	6.7×10^{-14}
Eu-155	1.5×10^3	9.0×10^{-2}	2.8×10^{-1}	5.8×10^{-14}	1.5×10^3	7.5×10^{-3}	8.3×10^{-2}	3.3×10^{-14}
Gd-159	1.0×10^3	1.1×10^{-1}	7.5×10^{-1}	1.9×10^{-13}				
Isotope	Organ Affected							
	Liver				Lung			
	T_b	F_a	E	C_f	T_b	F_a	E	C_f
Ga-72	4.8×10^0	6.3×10^{-2}	1.1×10^0	6.5×10^{-13}	1.2×10^2	1.2×10^{-1}	1.1×10^0	2.1×10^{-12}
As-77	5.5×10^2	8.0×10^{-3}	2.4×10^{-1}	1.8×10^{-14}	1.2×10^2	1.2×10^{-1}	2.4×10^{-1}	4.6×10^{-13}
Br-82					1.2×10^2	1.2×10^{-1}	8.5×10^{-1}	1.6×10^{-12}
Rb-86	6.3×10^1	4.0×10^{-2}	6.6×10^{-1}	2.5×10^{-13}	1.2×10^2	1.2×10^{-1}	6.6×10^{-1}	1.3×10^{-12}
Rb-87	6.3×10^1	4.0×10^{-2}	9.0×10^{-2}	3.4×10^{-14}	1.2×10^2	1.2×10^{-1}	9.0×10^{-2}	1.7×10^{-13}
Sr-89					1.2×10^2	1.2×10^{-1}	5.5×10^{-1}	1.1×10^{-12}
Sr-90					1.2×10^2	1.2×10^{-1}	1.1×10^0	2.1×10^{-12}
Sr-91					1.2×10^2	1.2×10^{-1}	1.6×10^0	3.1×10^{-12}
Sr-92					1.2×10^2	1.2×10^{-1}	2.0×10^0	3.8×10^{-12}

TABLE III (Contd.)
PARAMETERS AND CONVERSION FACTORS
FOR INHALATION DOSE CALCULATIONS

Isotope	Organ Affected							
	Liver				Lung			
	T_b	F_a	E	C_f	T_b	F_a	E	C_f
Y-90					1.2×10^2	1.2×10^{-1}	8.9×10^{-1}	1.7×10^{-12}
Y-91m					1.2×10^2	1.2×10^{-1}	5.5×10^{-1}	1.1×10^{-12}
Y-91					1.2×10^2	1.2×10^{-1}	5.9×10^{-1}	1.1×10^{-12}
Y-92					1.2×10^2	1.2×10^{-1}	1.5×10^0	2.9×10^{-12}
Y-93					1.2×10^2	1.2×10^{-1}	1.5×10^0	2.9×10^{-12}
Zr-93	3.2×10^2	2.0×10^{-2}	2.5×10^{-2}	4.7×10^{-15}	1.2×10^2	1.2×10^{-1}	2.0×10^{-2}	3.8×10^{-14}
Zr-95	3.2×10^2	2.0×10^{-2}	5.7×10^{-1}	1.1×10^{-13}	1.2×10^2	1.2×10^{-1}	5.2×10^{-1}	1.0×10^{-12}
Zr-97	3.2×10^2	2.0×10^{-2}	1.6×10^0	3.0×10^{-13}	1.2×10^2	1.2×10^{-1}	1.6×10^0	3.1×10^{-12}
Nb-95	8.5×10^2	2.0×10^{-2}	2.6×10^{-1}	4.9×10^{-14}	1.2×10^2	1.2×10^{-1}	2.6×10^{-1}	5.0×10^{-13}
Nb-97	8.5×10^2	2.0×10^{-2}	6.4×10^{-1}	1.2×10^{-14}	1.2×10^2	1.2×10^{-1}	6.4×10^{-1}	1.2×10^{-12}
Mo-99	4.5×10^1	6.5×10^{-2}	4.4×10^{-1}	2.7×10^{-13}	1.2×10^2	1.2×10^{-1}	4.5×10^{-1}	8.5×10^{-13}
Tc-99m	3.0×10^1	1.5×10^{-3}	3.5×10^{-2}	4.9×10^{-16}	1.2×10^2	1.2×10^{-1}	3.5×10^{-2}	6.7×10^{-14}
Tc-99	3.0×10^1	1.5×10^{-3}	9.4×10^{-2}	1.3×10^{-15}	1.2×10^2	1.2×10^{-1}	9.4×10^{-2}	1.8×10^{-13}
Ru-103					1.2×10^2	1.2×10^{-1}	2.7×10^{-1}	5.2×10^{-13}
Ru-105					1.2×10^2	1.2×10^{-1}	9.1×10^{-1}	1.7×10^{-12}
Ru-106					1.2×10^2	1.2×10^{-1}	1.4×10^0	2.7×10^{-12}
Rh-105	1.8×10^1	1.4×10^{-2}	1.9×10^{-1}	2.5×10^{-14}	1.2×10^2	1.2×10^{-1}	1.9×10^{-1}	3.6×10^{-13}
Pd-109	1.9×10^1	3.0×10^{-2}	4.2×10^{-1}	1.2×10^{-13}	1.2×10^2	1.2×10^{-1}	4.2×10^{-1}	8.1×10^{-13}
Ag-111	1.5×10^1	7.7×10^{-3}	3.8×10^{-1}	2.8×10^{-14}	1.2×10^2	1.2×10^{-1}	3.8×10^{-1}	7.3×10^{-13}
Cd-115	2.0×10^2	1.0×10^{-1}	5.0×10^{-1}	1.0×10^{-12}	1.2×10^2	1.2×10^{-1}	5.0×10^{-1}	1.1×10^{-12}
In-115	5.8×10^1	4.0×10^{-2}	1.7×10^{-1}	6.4×10^{-14}	1.2×10^2	1.2×10^{-1}	1.7×10^{-1}	3.3×10^{-13}
Sn-125	7.0×10^1	2.8×10^{-3}	9.4×10^{-1}	2.5×10^{-14}	1.2×10^2	1.2×10^{-1}	9.6×10^{-1}	1.8×10^{-12}
Sb-125	3.8×10^1	5.0×10^{-4}	2.3×10^{-1}	1.1×10^{-15}	1.2×10^2	1.2×10^{-1}	2.6×10^{-1}	5.0×10^{-13}
Te-127m	3.0×10^1	2.0×10^{-2}	3.2×10^{-1}	6.0×10^{-14}	1.2×10^2	1.2×10^{-1}	3.2×10^{-1}	6.1×10^{-13}
Te-127	3.0×10^1	2.0×10^{-2}	2.4×10^{-1}	4.5×10^{-14}	1.2×10^2	1.2×10^{-1}	2.4×10^{-1}	4.6×10^{-13}
Te-129m	3.0×10^1	2.0×10^{-2}	8.3×10^{-1}	1.6×10^{-13}	1.2×10^2	1.2×10^{-1}	8.3×10^{-1}	1.6×10^{-12}
Te-129	3.0×10^1	2.0×10^{-2}	7.3×10^{-1}	1.4×10^{-13}	1.2×10^2	1.2×10^{-1}	7.3×10^{-1}	1.4×10^{-12}
Te-131m	3.0×10^1	2.0×10^{-2}	9.7×10^{-1}	1.8×10^{-13}	1.2×10^2	1.2×10^{-1}	1.0×10^0	1.9×10^{-12}
Te-132	3.0×10^1	2.0×10^{-2}	1.1×10^0	2.1×10^{-13}	1.2×10^2	1.2×10^{-1}	1.1×10^0	2.1×10^{-12}
I-129	7.0×10^0	9.0×10^{-2}	8.2×10^{-2}	7.0×10^{-14}	1.2×10^2	1.2×10^{-1}	8.2×10^{-2}	1.6×10^{-13}
I-131	7.0×10^0	9.0×10^{-2}	3.0×10^{-1}	2.6×10^{-13}	1.2×10^2	1.2×10^{-1}	3.0×10^{-1}	5.8×10^{-13}
I-132	7.0×10^0	9.0×10^{-2}	1.0×10^0	8.5×10^{-13}	1.2×10^2	1.2×10^{-1}	1.0×10^0	1.9×10^{-12}
I-133					1.2×10^2	1.2×10^{-1}	6.4×10^{-1}	1.2×10^{-12}
I-134					1.2×10^2	1.2×10^{-1}	1.1×10^0	2.1×10^{-12}
I-135					1.2×10^2	1.2×10^{-1}	7.7×10^{-1}	1.5×10^{-12}

TABLE III (Contd.)

PARAMETERS AND CONVERSION FACTORS
FOR INHALATION DOSE CALCULATIONS

Isotope	Organ Affected							
	Liver				Lung			
	T_b	F_a	E	C_f	T_b	F_a	E	C_f
Cs-135	9.0×10^1	5.0×10^{-2}	6.6×10^{-2}	3.1×10^{-14}	1.2×10^2	1.2×10^{-1}	6.6×10^{-2}	1.3×10^{-13}
Cs-137	9.0×10^1	5.0×10^{-2}	4.1×10^{-1}	1.9×10^{-13}	1.2×10^2	1.2×10^{-1}	4.1×10^{-1}	7.9×10^{-13}
Ba-140	9.8×10^2	1.7×10^{-4}	1.4×10^0	2.2×10^{-15}	1.2×10^2	1.2×10^{-1}	1.4×10^0	2.7×10^{-12}
La-140	4.0×10^2	4.0×10^{-2}	1.1×10^0	4.1×10^{-13}	1.2×10^2	1.2×10^{-1}	1.1×10^0	2.1×10^{-12}
Ce-141	2.9×10^2	6.0×10^{-2}	1.8×10^{-1}	1.0×10^{-13}	1.2×10^2	1.2×10^{-1}	1.8×10^{-1}	3.5×10^{-13}
Ce-143	2.9×10^2	6.0×10^{-2}	8.5×10^{-1}	4.8×10^{-13}	1.2×10^2	1.2×10^{-1}	8.3×10^{-1}	1.6×10^{-12}
Ce-144	2.9×10^2	6.0×10^{-2}	1.3×10^0	7.3×10^{-13}	1.2×10^2	1.2×10^{-1}	1.3×10^0	2.5×10^{-12}
Pr-143	3.8×10^2	5.0×10^{-2}	3.2×10^{-1}	1.5×10^{-13}	1.2×10^2	1.2×10^{-1}	3.2×10^{-1}	6.1×10^{-13}
Nd-147	1.3×10^2	1.3×10^{-1}	3.2×10^{-1}	3.9×10^{-13}	1.2×10^2	1.2×10^{-1}	3.0×10^{-1}	5.8×10^{-13}
Nd-149	1.3×10^2	1.3×10^{-1}	9.9×10^{-1}	1.2×10^{-12}	1.2×10^2	1.2×10^{-1}	9.9×10^{-1}	1.9×10^{-12}
Pm-147	6.6×10^2	2.0×10^{-2}	6.9×10^{-2}	1.3×10^{-14}	1.2×10^2	1.2×10^{-1}	6.9×10^{-2}	1.3×10^{-13}
Sm-153	1.9×10^2	9.0×10^{-2}	2.6×10^{-1}	2.2×10^{-13}	1.2×10^2	1.2×10^{-1}	2.6×10^{-1}	5.0×10^{-13}
Eu-155	1.3×10^2	6.0×10^{-2}	9.5×10^{-2}	5.4×10^{-14}	1.2×10^2	1.2×10^{-1}	9.5×10^{-2}	1.8×10^{-13}
Gd-159	4.6×10^2	3.0×10^{-2}	3.3×10^{-1}	9.3×10^{-14}	1.2×10^2	1.2×10^{-1}	3.3×10^{-1}	6.3×10^{-13}

Isotope	Organ Affected							
	Thyroid				Total Body			
	T_b	F_a	E	C_f	T_b	F_a	E	C_f
Ga-72					6.0×10^0	2.5×10^{-1}	1.8×10^0	1.0×10^{-13}
As-77					2.8×10^2	2.7×10^{-1}	2.4×10^{-1}	1.5×10^{-14}
Br-82					8.0×10^0	7.5×10^{-1}	1.8×10^0	3.1×10^{-13}
Rb-86					4.5×10^1	7.5×10^{-1}	7.0×10^{-1}	1.2×10^{-13}
Rb-87					4.5×10^1	7.5×10^{-1}	9.0×10^{-2}	1.6×10^{-14}
Sr-89					1.3×10^4	4.0×10^{-1}	5.5×10^{-1}	5.0×10^{-14}
Sr-90					1.3×10^4	4.0×10^{-1}	1.1×10^0	1.0×10^{-13}
Sr-91					1.3×10^4	4.0×10^{-1}	2.2×10^0	2.0×10^{-13}
Sr-92					1.3×10^4	4.0×10^{-1}	2.6×10^0	2.4×10^{-13}
Y-90					1.4×10^4	2.5×10^{-1}	8.9×10^{-1}	5.1×10^{-14}
Y-91m					1.4×10^4	2.5×10^{-1}	9.3×10^{-1}	5.3×10^{-14}
Y-91					1.4×10^4	2.5×10^{-1}	5.9×10^{-1}	3.4×10^{-14}
Y-92					1.4×10^4	2.5×10^{-1}	1.6×10^0	9.2×10^{-14}
Y-93					1.4×10^4	2.5×10^{-1}	1.7×10^0	9.7×10^{-14}
Zr-93					4.5×10^2	2.5×10^{-1}	2.4×10^{-2}	1.4×10^{-15}
Zr-95					4.5×10^2	2.5×10^{-1}	1.1×10^0	6.3×10^{-14}
Zr-97					4.5×10^2	2.5×10^{-1}	2.1×10^0	1.2×10^{-13}

TABLE III (Contd.)
PARAMETERS AND CONVERSION FACTORS
FOR INHALATION DOSE CALCULATIONS

Isotope	Organ Affected							
	Thyroid				Total Body			
	T_b	F_a	E	C_f	T_b	F_a	E	C_f
Nb-95					7.6×10^2	2.5×10^{-1}	5.1×10^{-1}	2.9×10^{-14}
Nb-97					7.6×10^2	2.5×10^{-1}	8.7×10^{-1}	5.0×10^{-14}
Mo-99					5.0×10^0	6.5×10^{-1}	6.1×10^{-1}	9.1×10^{-14}
Tc-99m					1.0×10^0	5.0×10^{-1}	8.0×10^{-2}	9.2×10^{-14}
Tc-99					1.0×10^0	5.0×10^{-1}	9.4×10^{-2}	1.1×10^{-14}
Ru-103					7.3×10^0	2.7×10^{-1}	4.4×10^{-1}	2.7×10^{-14}
Ru-105					7.3×10^0	2.7×10^{-1}	1.2×10^0	7.4×10^{-14}
Ru-106					7.3×10^0	2.7×10^{-1}	1.4×10^0	8.7×10^{-14}
Rh-105					1.0×10^1	3.5×10^{-1}	2.0×10^{-1}	1.6×10^{-14}
Pd-109					5.0×10^0	3.5×10^{-1}	4.2×10^{-1}	3.4×10^{-14}
Ag-111					5.0×10^0	2.6×10^{-1}	4.0×10^{-1}	2.4×10^{-14}
Cd-115					2.0×10^2	2.5×10^{-1}	7.1×10^{-1}	4.1×10^{-14}
In-115	8.4×10^0	1.0×10^{-4}	1.7×10^{-1}	1.4×10^{-13}	4.8×10^1	2.5×10^{-1}	1.7×10^{-1}	9.7×10^{-15}
Sn-125	7.0×10^1	2.8×10^{-5}	9.3×10^{-1}	2.1×10^{-14}	3.5×10^1	2.8×10^{-1}	9.4×10^{-1}	6.0×10^{-14}
Sb-125	4.0×10^0	8.0×10^{-6}	1.5×10^{-1}	9.6×10^{-16}	3.8×10^1	2.7×10^{-1}	3.4×10^{-1}	2.1×10^{-14}
Te-127m	9.0×10^0	3.8×10^{-4}	3.0×10^{-1}	9.1×10^{-14}	1.5×10^1	3.8×10^{-1}	3.2×10^{-1}	2.8×10^{-14}
Te-127	9.0×10^0	3.8×10^{-4}	2.4×10^{-1}	7.3×10^{-14}	1.5×10^1	3.8×10^{-1}	2.4×10^{-1}	2.1×10^{-14}
Te-129m	9.0×10^0	3.8×10^{-4}	6.8×10^{-1}	2.1×10^{-13}	1.5×10^1	3.8×10^{-1}	1.1×10^0	9.6×10^{-14}
Te-129	9.0×10^0	3.8×10^{-4}	6.0×10^{-1}	1.8×10^{-13}	1.5×10^1	3.8×10^{-1}	9.8×10^{-1}	8.5×10^{-14}
Te-131m	9.0×10^0	3.8×10^{-4}	6.9×10^{-1}	2.1×10^{-13}	1.5×10^1	3.8×10^{-1}	1.6×10^0	1.4×10^{-13}
Te-132	9.0×10^0	3.8×10^{-4}	7.4×10^{-1}	2.3×10^{-13}	1.5×10^1	3.8×10^{-1}	1.9×10^0	1.7×10^{-13}
I-129	1.4×10^2	2.3×10^{-1}	6.8×10^{-2}	1.3×10^{-11}	1.4×10^2	7.5×10^{-1}	8.9×10^{-2}	1.5×10^{-14}
I-131	1.4×10^2	2.3×10^{-1}	2.3×10^{-1}	4.2×10^{-11}	1.4×10^2	7.5×10^{-1}	4.4×10^{-1}	7.6×10^{-14}
I-132	1.4×10^2	2.3×10^{-1}	6.5×10^{-1}	1.2×10^{-10}	1.4×10^2	7.5×10^{-1}	1.7×10^0	2.9×10^{-13}
I-133	1.4×10^2	2.3×10^{-1}	5.4×10^{-1}	9.9×10^{-11}	1.4×10^2	7.5×10^{-1}	8.4×10^{-1}	1.4×10^{-13}
I-134	1.4×10^2	2.3×10^{-1}	8.2×10^{-1}	1.5×10^{-10}	1.4×10^2	7.5×10^{-1}	1.5×10^0	2.6×10^{-13}
I-135	1.4×10^2	2.3×10^{-1}	5.2×10^{-1}	9.6×10^{-11}	1.4×10^2	7.5×10^{-1}	1.3×10^0	2.2×10^{-13}
Cs-135					7.0×10^1	7.5×10^{-1}	6.6×10^{-2}	1.1×10^{-14}
Cs-137					7.0×10^1	7.5×10^{-1}	5.9×10^{-1}	1.0×10^{-13}
Ba-140					6.5×10^1	2.8×10^{-1}	2.3×10^0	1.5×10^{-13}
La-140					5.0×10^2	2.5×10^{-1}	1.9×10^0	1.1×10^{-13}
Ce-141					5.6×10^2	2.5×10^{-1}	2.1×10^{-1}	1.2×10^{-14}
Ce-143					5.6×10^2	2.5×10^{-1}	9.7×10^{-1}	5.6×10^{-14}
Ce-144					5.6×10^2	2.5×10^{-1}	1.3×10^0	7.4×10^{-14}
Pr-143					7.5×10^2	2.5×10^{-1}	3.2×10^{-1}	1.8×10^{-14}

TABLE III (Contd.)
PARAMETERS AND CONVERSION FACTORS
FOR INHALATION DOSE CALCULATIONS

Isotope	Organ Affected							
	Thyroid				Total Body			
	T_b	F_a	E	C_f	T_b	F_a	E	C_f
Nd-147					6.6×10^2	2.5×10^{-1}	4.0×10^{-1}	2.3×10^{-14}
Nd-149					6.6×10^2	2.5×10^{-1}	1.1×10^0	6.3×10^{-14}
Pm-147					6.6×10^2	2.5×10^{-1}	6.9×10^{-2}	4.0×10^{-15}
Sm-153					6.6×10^2	2.5×10^{-1}	3.0×10^{-1}	1.7×10^{-14}
Eu-155					6.4×10^2	2.5×10^{-1}	1.6×10^{-1}	9.2×10^{-15}
Gd-159					5.5×10^2	2.5×10^{-1}	3.6×10^{-1}	2.1×10^{-14}

Isotope	Organ Affected							
	Muscle				Testes			
	T_b	F_a	E	C_f	T_b	F_a	E	C_f
Ga-72								
As-77								
Br-82								
Rb-86	8.0×10^1	3.4×10^{-1}	7.0×10^{-1}	1.3×10^{-13}				
Rb-87	8.0×10^1	3.4×10^{-1}	9.0×10^{-2}	1.6×10^{-14}				
Sr-89								
Sr-90								
Sr-91								
Sr-92								
Y-90								
Y-91m								
Y-91								
Y-92								
Y-93								
Zr-93								
Zr-95								
Zr-97								
Nb-95								
Nb-97								
Mo-99								
Tc-99m								
Tc-99								
Ru-103								
Ru-105								
Ru-106								

TABLE III (Contd.)
PARAMETERS AND CONVERSION FACTORS
FOR INHALATION DOSE CALCULATIONS

Isotope	Organ Affected							
	Muscle				Testes			
	T_b	F_a	E	C_f	T_b	F_a	E	C_f
Rh-105								
Pd-109								
Ag-111								
Cd-115								
In-115								
Sn-125								
Sb-125								
Te-127m					3.0×10^1	1.1×10^{-3}	3.1×10^{-1}	1.4×10^{-13}
Te-127					3.0×10^1	1.1×10^{-3}	2.4×10^{-1}	1.1×10^{-13}
Te-129m					3.0×10^1	1.1×10^{-3}	6.9×10^{-1}	3.0×10^{-13}
Tc-129					3.0×10^1	1.1×10^{-3}	6.0×10^{-1}	2.6×10^{-13}
Te-131m								
Te-132					3.0×10^1	1.1×10^{-3}	7.3×10^{-1}	3.2×10^{-13}
I-129					7.0×10^0	3.8×10^{-3}	6.8×10^{-2}	1.0×10^{-13}
I-131								
I-132					7.0×10^0	3.8×10^{-3}	6.5×10^{-1}	9.9×10^{-13}
I-133								
I-134								
I-135								
Cs-135	1.4×10^2	3.0×10^{-1}	6.6×10^{-2}	1.1×10^{-14}				
Cs-137	1.4×10^2	3.0×10^{-1}	5.9×10^{-1}	9.4×10^{-14}				
Ba-140	2.0×10^3	8.3×10^{-4}	2.3×10^0	1.0×10^{-15}				
La-140								
Ce-141								
Ce-143								
Ce-144								
Pr-143								
Nd-147								
Nd-149								
Pm-147								
Sm-153								
Eu-155								
Gd-159								

2. INPUT AND OUTPUT FOR RSAC

2.1 Input

Input information does not have a specific format for each card. There can be as few or as many data fields as desired per card. However, the information should not exceed the first 72 columns on the card.

The types of data fields are listed below.

(1) Floating point numbers

$\pm XXXX \pm EE$

where the decimal point is assumed XXXX (eg, $\pm .XXXX$). The number XXXX may range from one digit to seven digits. The number EE is a power of ten and may range from 0 to 38. The plus sign at the beginning may be omitted; however, a negative sign cannot.

(2) Integer numbers are of the form

$\pm XXXX$

where XXXX may range from one digit to seven digits. The plus sign may be omitted.

(3) Alphanumeric fields

ZZZZZZ

where Z is:

- (a) any alphabetic character
- (b) any numeric character
- (c) any special character such as a blank, a comma, ?, *, =, (,), +, -, ., or \$ (except that \$ cannot be the first character on a card).

Included in the RSAC program is a data editing program (DEP) which will read the data and give estimated lines of output and estimated calculation time on the computer. When an error is encountered in either RSAC or DEP, the data card in which the error occurred is printed with an error message and the program is halted. Listed below are the possible types of error messages.

(1) XXXXXX LOCATION. AN ILLEGAL CHARACTER IS IN A NUMERIC DATA FIELD. EXECUTION TERMINATED.

In a numeric data field, only numbers and plus or minus signs may occur.

- (2) XXXXXX LOCATION. AN ILLEGAL INTEGER NUMBER ENCOUNTERED. EXECUTION TERMINATED.

In an integer number, plus or minus signs may occur only at the beginning of the number.

- (3) XXXXXX LOCATION. AN ILLEGAL DECIMAL NUMBER ENCOUNTERED. EXECUTION TERMINATED.

In a decimal or floating point number, there must be a sign between the number and the exponent.

- (4) XXXXXX LOCATION. AN ILLEGAL BCD WORD ENCOUNTERED. EXECUTION TERMINATED.

A binary coded decimal (BCD) word or an alphanumeric field must end with a comma or a blank.

- (5) XXXXXX LOCATION. AN EXPONENT NOT IN THE LEGAL RANGE. EXECUTION TERMINATED.

The exponent of a floating point number must be greater than or equal to -38 and less than or equal to +38.

2.2 Output (See Sample Problems, page 79.)

If additional information is desired, it is possible to enter an information card which has a blank in column one. This card can have any information in the rest of the card. The card will be printed when it is read in by RSAC or DEP.

All of the data which are unique to any particular problem (ie, deposition velocities, release and exposure times, leakage constants, etc) are part of the normal output.

2.3 Data Edit Program (DEP)

The DEP program reads the data which are needed for the RSAC program and estimates the number of lines of output and the calculation time which is required on the IBM 7040 for any combination of problems, assuming that the standard set of chains and isotopes is used. It has the same error comments as the RSAC program, and it prints out all data pertaining to each problem as well as all comment cards (ie, cards with a blank in Column 1).

2.4 Input Format for RSAC

AOR-0011

DET = 7

DET = 6

DET = 5

DET = 4

AOR - 0014

AOR-0013

STANDARD DATA DECK

AOR-0016

LEGEND

LOCATION

QUESTION BOX

READ A FLOATING POINT NUMBER

READ AN ALPHANUMERIC WORD

READ CONTENTS OF BOX, N TIMES

READ AN INTEGER NUMBER

AOR-0017

3. GLOSSARY OF TERMS FOR INPUT TO RSAC

tempa	Control word, calculate F.P.I. or read F.P.I. from tape
ubar	Wind speed (m/sec)
time	Time (sec)
die	Downwind distance (m)
power	Power (watts)
conv	Conversion factor (fission/watt-sec)
add	Control work clean core or old core
trop	Reactor operating time (sec)
ttrop	Control work [shutdown time (sec) refueling, shutdown, or release]
w3	Functional exponent corresponding to the vertical diffusion coefficient
w2	Functional exponent corresponding to the horizontal diffusion coefficient
w1	Average of w2 and w3
sh	Stack height (m)
h	Inversion height (m)
ambda	Washout factor (1/m)
vg(Cs)	Settling velocity for Cs (m/sec)
vg(NG)	Settling velocity for the Noble Gases (m/sec)
vg(Hal)	Settling velocity for the Halogens (m/sec)
vg(Sol)	Settling velocity for the Solids (m/sec)
nk1	Number of exponentials used to approximate the leak rate curve (max. of 10)
k1	Linear constant in leak rate curve (1/sec)
k2	Exponential constant in leak rate curve (1/sec)
lb	Number of crosswind distances (max. of 25)
elb	Crosswind distance (m)
cy	Horizontal diffusion coefficient ($m^{N/2}$)

cz	Vertical diffusion coefficient ($m^{N/2}$)
tempo	Percent of core remaining after refueling
ncha	Control word total F.P.I., by element group, or total F.P.I. except certain elements
tempc	Percent of F.P.I. released
tempd	Percent of F.P.I. released, except for certain elements
chna	Atomic number of element
tempe	Percent released for that element
%Cs	Percent released for Cs
%NG	Percent released for the Noble Gases
%Hal	Percent released for the Halogens
%Sol	Percent released for the Solids
nchb	Control word (number of chains to be printed) normally zero
chnb	Chain number to be printed*
det	Control word, what to do next
1 betad	Routine to calculate F.P.I. in MeV/sec (cannot print F.P.I. in curies if F.P.I. is calculated in MeV/sec first)
2 depos	Routine to calculate gamma deposition dose
3 inhal	Routine to calculate inhalation dose to a particular organ
4 gamma	Routine to calculate cloud gamma dose
5 decay	Routine to print out F.P.I. in curies
6 new	Routine to run new problem or use old core and rerun the reactor
7 meter	Routine to read in new meteorological conditions
8 wtape	Routine to write F.P.I. on tape
9 rtape	Routine to read F.P.I. from tape
gamen	Gamma energy for each isotope (MeV/dis)

*Chain numbers correspond to the numerical order of the chains rather than the mass number of the chain (ie, the first chain is number one).

tdepos	Time of deposition from cloud for deposition gamma dose
nreg	Number of Hermite points
hakp	Hermite weighting values
hxkp	Hermite points
organ	Organ for inhalation dose
cntrl	Control word, type of output from inhalation dose, and input of cy and cz
nchd	Number of elements which contribute to the dose for the organ
chnd	An element which contributes to the inhalation dose
longb	Biological decay constant for the element (1/sec)
nchc	Control word, type of output for the F.P.I.
chnc	Atomic number of the element to be summed
mtot	Number of chains (max. of 100)
neg	Number of energy groups
ene	Average energy for the group (MeV/ γ)
mu	Linear absorption coefficient of air for the group (1/m)
nu	Conversion factor (rem-m ² / γ)
mmm	Mass number
nnm	Number of isotopes this chain
halm	Half life
longm	Half life code (1-sec, 2-min, 3-hrs, 4-days, and 5-yrs)
elemm	First three characters are half life code (eg, MIN) and the last three characters are the symbol of the element which is right adjusted (eg, γ ZR)
nprotm	Atomic number (eg, I = 53)
yieldm	Fission yield in percent
jgasmd	Element group (3-Cs, 2-Noble Gases, 1-Halogens, and 0-Solids)
jgasma	Energy group
gdmpy	Number of photons per dis

bone	Critical fraction times conversion factor for the bone
g.i.	Critical fraction times conversion factor for the GI tract (no calculation)
kidney	Critical fraction times conversion factor for the kidney
liver	Critical fraction times conversion factor for the liver
lung	Critical fraction times conversion factor for the lung
muscle	Critical fraction times conversion factor for the muscle
testes	Critical fraction times conversion factor for the testes
thyroid	Critical fraction times conversion factor for the thyroid
body	Critical fraction times conversion factor for the body
cntrl	Control word for ingestion and inhalation calculation. If equal to zero, do an inhalation calculation
nui	Control word used in DATAIN
T	Exposure time (sec)
mtot+8	Control word for cloud depletion if greater than zero depletion from cloud is neglected, otherwise depletion is considered
tinha	Inhalation time (sec)
breath	Breathing rate (m^3/sec).

4. SAMPLE PROBLEMS

The following problems were selected to show how to set up the input for typical problems and also to show the form of the output. The data, which involve the decay schemes, the fission yields, and the half lives, were taken, for the most part, from the "Curie" Code [7].

The first problem shows the fission product inventory in curies for a steady state operation and the various doses resulting from a continuous release of these fission products after fractionation.

The second problem shows the fission product inventory in MeV/sec for a transient operation and the various doses resulting from an instantaneous release of these fission products.

91.4,1+2,1,SEC KF,72+2,1,SEC RB,97+1,3,HRS SR,58+2,4,DAY Y
 36,138+1,2,37,79+0,0,38,152+0,0,39,0+0,0
 10,0+0,10,0+0,7,102+1,8,3-2
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 4104-11,0+0,0+0,0+0,30+2-11,0+0,0+0,0+0,1969-12
 1262-11,0+0,0+0,0+0,1133-11,0+0,0+0,0+0,3378-13
 92,4,3+1,1,SEC KF,53+1,1,SEC RB,27+1,3,HRS SR,36+1,3,HRS Y
 36,187+1,2,37,283+1,0,38,6+0,0,39,0+0,0
 10,0+0,10,0+0,8,1+1,7,5122+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 513-11,0+0,0+0,0+0,384-11,0+0,0+0,0+0,2382-12
 3002-11,0+0,0+0,0+0,286-11,0+0,0+0,0+0,916-13
 93,5,2+1,1,SEC KF,56+1,1,SEC RB,79+1,2,MIN SR,103+2,3,HRS Y,1+7,5
 YRS ZR
 36,48+0,2,37,352+1,0,38,2+1,0,39,1+0,0,40,35+0,0
 10,0+0,10,0+0,10,0+0,6,1+1,1,24+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 282E-11,0+0,0+0,0+0,288-11,0+0,0+0,0+0,9733-13
 226E-13,0+0,0+0,0+0,14,47+1-14,384-13,0+0,0+0,0+0,1374-14
 94,4,14+1,1,SEC KF,29+1,1,SEC RB,13+1,2,MIN SR,200+2,2,MIN Y
 36,1+0,2,37,23+1,0,38,23+1,0,39,7+0,0
 10,0+0,10,0+0,10,0+0,8,1+1
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 95,5,5+0,1,SEC KF,4+2,1,SEC SR,1+2,2,MIN Y,65+2,4,DAY ZR,35+2,4,DAY NR
 36,7+0,2,2,38,449+1,0,39,17+1,0,40,0+0,0,41,0+0,0
 10,0+0,10,0+0,10,0+0,6,1022+1,6,1+1
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 226E-12,0+0,1226-12,1074-12,9984-12,0+0,0+0,0+0,6298-13
 847E-13,0+0,533-13,4898-13,4992-12,0+0,0+0,0+0,292E-13
 96,1,234+2,3,HRS NB
 41,57-3,0
 6,311+1
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 97,5,41+0,1,SEC SR,51+0,1,SEC Y,17+2,3,HRS ZR,1+1,2,MIN NB,73+2,2,MIN NB
 38,2+1,0,39,31+1,0,40,14+1,0,41,0+0,0,41,0+0,0
 10,0+0,10,0+0,6,1+1,6,1+1,6,1+1
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 1277-11,0+0,0+0,0+0,3998-12,3014-12,3072-11,0+0,0+0,0+0,1202-12
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 55-12,0+0,1599-12,1206-13,1229-11,0+0,0+0,0+0,4981-13
 98,1,520+2,2,MIN NR
 41,64+1,0
 10,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 99,5,330+2,1,SEC ZR,24-1,2,MIN NB,665+2,3,HRS MO,60+1,3,HRS TC,2+6,5
 YRS TC
 40,52722+1,0,41,0+0,0,42,0+0,0,43,0+0,0,43,0+0,0
 10,0+0,10,0+0,4,1+1,4,1+1,10,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0

0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,1093-11,2694-12,8544-12,0+0,0+0,0+0,908-13
 23 458-16,0+0,6929-14,4946-15,672-13,0+0,0+0,0+0,916-13
 91A1 1076-15,0+0,2505-13,1328-14,1804-12,0+0,0+0,0+0,1098-13
 91A2 99,4,330+2,1,SEC ZR,24+1,2,MIN NB,665+2,3,HRS MO,2+6,5,YRS TC
 91A3 40,7878+0,0,41,0+0,0,42,0+0,0,43,0+0,0
 91A4 10,0+0,10,0+0,4,1+1,10,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 24 0+0,0+0,1093-11,2694-12,8544-12,0+0,0+0,0+0,908-13
 92 1 1076-15,0+0,2505-13,1328-14,1804-12,0+0,0+0,0+0,1098-13
 92 2 100,1,30+1,2,MIN NB
 92 3 41,63+1,0
 92 4 10,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 101,3,10+1,2,MIN NB,146+2,2,MIN MO,1+0+2,2,MIN TC
 41,26+1,0,42,0+0,0,43,0+0,0
 25 10,0+0,6,17+1,4,1+1
 93 1 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 93 2 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 93 3 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 93 4 102,2,115+2,2,MIN MO,41+1,2,MIN TC
 93 5 42,43+1,0,43,0+0,0
 10,0+0,10,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 26 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 94 1 103,3,12+1,2,MIN TC,397+2,4,DAY RU,570+2,2,MIN RH
 94 2 43,3+1,0,44,0+0,0,45,0+0,0
 94 3 10,0+0,5,95+0,10,0+0
 94 4 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 284-13,0+0,5863-12,0+0,5184-12,0+0,0+0,0+0,2721-13
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 27 104,2,25+1,2,MIN MO,180+2,2,MIN TC
 95 1 42,18+1,0,43,0+0,0
 95 2 10,0+0,6,1+1
 95 3 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 95 4 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 95 5 105,5,20+1,2,MIN MO,90+1,2,MIN TC,445+1,3,HRS RU,380+2,1,SEC RH,360+2,3
 HRS RH
 42,6+0,0,43,3+0,0,44,0+0,0,45,0+0,0,45,0+0,0
 28 10,0+0,10,0+0,6,1+1,4,1+1,5,1+0
 96 1 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 1603-12,0+0,2239-11,0+0,1747-11,0+0,0+0,0+0,742-13
 29 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 97 1 4351-13,0+0,1051-12,2506-13,3648-12,0+0,0+0,0+0,1603-13
 97 2 106,2,101+1,5,YRS RU,290+2,1,SEC RH
 97 3 44,38+0,0,45,0+0,0
 97 4 6,4063+0,6,4146+0
 97 5 2977-12,0+0,3465-10,0+0,2688-11,0+0,0+0,0+0,8656-13
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 107,5,1+1,2,MIN TC,44+1,2,MIN RU,217+2,2,MIN RH,1+1,1,SEC PD,7+7,5
 30 YRS PD
 98 1 43,15+0,0,44,04+0,0,45,0+0,0,45,0+0,0,46,0+0,0
 10,0+0,6,1+1,5,1224+1,10,0+0,10,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 31 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
 99 1 0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0

99 2
 99 3
 99 4
 99 5
 32
 99A1
 99A2
 99A3
 99A4
 33
 100 1
 34
 101 1
 101 2
 101 3
 35
 102 1
 102 2
 36
 103 1
 103 2
 103 3
 37
 104 1
 104 2
 38
 105 1
 105 2
 105 3
 105 4
 105 5
 39
 106 1
 106 2
 40
 107 1
 107 2
 107 3
 107 4

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107 5 0+0,0+0,0+0,0+0,0+0,0+0,0+0,C=0  

    123,1,125+3,4,DAY SN  

    50,13-2,0  

    41 8,2-1  

109 1 0+0,0+0,0+0,0+0,0+0,0+0,0+0  

109 2 123,1,400+2,2,MIN SN  

109 3 50,14-1,0  

    4,1+1  

    0+0,0+0,0+0,0+0,0+0,0+0,0+0  

    42 125,3,96+1,4,DAY SN,20+1,5,YRS SR;80+2,4,DAY TE  

111 1 50,39-2,0,51,24-2,0,52,0+0,0  

111 2 4,5+0,5,1+1,3,1986+1  

111 3 8794-12,0+0,0+0,2479-13,1843-11,0+0,0+0,212-13,6027-13  

    474-13,0+0,0+0,1083-14,4992-12,0+0,0+0,96-15,2102-13  

    0+0,0+0,0+0,0+0,0+0,0+0,0+0  

    43 125,2,96+1,4,DAY SN,20+1,5,YRS SB  

112 1 50,91-2,0,51,56-2,0  

112 2 4,5+0,5,1+1  

    8794-12,0+0,0+0,2479-13,1843-11,0+0,0+0,212-13,6027-13  

    474-13,0+0,0+0,1083-14,4992-12,0+0,0+0,96-15,2102-13  

    44 126,3,1+6,5,YRS SN,19+2,2,MIN SR,1+5+2,4,DAY SB  

113 1 50,1+0,0,51,0+0,0,51,0+0,0  

113 2 10,0+0,5,1+1,5,1+1  

    0+0,0+0,0+0,0+0,0+0,0+0,0+0  

    0+0,0+0,0+0,0+0,0+0,0+0,0+0  

    0+0,0+0,0+0,0+0,0+0,0+0,0+0  

    45 0+0,0+0,0+0,0+0,0+0,0+0,0+0  

114 1 127,4,19+1,3,HRS SN,910+2,3,HRS SB,1050+3,4,DAY TE,93+1,3,HRS TE  

114 2 50,0264+0,0,51,0022+0,0,52,0064+0,0,52,0+0,0  

    10,0+0,6,1+1,3,1+1,5,1+1  

    0+0,0+0,0+0,0+0,0+0,0+0,0+0  

    0+0,0+0,0+0,0+0,0+0,0+0,0+0  

    46 0+0,0+0,0+0,0+0,0+0,0+0,0+0  

115 1 1168-12,0+0,5117-12,6029-13,6144-12,0+0,1364-12,912-13,2785-13  

115 2 9343-13,0+0,3838-12,4518-13,4608-12,0+0,1056-12,7296-13,2088-13  

115 3 127,3,19+1,3,HRS SN,910+2,3,HRS SB,93+1,3,HRS TE  

    50,935-1,0,51,8-2,0,52,0+0,0  

    10,0+0,6,1+1,5,1+1  

    0+0,0+0,0+0,0+0,0+0,0+0,0+0  

    47 0+0,0+0,0+0,0+0,0+0,0+0,0+0  

115A1 0+0,0+0,0+0,0+0,0+0,0+0,0+0  

115A2 9343-13,0+0,3838-12,4518-13,4608-12,0+0,1056-12,7296-13,2088-13  

115A3 128,7,57+2,2,MIN SN,103+2,2,MIN SB  

    50,37+0,0,51,0+0,0  

    5,1+1,6,1+1  

    0+0,0+0,0+0,0+0,0+0,0+0,0+0  

    48 0+0,0+0,0+0,0+0,0+0,0+0,0+0  

117 1 0+0,0+0,0+0,0+0,0+0,0+0,0+0  

117 2 129,4,46+1,3,HRS SR,37+2,4,DAY TE,72+2,2,MIN TE,17+8,5,YRS I  

117 3 51,253+0,0,52,103+0,0,52,0+0,0,53,0+0,1  

    6,1+1,4,1+1,7,9587+0,2,1+1  

    0+0,0+0,0+0,0+0,0+0,0+0,0+0  

    49 2492-12,0+0,1247-11,1564-12,1594-11,0+0,3336-12,2067-12,9572-13  

118 1 218-12,0+0,1087-11,1375-12,1402-11,0+0,264-12,1824-12,8528-13  

118 2 3634-13,0+0,1232-12,6974-13,1574-12,0+0,1033-12,1251-10,1529-13  

    129,3,46+1,3,HRS SR,72+2,2,MIN TE,17+8,5,YRS I  

    51,45+0,0,52,0+0,0,53,0+0,1  

    6,1+1,7,9587+0,2,1+1  

    50 0+0,0+0,0+0,0+0,0+0,0+0,0+0  

119 1 0+0,0+0,0+0,0+0,0+0,0+0,0+0  

119 2 218-12,0+0,1087-11,1375-12,1402-11,0+0,264-12,1824-12,8528-13  

    3634-13,0+0,1232-12,6974-13,1574-12,0+0,1033-12,1251-10,1529-13  

    130,2,26+1,2,MIN SN,71+1,2,MIN SB  

    51 50,2+1,0,51,0+0,0

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121 1
52
123 1
53
123A1
54
125 1
125 2
125 3
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125A1
125A2
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126 1
126 2
126 3
57
127 1
127 2
127 3
127 4
58
127A1
127A2
127A3
59
128 1
128 2
60
129 1
129 2
129 3
129 4
61
129A1
129A2
129A3

10,0*0,10,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 131,3,230*2,2,MIN SB,240*2,2,MIN TE,805*1,4,DAY I
 51,221*1,0,52,0*0,0,53,306*0,1
 10,0*0,5,1448*1,5,98*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 1211*12,0*0,4320*12,2552*12,5760*12,0*0,0000*00,4232*10,7557*13
 131,3,230*2,2,MIN SB,300*2,3,HRS TE,805*1,4,DAY I
 51,39*0,0,52,05*0,0,53,054*0,1
 10,0*0,4,1*1,5,98*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 2024*12,0*0,1295*11,1827*12,192*11,0*0,0*0,2098*12,1392*12
 1211*12,0*0,4320*12,2552*12,5760*12,0*0,0000*00,4232*10,7557*13
 132,4,22*1,2,MIN SN,2*1,2,MIN SB,770*2,3,HRS TE,23*1,3,HRS I
 50,13*1,0,51,2*1,0,52,11*1,0,53,1*3,1
 10,0*0,10,0*0,4,2*1,6,2522*1
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 2414*12,0*0,1535*11,2072*12,2112*11,0*0,3212*12,225*12,1653*12
 3271*12,0*0,1376*12,8505*12,1920*11,0*0,9880*12,1196*9,292*12
 133,4,41*1,2,MIN SB,520*2,2,MIN TE,208*2,3,HRS I,527*1,4,DAY XE
 51,288*1,0,52,202*1,0,53,0*0,1,54,0*0,2
 10,0*0,5,1*1,6,1*1,3,1*1
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,1229*11,0*0,0*0,9936*10,1442*12
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 133,4,410*1,2,MIN SB,20*1,2,MIN TE,208*2,3,HRS I,527*1,4,DAY XE
 51,142*1,0,52,88*0,0,53,0*0,1,54,0*0,2
 10,0*0,6,17*1,6,1*1,3,1*1
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,1229*11,0*0,0*0,9936*10,1442*12
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 134,3,500*2,1,SEC SB,430*2,2,MIN TE,525*2,2,MIN I
 51,32*1,0,52,37*1,0,53,8*0,3
 10,0*0,10,0*0,8,95*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,2112*11,0*0,0*0,1509*9,2576*12
 135,5,300*2,1,SEC TE,67*1,3,HRS I,153*2,2,MIN XE,92*1,3,HRS XE,2*7,5
 YRS CS
 52,132*1,0,53,51*0,1,54,0*0,2,54,6*1,2,55,33*1,3
 10,0*0,8,1*1,6,1*1,4,1*1,10,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,1478*11,0*0,0*0,9568*10,2233*12
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 2267*12,0*0,2638*13,3109*13,1267*12,1055*13,0*0,0*0,1134*13
 135,4,300*2,1,SEC TE,67*1,3,HRS I,92*1,3,HRS XE,2*7,5,YRS CS
 52,308*1,0,53,119*1,1,54,14*0,2,55,77*1,3
 10,0*0,8,1*1,4,1*1,10,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,1478*11,0*0,0*0,9568*10,2233*12
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 2267*12,0*0,2638*13,3109*13,1267*12,1055*13,0*0,0*0,1134*13
 136,1,860*2,1,SEC I

62 53,31*1,1
 130 1 6,1*1
 130 2 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 137,4,244*2,1,SEC I,39*1,2,MIN XE,300*2,5,YRS CS,257*1,2,MIN BA
 53,49*1,1,54,11*1,2,55,15*0,3,55,0*0,0
 63 10,0*0,10,0*0,6,92*0,6,1*1
 131 1 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 131 2 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 131 3 9618*13,0*0,1479*12,1931*12,7872*12,9434*13,0*0,0*0,1013*12
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 138,3,63*1,1,SEC I,170*2,2,MIN XE,322*2,2,MIN CS
 53,34*1,1,54,209*1,2,55,0*0,3
 131A1 10,0*0,5,2*1,8,2*1
 131A2 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 131A3 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 139,4,20*1,1,SEC I,410*2,1,SEC XE,95*1,2,MIN CS,030*2,2,MIN BA
 53,18*1,1,54,36*1,2,55,107*1,3,56,08*0,0
 132 1 10,0*0,10,0*0,10,0*0,5,85*0
 132 2 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 132 3 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 132 4 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 140,4,160*2,1,SEC XE,660*2,1,SEC CS,128*2,4,DAY BA,402*2,3,HRS LA
 54,38*1,2,55,22*1,3,56,35*0,0,57,0*0,0
 133 1 10,0*0,10,0*0,4,15*1,8,1755*1
 133 2 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 133 3 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 133 4 1827*11,0*0,1791*14,224*14,2688*11,1017*14,0*0,0*0,1475*12
 6183*12,0*0,0*0,4145*12,2112*11,0*0,0*0,1088*12
 141,5,17*1,1,SEC XF,250*2,1,SEC CS,180*2,2,MIN BA,038*2,3,HRS LA,330*2
 4,DAY CE
 133A1 54,133*1,2,55,327*1,3,56,17*1,0,57,1*0,0,58,0*0,0
 133A2 10,0*0,10,0*0,6,1*1,8,5*1,4,67*0
 133A3 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 133A4 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 1389*12,0*0,4797*13,1017*12,3456*12,0*0,0*0,0*0,1202*13
 134 1 142,4,15*1,1,SEC XE,80*1,1,SEC CS,100*2,2,MIN BA,810*2,2,MIN LA
 134 2 54,35*0,2,55,305*1,3,56,22*1,0,57,3*0,0
 134 3 10,0*0,10,0*0,6,1*1,6,1*1
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 69 143,5,10*1,1,SEC CS,130*2,1,SEC BA,140*2,2,MIN LA,33*2,3,HRS CE,137*2
 4,DAY PR
 135 1 55,190*1,3,56,3*1,0,57,13*1,0,58,0*0,0,59,0*0,0
 135 2 10,0*0,10,0*0,10,0*0,5,1*1,10,0*0
 135 3 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 135 4 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 6524*12,0*0,2185*12,4804*12,1594*11,0*0,0*0,0*0,5553*13
 135A1 3664*12,0*0,8528*13,1507*12,6144*12,0*0,0*0,0*0,1832*13
 135A2 144,5,3*0,1,SEC CS,4*0,1,SEC BA,5*0,1,SEC LA,28*3,4,DAY CE,174*2,2,MIN PR
 135A3 55,9*0,3,56,25*1,0,57,23*1,0,58,3*0,0,59,0*0,0
 135A4 10,0*0,10,0*0,10,0*0,3,5*0,8,7*1
 0*0,0*0,0*0,0*0,0*0,0*0,0*0,0*0
 79
 144 1

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0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
108-11,0+0,3465-12,7347-12,2496-11,0+0,0+0,0+0,7443-13
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
145,2,30+1,2,MIN CE,596+1,3,HRS PR
58,42+1,0,59,0+0,0
10,0+0,6,1+1
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
146,2,139+2,2,MIN CE,244+2,2,MIN PR
58,32+1,0,59,0+0,0
4,136+1,6,122+1
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
147,2,111+2,4,DAY ND,26+1,5,YRS PM
60,27+1,0,61,0+0,0
4,1+1,10,0+0
2885-12,0+0,1652-12,3519-12,576-12,0+0,0+0,0+0,229-13
7214-13,0+0,1839-14,13-13,1325-12,0+0,0+0,0+0,395-14
149,2,20+1,3,HRS ND,531+2,3,HRS PM
60,13+1,0,61,0+0,0
4,1+1,4,1+1
9687-12,0+0,517-12,1212-11,1901-11,0+0,0+0,0+0,6298-13
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
151,3,13+2,2,MIN ND,284+2,3,HRS PM,9+2,5,YRS SM
60,42+0,0,61,02+0,0,62,0+0,0
5,3+1,4,2+1,1,1+1
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
153,1,470+2,3,HRS SM
62,15+0,0
4,112+1
2267-12,0+0,6663-13,2204-12,4992-12,0+0,0+0,0+0,1718-13
155,2,24+2,2,MIN SM,17+1,5,YRS EU
62,33-1,0,63,0+0,0
4,2+1,4,5+1
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
5771-13,0+0,3318-13,5369-13,1824-12,0+0,0+0,0+0,916-14
156,2,90+1,3,HRS SM,154+2,4,DAY EU
62,13-1,0,63,10-1,0
10,0+0,9,6+0
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
157,1,154+2,3,HRS EU
63,78-2,0
5,2+1
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
158,1,10+1,3,HRS EU
63,20-2,0
10,0+0
0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0,0+0
159,1,180+2,3,HRS GD
64,107-2,0
4,2+1
189-12,0+0,0+0,9317-13,6336-12,0+0,0+0,0+0,2061-13

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144 2 *** 50 M-WATTS FOR 800 HRS.(2.68+6 SECONDS) *****
144 3 *** CONTINUOUS RELEASE *****
144 4 *** RELEASE TIME = 6HRS.(2.16+4 SECONDS) *****
144 5 *** EXPOSURE TIME = 5 DAYS = 6HRS.(4.104+5 SECONDS) *****
18+1 AVERAGE WIND SPEED
1-4,1+5,0+0 DOWNWIND DETECTOR POSITIONS
80 5-8,325+11,0+0,288+7 REACTOR HISTORY
145 1 -1+0 RELEASE REQUESTED
145 2 18+1,18+1,18+1,0+0,0+0,0+0 THE MFT. CONDITIONS
4+04+6 EXPOSURE TIME
1,2-2,0+0,1-1,2+2 NEGLECT CLOUD DEPLETION AND SETTLING VELOCITIES
81 2,168-7,85-6,6+8,4-4 LEAKAGE RATE COEFFICIENTS
146 1 1,0+0 CROSSWIND DETECTOR POSITIONS
146 2 -1,334+0,334+0 ONE SET OF CY AND CZ VALUES
-1,1+1,1+3,1+1,1+1 FRACTIONATE BY ELEMENT GROUP
5,0 PRINT FISSION PRODUCT INVENTORY IN CURIES
82 -1,0 PRINT SUMS OF THE ELEMENT GROUPS
147 1 3,0 CALCULATE INHALATION DOSE
147 2 THYROID THE ORGAN UNDER CONSIDERATION IS THE THYROID
1 PRINT DOSE CONTRIBUTIONS FROM EACH ELEMENT FOR EACH DOWNWIND PT.
216+5 INHALATION TIME
83 347-3 BREATHING RATE
149 1 0 NOT AN INGESTION DOSE CALCULATION
149 2 5 THERE ARE 5 CONTRIBUTING ELEMENTS
49,95485-6 ELEMENT = I AND BIOLOGICAL DECAY CONSTANT
50,11456-6 ELEMENT = SA AND BIOLOGICAL DECAY CONSTANT
84 51,20052-5 ELEMENT = SE AND BIOLOGICAL DECAY CONSTANT
151 1 52,89120-6 ELEMENT = TE AND BIOLOGICAL DECAY CONSTANT
151 2 53,58122-7 ELEMENT = I AND BIOLOGICAL DECAY CONSTANT
151 3 3,0 CALCULATE INHALATION DOSE
BODY THE ORGAN IS THE TOTAL BODY
0 PRINT ONLY TOTAL DOSE AT EACH DOWNWIND PT.
85 216+5,347-3,0
153 1 30,31,13368-5,33,14584-7,35,10026-5,37,17824-6,38,61699-9,39,57291-9
40,17824-7,41,10554-7,42,16042-5,43,80208-5,44,10987-5,45,77123-6,46,14042-5
47,16042-5,48,40104-7,49,16710-6,50,22916-6,51,21107-6,52,53472-6,53,58122-7
86 55,11458-6,56,12339-6,57,16042-7,58,14247-7,59,10694-7,60,12227-7,61,12227-7
155 1 62,12227-7,63,12631-7,64,14584-7
155 2 3,0
THYROID,0
216+5,347-3
87 1 DO AN INGESTION DOSE CALCULATION
156 1 53,131,58122-7,12+4 CONTRIBUION FROM I-131, MULTIPLICATION FACTOR= 1200.
156 2 3,0
THYROID,0
216+5,347-3
88 1 DO AN INGESTION DOSE CALCULATION
157 1 53,133,58122-7,1+3 CONTRIBUION FROM I-133, MULTIPLICATION FACTOR= 100.
4,0 DO A CLOUD GAMMA DOSE CALCULATION
216+5 EXPOSURE TIME = RELEASE TIME
89 5 USE FIVE PT. HERMITE FOR INTEGRATION, FOLLOWING ARE H(I) AND X(I)
158 1 94530872+0,0+0,39361932+0,95857246+0,39361932+0,-95857246+0
19953242-1,20201829+1,19953242-1,-20201829+1
2,0 DO A DEPOSITION GAMMA DOSE CALCULATION
90 216+5 DEPOSITION TIME
159 1 4+04+6 EXPOSURE TIME
5 USE FIVE PT. HERMITE FOR INTEGRATION, FOLLOWING ARE H(I) AND X(I)
94530872+0,0+0,39361932+0,95857246+0,39361932+0,-95857246+0
19953242-1,20201829+1,19953242-1,-20201829+1

```


6,0 START A NEW PROBLEM
1+1 AVERAGE WIND SPEED
*** 50 M-WATTS FOR 1 SECOND *****
*** INSTANTANEOUS RELEASE *****
*** EXPOSURE TIME = 1 YR. (3.1536*7 SECONDS) *****
1+4,1+5,0+0 DOWNWIND DETECTOR POSITIONS
5+8,325+11,0+0,1+1 REACTOR HISTORY
-1+J RELEASE REQUESTED
18+L,18+1,18+1,0+0,0+0,0+0 THE MET. CONDITIONS
31556+8 EXPOSURE TIME
1,2-2,0+0,1-1,2-2 NEGLECT CLOUD DEPLETION AND SETTLING VELOCITIES
1,1+3,1+3 LEAKAGE COEFFICIENTS FOR INSTANTANEOUS RELEASE
1,0+0 CROSSWIND DETECTOR POSITIONS
-1,534+0,334+0 ONE SET OF CY AND CZ VALUES
0,1-3 100 PER CENT OF TOTAL FISSION PRODUCT INVENTORY
1,0 PRINT FISSION PRODUCT INVENTORY IN MEV/SEC
91+4,27+1,1-37,68-1,29+0,38+0,1-1,38+0,89+0,1-1,1-37,8+0,96-1,96-1,1-37
1-37,1-37,1+0,1-37,36+1,2+1,51-1,42-1,2+1,31+1,51-1,42-1,1-37,21+1,24+1
1-37,1-37,18+1,1-37,1-37,18+0,52-2,13+0,1-37,30+1,56-1,1-37,1-37,21+0,47+0
1-37,1-37,31+1,1-37,1-37,1-37,1-37,56-2,1-37,1-37,85+0,55+0,36-2
1-37,1-37,85+0,36-2,1-37,1-37,13+1,42+0,1-37,1-37,7+0,7-2,1-37,1-37
1-37,14+1,1-37,1-37,1-37,73+0,75+0,24+1,1-37,1-37,75+0,75+0,67+0,1-37
1-37,1-37,24+0,14+0,1-37,1-37,1-37,1-37,24+0,1-37,1-37,1-37,86+0,3+0,1-37,1-37
1-37,47+0,1-37,1-37,7+1,1-37,1-37,73+0,13+0,32-1,25+0,25+0,1-37,7+0,4+0
1-37,1-37,1-37,88+1,1-37,7-1,7-1,3-1,18-1,16+1,1-37,7+3,1-37,7+0,7+0
32+0,34+0,1-37,32+0,34+0,79+0,7+0,19+0,1-37,1-37,1-37,1-37,22+1,15+0
95-1,46+0,145+0,95-1,46+0,1-37,46+0,46+0,1-37,72+0,89-1,4-2,1-37,72+0
4-2,4+0,7+0,7+0,11+0,84+0,39-1,7+0,4-2,39-1,1-37,1-37,1-37,18+0,39+0,1-37
48+0,39+0,1-37,1-37,28+0,2+1,1-37,4+1,56+0,81-1,1-37,13+1,56+0,81-1,1-37
1-37,13+1,1-37,15+1,52+0,27+0,1-37,1-37,15+1,27+0,1-37,7+0,1-37,1-37
61+0,66+0,1-37,1-1,2+0,1-37,1-37,1-37,38+0,1-37,1-37,24+0,21+1,1-37,1-37
7+0,75-1,97-1,1-37,1-37,7+0,65+0,1-37,1-37,1-37,33+0,1-37,1-37,1-37
43-1,8+1,1-37,7+0,33+0,63+0,24+0,1-37,2+0,29+0,91+0,5+0,19-1,15+0,35+0
7+0,1-37,12+1,8+0,1-37,46+0
-1,0 ABOVE ARE THE GAMMA ENERGIES(MEV/DIS) AND 1,-38 IS USED FOR ZERO
3,0 CALCULATE INHALATION DOSE
THYROID THE ORGAN UNDER CONSIDERATION IS THE THYROID
1 PRINT DOSE CONTRIBUTIONS FROM EACH ELEMENT FOR EACH DOWNWIND PT.
1+1
347-3 BREATHING RATE
0 NOT AN INGESTION DOSE CALCULATION
5 THERE ARE 5 CONTRIBUTING ELEMENTS
49,95485-6 ELEMENT = IN AND BIOLOGICAL DECAY CONSTANT
50,11456-6 ELEMENT = SN AND BIOLOGICAL DECAY CONSTANT
51,20052-5 ELEMENT = SB AND BIOLOGICAL DECAY CONSTANT
52,89120-6 ELEMENT = TE AND BIOLOGICAL DECAY CONSTANT
53,56122-7 ELEMENT = I AND BIOLOGICAL DECAY CONSTANT
3,0
THYROID,0
1+1,347-3
1 DO AN INGESTION DOSE CALCULATION
53,131,58122-7,12+4 CONTRIBUTION FROM I-131, MULTIPLICATION FACTOR= 1200.
3,6
THYROID,0
1+1,347-3
1 DO AN INGESTION DOSE CALCULATION
53,133,58122-7,1+3 CONTRIBUTION FROM I-133, MULTIPLICATION FACTOR= 100.
4,0 DO A CLOUD GAMMA DOSE CALCULATION
1+1

5 USE FIVE PT. HERMITE FOR INTEGRATION, FOLLOWING ARE H(I) AND X(I)
94530872-0,0+0,39361932+0,95857246+0,39361932+0,-95857246+0
19953242-1,20201829+1,19953242-1,-20201829+1
2,0 DO A DEPOSITION GAMMA DOSE CALCULATION
1+1,31536+8
5 USE FIVE PT. HERMITE FOR INTEGRATION, FOLLOWING ARE H(I) AND X(I)
94530872+0,0+0,39361932+0,95857246+0,39361932+0,-95857246+0
19953242-1,20201829+1,19953242-1,-20201829+1
6,0

4.2 Output of Sample Problems from DEP

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RADIOLOGICAL SAFETY ANALYSIS CODE... EDIT DATA ...
***** STANDARD INPUT DECK FROM #CURIE# *****
***** ADAPTED FOR RSAC *****
*****

STANDARD DATA DECK HAS BEEN READ CORRECTLY.
*** 50 M-WATTS FOR 800 HRS.(2.88+6 SECONDS) *****
*** CONTINUOUS RELEASE *****
*** RELEASE TIME = 6HRS.(2.16+4 SECONDS) *****
*** EXPOSURE TIME = 5 DAYS - 6HRS.(4.104+5 SECONDS) *****

UBAR = .1800000E 1
DOWNWIND DISTANCES = .1000000E 4 .1000000E 5

W1 = .1800000E 1 W2 = .1800000E 1 W3 = .1800000E 1
STACK HEIGHT = 000000000000 INVERSION HEIGHT = 000.0000000000
WASHOUT FACTOR = 0000000.00000 EXPOSURE TIME = .4103999E 6
DEPLETION FROM THE CLOUD DUE TO FALLOUT HAS BEEN NEGLECTED.
DEPOSITION VELOCITIES.
FOR CESIUM = .2000000E- 2
FOR THE NOBLE GASES = 000000000000
FOR THE HALOGENS = .1000000E- 1
FOR THE SOLIDS = .2000000E- 2
THERE ARE 2 SET(S) OF EXPONENTIALS FOR THE LEAK RATE.
K = .1679999E- 7 P = .8499999E- 6 K = .5999999E- 8 P = .3999999E- 4
CROSSWIND DISTANCES = 000000000000
THERE IS ONE SET OF CY AND CZ VALUES.
CY = .3340000E 0 CZ = .3340000E 0
FRACTIONATION BY ELEMENT GROUP.
FOR CESIUM = .1000000E 1
FOR THE NOBLE GASES = .1000000E 3
FOR THE HALOGENS = .1000000E 1
FOR THE SOLIDS = .1000000E 1
ESTIMATED TIME IN SECONDS = 105 ESTIMATED LINES OF OUTPUT = 10
DET= 5 ENTRY TO DECAY TO PRINT OUT THE FISSION PRODUCT INVENTORY
ESTIMATED TIME IN SECONDS = 345 ESTIMATED LINES OF OUTPUT = 1100
DET= 3 ENTRY TO INHAL TO CALCULATE THE INHALATION DOSE TO THE THYROID
ESTIMATED TIME IN SECONDS = 349 ESTIMATED LINES OF OUTPUT = 1130
DET= 3 ENTRY TO INHAL TO CALCULATE THE INHALATION DOSE TO THE BODY
ESTIMATED TIME IN SECONDS = 353 ESTIMATED LINES OF OUTPUT = 1139
DET= 3 ENTRY TO INHAL TO CALCULATE THE INHALATION DOSE TO THE THYROID
ESTIMATED TIME IN SECONDS = 353 ESTIMATED LINES OF OUTPUT = 1148
DET= 3 ENTRY TO INHAL TO CALCULATE THE INHALATION DOSE TO THE THYROID
ESTIMATED TIME IN SECONDS = 353 ESTIMATED LINES OF OUTPUT = 1158
DET= 4 ENTRY TO GAMMA TO CALCULATE THE CLOUD GAMMA DOSE TO THE BODY:

```

THE EXPOSURE TIME = .2159999E 5
 ESTIMATED TIME IN SECONDS = 1153 ESTIMATED LINES OF OUTPUT = 1165
 DET= 2 ENTRY TO DEPOS TO CALCULATE DEPOSITION GAMMA DOSE.
 THE EXPOSURE TIME = .4103999E 6 THE DEPOSITION TIME = .2159999E 5
 ESTIMATED TIME IN SECONDS = 4033 ESTIMATED LINES OF OUTPUT = 1172
 DET= 6 ENTRY TO NEW TO READ IN NEW CONDITIONS FOR A NEW PROBLEM
 *** 50 M-WATTS FOR 1 SECOND *****
 *** INSTANTANEOUS RELEASE *****
 *** EXPOSURE TIME = 1 YR. (3.1536*7 SECONDS) *****
 UBAR = .1000000E 1
 DOWNWIND DISTANCES = .1000000E 4 .1000000E 5
 W1 = .1800000E 1 W2 = .1800000E 1 W3 = .1800000E 1
 STACK HEIGHT = 000000000000 INVERSION HEIGHT = 000000000000
 WASHOUT FACTOR = 000000000000 EXPOSURE TIME = .3153600E 8
 DEPLETION FROM THE CLOUD DUE TO FALLOUT HAS BEEN NEGLECTED.
 DEPOSITION VELOCITIES.
 FOR CESIUM = .2000000E- 2
 FOR THE NOBLE GASES = 000000000000
 FOR THE HALOGENS = .1000000E- 1
 FOR THE SOLIDS = .2000000E- 2
 THERE ARE 1 SET(S) OF EXPONENTIALS FOR THE LEAK RATE.
 K = .1000000E 3 P = .1000000E 3
 CROSSWIND DISTANCES = 000000000000
 THERE IS ONE SET OF CY AND CZ VALUES.
 CY = .3340000E 0 CZ = .3340000E 0
 PER CENT OF THE FISSION PRODUCT INVENTORY RELEASED = .1000000E 3
 ESTIMATED TIME IN SECONDS = 4114 ESTIMATED LINES OF OUTPUT = 1188
 DET= 1 ENTRY TO BETAD TO CALCULATE GAMMA HEATING
 DET= 5 ENTRY TO DECAY TO PRINT OUT THE FISSION PRODUCT INVENTORY
 ESTIMATED TIME IN SECONDS = 4358 ESTIMATED LINES OF OUTPUT = 2278
 DET= 3 ENTRY TO INHAL TO CALCULATE THE INHALATION DOSE TO THE THYROID
 ESTIMATED TIME IN SECONDS = 4362 ESTIMATED LINES OF OUTPUT = 2307
 DET= 3 ENTRY TO INHAL TO CALCULATE THE INHALATION DOSE TO THE THYROID
 ESTIMATED TIME IN SECONDS = 4362 ESTIMATED LINES OF OUTPUT = 2317
 DET= 3 ENTRY TO INHAL TO CALCULATE THE INHALATION DOSE TO THE THYROID
 ESTIMATED TIME IN SECONDS = 4362 ESTIMATED LINES OF OUTPUT = 2326
 DET= 4 ENTRY TO GAMMA TO CALCULATE THE CLOUD GAMMA DOSE TO THE BODY.
 THE EXPOSURE TIME = .1000000E 1
 ESTIMATED TIME IN SECONDS = 4762 ESTIMATED LINES OF OUTPUT = 2333
 DET= 2 ENTRY TO DEPOS TO CALCULATE DEPOSITION GAMMA DOSE.
 THE EXPOSURE TIME = .3153600E 8 THE DEPOSITION TIME = .1000000E 1
 ESTIMATED TIME IN SECONDS = 6202 ESTIMATED LINES OF OUTPUT = 2340
 DET= 6 ENTRY TO NEW TO READ IN NEW CONDITIONS FOR A NEW PROBLEM

4.3 Output of Sample Problems from RSAC

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RSAC... RADIOLOGICAL SAFETY ANALYSIS COMPUTER PROGRAM

***** FISSON PRODUCT INVENTORY CALCULATION *****
***** STANDARD INPUT DECK FROM #CURIE# *****
***** ADAPTED FOR RSAC *****
*****
*** 50 M-WATTS FOR 800 HRS. (2.88*6 SECONDS) *****
*** CONTINUOUS RELEASE *****
*** RELEASE TIME = 6HRS. (2.16*4 SECONDS) *****
*** EXPOSURE TIME = 5 DAYS = 6HRS. (4.104*5 SECONDS) *****
UBAR = .1800000E 1

DOWNWIND DISTANCES = .1000000E 4 .1000000E 5

W1 = .1800000E 1 W2 = .1800000E 1 W3 = .1800000E 1
STACK HEIGHT = 000000000000 INVERSION HEIGHT = 000000000000
WASHOUT FACTOR = 000000000000 EXPOSURE TIME = .4103999E 6
DEPLETION FROM THE CLOUD DUE TO FALLOUT HAS BEEN NEGLECTED.
DEPOSITION VELOCITIES,
FOR CESIUM = .2000000E- 2
FOR THE NOBLE GASES = 000000000000
FOR THE HALOGENS = .1000000E- 1
FOR THE SOLIDS = .2000000E- 2
THERE ARE 2-SET(S) OF EXPONENTIALS FOR THE LEAK RATE.
K = .1679999E- 7 P = .8499999E- 6 K = .5999999E- 8 P = .3999999E- 4
CROSSWIND DISTANCES = 000000000000
THERE IS ONE SET OF CY AND CZ VALUES.
CY = .3340000E 0 CZ = .3340000E 0
THE REACTOR HAS OPERATED AT .5000000E 8 WATTS FOR .2880000E 7 SECONDS
THE CONVERSION FACTOR FROM WATTS TO FISSIONS PER SECOND IS .3250000E 11
FRACTIONATION BY ELEMENT GROUP,
FOR CESIUM = .1000000E 1
FOR THE NOBLE GASES = .1000000E 3
FOR THE HALOGENS = .1000000E 1
FOR THE SOLIDS = .1000000E 1
TOTAL FISSION PRODUCT RELEASE .1051385E 19 D/SEC OR .2841581E 8 CURIES
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1599999E- 4 DECAY CONSTANT FOR ISOTOPE 1 = .4095745E- 5
HALF LIFE .4700001E 2 HRS ZN 72
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .1365248E- 4
HALF LIFE .1410000E 2 HRS GA 72

TIME IN SECONDS CURIES CURIES
000000000000 .7026973E- 1 .7026951E- 1
.5555556E 3 .7011003E- 1 .7026891E- 1
.5555556E 4 .6868887E- 1 .7021085E- 1

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .9800000E- 4 DECAY CONSTANT FOR ISOTOPE 1 = .5775000E- 2
HALF LIFE .2000001E 1 MIN ZN 73
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .1199999E- 4 DECAY CONSTANT FOR ISOTOPE 2 = .3928572E- 4
HALF LIFE .4899999E 1 HRS GA 73

TIME IN SECONDS CURIES CURIES
000000000000 .4304054E 0 .4831081E 0
.5555556E 3 .1739867E- 1 .4754435E 0
.5555556E 4 .5014910E-14 .3907507E 0

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .7999999E- 3 DECAY CONSTANT FOR ISOTOPE 1 = .1408536E- 3
HALF LIFE .8200001E 2 MIN GE 75

```

TIME IN SECONDS	CURIES		
000000000000	,3513514E 1		
,5555556E 3	,3249055E 1		
,5555556E 4	,1606562E 1		
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,4200999E- 2 DECAY CONSTANT FOR ISOTOPE 1 = ,1283333E- 1			
HALF LIFE	,5400000E 2	SEC GE 77	
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2000000E- 3 DECAY CONSTANT FOR ISOTOPE 2 = ,4974160E- 5			
HALF LIFE	,3869999E 2	HRS AS 77	
TIME IN SECONDS	CURIES	CURIES	
000000000000	,1848548E 2	,1936384E 2	
,5555556E 3	,1480716E- 1	,1931755E 2	
,5555556E 4	,2010215E-29	,1884304E 2	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1186999E- 2 DECAY CONSTANT FOR ISOTOPE 1 = ,1283333E- 1			
HALF LIFE	,5400000E 2	SEC GE 77	
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2087000E- 2 DECAY CONSTANT FOR ISOTOPE 2 = ,1703539E- 4			
HALF LIFE	,1129999E 2	HRS GE 77	
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,4999999E- 3 DECAY CONSTANT FOR ISOTOPE 3 = ,4974160E- 5			
HALF LIFE	,3869999E 2	HRS AS 77	
TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	,5213175E 1	,1437905E 2	,1657498E 2
,5555556E 3	,4175837E- 2	,1425047E 2	,1656875E 2
,5555556E 4	,5669102E-30	,1308691E 2	,1649725E 2
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2000000E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,9166667E- 4			
HALF LIFE	,2100000E 1	HRS GE 78	
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,1269230E- 3			
HALF LIFE	,9100000E 2	MIN AS 78	
TIME IN SECONDS	CURIES	CURIES	
000000000000	,8783783E 2	,8783783E 2	
,5555556E 3	,8347661E 2	,8768636E 2	
,5555556E 4	,5278531E 2	,7719790E 2	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,5599999E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,1283333E- 2			
HALF LIFE	,9000000E 1	MIN AS 79	
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,2961539E- 2			
HALF LIFE	,3900000E 1	MIN SE 79	
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,3136882E-12			
HALF LIFE	,7000001E 5	YRS SE 79	
TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	,2459459E 3	,2459459E 3	,2221067E- 3
,5555556E 3	,1205602E 3	,1764630E 3	,2221448E- 3
,5555556E 4	,1970066E 0	,3476454E 0	,2221928E- 3
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1250000E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,2100000E- 1			
HALF LIFE	,3300000E 2	SEC AS 81	
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3299999E- 2 DECAY CONSTANT FOR ISOTOPE 2 = ,6277174E- 3			
HALF LIFE	,1840000E 2	MIN SE 81	
TIME IN SECONDS	CURIES	CURIES	
000000000000	,5489865E 3	,5634797E 3	
,5555556E 3	,4707526E- 2	,4095165E 3	
,5555556E 4	000000000000	,1775008E 2	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,8399999E- 2 DECAY CONSTANT FOR ISOTOPE 1 = ,2026315E- 3			
HALF LIFE	,5700000E 2	MIN SE 81	

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3299999E- 2 DECAY CONSTANT FOR ISOTOPE 2 = ,6277174E- 3
 HALF LIFE ,1840000E 2 MIN SE 81

TIME IN SECONDS	CURIES	CURIES
000000000000	,3689190E 2	,5138514E 2
,5555556E 3	,3296408E 2	,4649551E 2
,5555556E 4	,1196829E 2	,1757881E 2

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3799999E- 4 DECAY CONSTANT FOR ISOTOPE 1 = ,5362116E- 5
 HALF LIFE ,3589999E 2 HRS BR 82

TIME IN SECONDS	CURIES
000000000000	,1668918E 0
,5555556E 3	,1663955E 0
,5555556E 4	,1619935E 0

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2700000E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,1004347E- 1
 HALF LIFE ,6900001E 2 SEC SE 83

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 01.0 E- 2 DECAY CONSTANT FOR ISOTOPE 2 = ,8020833E- 4
 HALF LIFE ,2400000E 1 HRS BR 83

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,1013157E- 3
 HALF LIFE ,1140000E 3 MIN KR 83

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	,1185810E 4	,1229730E 4	,1229730E 6
,5555556E 3	,4474846E 1	,1185229E 4	,1163087E 6
,5555556E 4	,6944521E-21	,7936802E 3	,7046377E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3000000E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,1004347E- 1
 HALF LIFE ,6900001E 2 SEC SE 83

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,1900000E 0 DECAY CONSTANT FOR ISOTOPE 2 = ,4619999E- 3
 HALF LIFE ,2500000E 2 MIN SE 83

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,2000000E- 1 DECAY CONSTANT FOR ISOTOPE 3 = ,8020833E- 4
 HALF LIFE ,2400000E 1 HRS BR 83

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,1013157E- 3
 HALF LIFE ,1140000E 3 MIN KH 83

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	,1317568E 3	,9662162E 3	,1054053E 4	,1054054E 6
,5555556E 3	,4972051E 0	,7523809E 3	,1049415E 4	,9969386E 5
,5555556E 4	,7716135E-22	,7468466E 2	,7901894E 3	,6043596E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,9199999E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,3500000E- 2
 HALF LIFE ,3300000E 1 MIN SE 84

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,3632075E- 3
 HALF LIFE ,3179999E 2 MIN BR 84

TIME IN SECONDS	CURIES	CURIES
000000000000	,4040541E 4	,4040541E 4
,5555556E 3	,5780668E 3	,3617653E 4
,5555556E 4	,1451525E- 4	,5993682E 3

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1899999E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,1925000E- 2
 HALF LIFE ,6000000E 1 MIN BR 84

TIME IN SECONDS	CURIES
000000000000	,8344594E 2
,5555556E 3	,2863858E 2
,5555556E 4	,1891765E- 2

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,8519999E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,1776923E- 1
 HALF LIFE ,3900000E 2 SEC SE 85

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,7699999E- 1 DECAY CONSTANT FOR ISOTOPE 2 = ,3850000E- 2
 HALF LIFE ,3000001E 1 MIN BR 85

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,4375000E- 4
 HALF LIFE ,4400000E 1 HRS KR 85

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	,3741891E 4	,4080067E 4	,4080067E 6
,5555556E 3	,1931191E 0	,6024270E 3	,3982575E 6
,5555556E 4	000000000000	,2628901E- 5	,3200143E 6

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2480000E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,1776923E- 1
 HALF LIFE ,3900000E 2 SEC SE 85

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3500000E- 1 DECAY CONSTANT FOR ISOTOPE 2 = ,3850000E- 2
 HALF LIFE ,3000001E 1 MIN BR 85

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,4375000E- 4
 HALF LIFE ,4400000E 1 HRS KR 85

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,2071525E- 8
 HALF LIFE ,1060000E 2 YRS KR 85

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	,1089190E 4	,1242906E 4	,1242906E 6	,7333797E 3
,5555556E 3	,5621307E- 1	,1818655E 3	,1213205E 6	,7335201E 3
,5555556E 4	000000000000	,7936314E- 6	,9748544E 5	,7346412E 3

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2800000E- 4 DECAY CONSTANT FOR ISOTOPE 1 = ,4113248E- 6
 HALF LIFE ,1950000E 2 DAY RB 86

TIME IN SECONDS	CURIES
000000000000	,8535998E- 1
,5555556E 3	,8534048E- 1
,5555556E 4	,8516515E- 1

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2000000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,4331250E- 1
 HALF LIFE ,1600000E 2 SEC SE 87

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,4899999E 0 DECAY CONSTANT FOR ISOTOPE 2 = ,1271559E- 1
 HALF LIFE ,5449999E 2 SEC BR 87

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,1480770E- 3
 HALF LIFE ,7800001E 2 MIN KR 87

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,4391634E-18
 HALF LIFE ,5000000E 11 YRS RB 87

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	,8783783E 4	,1093582E 5	,1093582E 7	,1379862E- 7
,5555556E 3	,3115091E- 6	,1247357E 2	,1007365E 7	,1405478E- 7
,5555556E 4	000000000000	,3050871E-26	,4804433E 6	,1561751E- 7

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2899999E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,4251534E- 1
 HALF LIFE ,1629999E 2 SEC BR 88

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,7999999E 0 DECAY CONSTANT FOR ISOTOPE 2 = ,6875000E- 4
 HALF LIFE ,2800000E 1 HRS KR 88

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,6488764E- 3
 HALF LIFE ,1780000E 2 MIN RB 88

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	,1273648E 5	,1625000E 7	,1625000E 5
,5555556E 3	,7033536E- 6	,1964124E 7	,4933390E 6
,5555556E 4	000000000000	,1109130E 7	,1191592E 7

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2500000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,1575000E 0
 HALF LIFE ,4399999E 1 SEC BR 89

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .1900000E 1 DECAY CONSTANT FOR ISOTOPE 2 = .3609374E- 2
 HALF LIFE .3200000E 1 MIN KR 89

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .3999999E 0 DECAY CONSTANT FOR ISOTOPE 3 = .7500000E- 3
 HALF LIFE .1539999E 2 MIN RB 89

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .1588283E- 6
 HALF LIFE .5050000E 2 DAY SR 89

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	.1097973E 5	.1932432E 7	.2108108E 5	.7735264E 4
.5555556E 3	.1096035E-33	.2602024E 6	.2798391E 6	.7753381E 4
.5555556E 4	000000000000	.3781404E- 2	.8186265E 4	.7816163E 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .5000000E 1 DECAY CONSTANT FOR ISOTOPE 1 = .4331250E 0
 HALF LIFE .1599999E 1 SEC BR 90

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .2100000E- 1
 HALF LIFE .3300000E 2 SEC KR 90

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .7700000E 0 DECAY CONSTANT FOR ISOTOPE 3 = .4277777E- 2
 HALF LIFE .2699999E 1 MIN RB 90

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .7842205E- 9
 HALF LIFE .2800000E 2 YRS SR 90

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000 DECAY CONSTANT FOR ISOTOPE 5 = .2993779E- 5
 HALF LIFE .6430000E 2 MRS Y 90

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	CURIES
000000000000	.2195946E 5	.2195946E 7	.2534122E 5	.5716446E 2	.5054076E 2
.5555556E 3	000000000000	.1883970E 2	.5454485E 5	.5724111E 2	.5055185E 2
.5555556E 4	000000000000	000000000000	.2803599E- 4	.5725089E 2	.5065136E 2

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .2070000E 1 DECAY CONSTANT FOR ISOTOPE 1 = .6930000E- 1
 HALF LIFE .1000000E 2 SEC KR 91

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .1190000E 1 DECAY CONSTANT FOR ISOTOPE 2 = .9624999E- 2
 HALF LIFE .7200000E 2 SEC RB 91

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .2280000E 0 DECAY CONSTANT FOR ISOTOPE 3 = .1984537E- 4
 HALF LIFE .9700001E 1 MRS SR 91

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .2264706E- 3
 HALF LIFE .5100001E 2 MIN Y 91

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000 DECAY CONSTANT FOR ISOTOPE 5 = .1382903E- 6
 HALF LIFE .5800001E 2 DAY Y 91

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	CURIES
000000000000	.9091216E 6	.1431756E 5	.1531892E 5	.1531892E 5	.4953957E 4
.5555556E 3	.1730951E-10	.7663411E 3	.1543672E 5	.1533601E 5	.4954754E 4
.5555556E 4	000000000000	.9638300E-18	.1397996E 5	.1481183E 5	.4961809E 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1380000E 1 DECAY CONSTANT FOR ISOTOPE 1 = .6930000E- 1
 HALF LIFE .1000000E 2 SEC KR 91

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .7899999E 0 DECAY CONSTANT FOR ISOTOPE 2 = .9624999E- 2
 HALF LIFE .7200000E 2 SEC RB 91

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .1520000E 0 DECAY CONSTANT FOR ISOTOPE 3 = .1984537E- 4
 HALF LIFE .9700001E 1 MRS SR 91

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .1382903E- 6
 HALF LIFE .5800001E 2 DAY Y 91

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	.6060811E 6	.9530404E 4	.1019797E 5	.3302117E 4
.5555556E 3	.1153967E-10	.5108244E 3	.1027663E 5	.3302655E 4
.5555556E 4	000000000000	.6424658E-18	.9306836E 4	.3307134E 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1870000E 1				DECAY CONSTANT FOR ISOTOPE 1 = ,2310000E 0	
HALF LIFE ,3000000E 1 SEC KR 92					
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2830000E 1				DECAY CONSTANT FOR ISOTOPE 2 = ,1307548E 0	
HALF LIFE ,5299999E 1 SEC RB 92					
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,6000000E 0				DECAY CONSTANT FOR ISOTOPE 3 = ,7129629E- 4	
HALF LIFE ,2699999E 1 HRS SR 92					
FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000				DECAY CONSTANT FOR ISOTOPE 4 = ,5347223E- 4	
HALF LIFE ,3600000E 1 HRS Y 92					
TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	
000000000000	,0212838E 6	,2064189E 5	,2327702E 5	,2327702E 5	
,5555556E 3	000000000000	,3092919E-25	,2262773E 5	,2327109E 5	
,5555556E 4	000000000000	000000000000	,1584249E 5	,2224174E 5	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,4800000E 0				DECAY CONSTANT FOR ISOTOPE 1 = ,3465000E 0	
HALF LIFE ,2000001E 1 SEC KR 93					
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3520000E 1				DECAY CONSTANT FOR ISOTOPE 2 = ,1237500E 0	
HALF LIFE ,5600000E 1 SEC RB 93					
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,2000000E 1				DECAY CONSTANT FOR ISOTOPE 3 = ,1462026E- 2	
HALF LIFE ,7899999E 1 MIN SR 93					
FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 01,0 E- 1				DECAY CONSTANT FOR ISOTOPE 4 = ,1868932E- 4	
HALF LIFE ,1030000E 2 HRS Y 93					
FISSION YIELD IN PERCENT FOR ISOTOPE 5 = ,3500000E 0				DECAY CONSTANT FOR ISOTOPE 5 = ,2195817E-13	
HALF LIFE ,1000000E 7 YRS ZR 93					
TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	CURIES
000000000000	,2108108E 6	,1756756E 5	,2635134E 5	,2679054E 5	,1759555E- 2
,5555556E 3	000000000000	,1868842E-24	,1219088E 5	,2670770E 5	,1759881E- 2
,5555556E 4	000000000000	000000000000	,0152436E 1	,2446870E 5	,1762696E- 2
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01,0 E- 1				DECAY CONSTANT FOR ISOTOPE 1 = ,4950001E 0	
HALF LIFE ,1400000E 1 SEC KR 94					
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2299999E 1				DECAY CONSTANT FOR ISOTOPE 2 = ,2389655E 0	
HALF LIFE ,2900000E 1 SEC RB 94					
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,2299999E 1				DECAY CONSTANT FOR ISOTOPE 3 = ,8884615E- 2	
HALF LIFE ,1300000E 1 MIN SR 94					
FISSION YIELD IN PERCENT FOR ISOTOPE 4 = ,6999999E 0				DECAY CONSTANT FOR ISOTOPE 4 = ,5775000E- 3	
HALF LIFE ,1999999E 2 MIN Y 94					
TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	
000000000000	,4391891E 5	,1054054E 5	,2064189E 5	,2371622E 5	
,5555556E 3	000000000000	000000000000	,1572048E 3	,1829710E 5	
,5555556E 4	000000000000	000000000000	,8012517E-17	,1020039E 4	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,6999999E- 2				DECAY CONSTANT FOR ISOTOPE 1 = ,1386000E 1	
HALF LIFE ,4999999E 0 SEC KR 95					
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,4490000E 1				DECAY CONSTANT FOR ISOTOPE 2 = ,1732500E- 1	
HALF LIFE ,4000000E 2 SEC SR 95					
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,1700000E 1				DECAY CONSTANT FOR ISOTOPE 3 = ,1155000E- 2	
HALF LIFE ,1000000E 2 MIN Y 95					
FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000				DECAY CONSTANT FOR ISOTOPE 4 = ,1233975E- 6	
HALF LIFE ,6500001E 2 DAY ZR 95					
FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000				DECAY CONSTANT FOR ISOTOPE 5 = ,2291667E- 6	
HALF LIFE ,3500001E 2 DAY NB 95					

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	CURIES
000000000000	.3074325E 4	.1975033E 5	.2721656E 5	.8138230E 4	.2294998E 4
.5555556E 3	000000000000	.1307209E 1	.1507117E 5	.8139110E 4	.2295743E 4
.5555556E 4	000000000000	000000000000	.4678418E 2	.8135694E 4	.2302433E 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .5700000E- 3 DECAY CONSTANT FOR ISOTOPE 1 = .8226495E- 5
 HALF LIFE .2340000E 2 HRS NB 96

TIME IN SECONDS	CURIES
000000000000	.2503379E 1
.5555556E 3	.2491963E 1
.5555556E 4	.2391543E 1

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1400000E 1 DECAY CONSTANT FOR ISOTOPE 1 = .1690244E 1
 HALF LIFE .4100000E 0 SEC SR 97

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .3099999E 1 DECAY CONSTANT FOR ISOTOPE 2 = .1358823E 1
 HALF LIFE .5100000E 0 SEC Y 97

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .1400000E 1 DECAY CONSTANT FOR ISOTOPE 3 = .1132352E- 4
 HALF LIFE .1700000E 2 HRS ZR 97

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .1155000E- 1
 HALF LIFE .1000000E 1 MIN NB 97

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000 DECAY CONSTANT FOR ISOTOPE 5 = .1582192E- 3
 HALF LIFE .7300000E 2 MIN NB 97

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	CURIES
000000000000	.6148649E 4	.1976352E 5	.2591216E 5	.2591216E 5	.2591216E 5
.5555556E 3	000000000000	000000000000	.2574987E 5	.2577510E 5	.2590705E 5
.5555556E 4	000000000000	000000000000	.2433248E 5	.2435635E 5	.2539292E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .6400000E- 1 DECAY CONSTANT FOR ISOTOPE 1 = .2221154E- 3
 HALF LIFE .5200000E 2 MIN NB 98

TIME IN SECONDS	CURIES
000000000000	.2810811E 3
.5555556E 3	.2484510E 3
.5555556E 4	.8183203E 2

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .5272199E 1 DECAY CONSTANT FOR ISOTOPE 1 = .2100000E- 1
 HALF LIFE .3299999E 2 SEC ZR 99

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .4812500E- 2
 HALF LIFE .2399999E 1 MIN NB 99

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = .2894737E- 5
 HALF LIFE .6650000E 2 HRS MU 99

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .3208334E- 4
 HALF LIFE .6000000E 1 HRS TC 99

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000 DECAY CONSTANT FOR ISOTOPE 5 = .1097908E-12
 HALF LIFE .2000001E 6 YRS TC 99

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	CURIES
000000000000	.2315493E 5	.2315493E 5	.2314938E 5	.2314883E 5	.6363666E- 2
.5555556E 3	.1985521E 0	.2072698E 4	.2312803E 5	.2314871E 5	.6365078E- 2
.5555556E 4	000000000000	.7350848E- 7	.2279693E 5	.2312047E 5	.6377779E- 2

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .7877999E 0 DECAY CONSTANT FOR ISOTOPE 1 = .2100000E- 1
 HALF LIFE .3299999E 2 SEC ZR 99

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .4812500E- 2
 HALF LIFE .2399999E 1 MIN NB 99

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = .2894737E- 5
 HALF LIFE .6650000E 2 HRS MO 99

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .1097908E-12
 HALF LIFE ,2000001E 6 YRS TC 99

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	,3459932E 4	,3459932E 4	,3459102E 4	,9627295E- 3
,5555556E 3	,2966870E- 1	,3097135E 3	,3455914E 4	,9629405E- 3
,5555556E 4	000000000000	,1098402E- 7	,3406437E 4	,9648240E- 3

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,6299999E 1 DECAY CONSTANT FOR ISOTOPE 1 = .3850000E- 2
 HALF LIFE ,3000000E 1 MIN NB 100

TIME IN SECONDS	CURIES
000000000000	,2766891E 5
,5555556E 3	,3259002E 4
,5555556E 4	,1422053E- 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,5599999E 1 DECAY CONSTANT FOR ISOTOPE 1 = .1155000E- 1
 HALF LIFE 01.0 E 0 MIN NB 101

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,7910958E- 3
 HALF LIFE ,1459999E 2 MIN MO 101

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,8250001E- 3
 HALF LIFE ,1400000E 2 MIN TC 101

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	,2459459E 5	,2459460E 5	,2459458E 5
,5555556E 3	,4018988E 2	,1701009E 5	,2318898E 5
,5555556E 4	,3338956E-23	,3257911E 3	,1610965E 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,4300000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,1004347E- 2
 HALF LIFE ,1149999E 2 MIN MO 102

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,2817073E- 2
 HALF LIFE ,4100000E 1 MIN TC 102

TIME IN SECONDS	CURIES	CURIES
000000000000	,1888514E 5	,1888514E 5
,5555556E 3	,1080926E 5	,1461050E 5
,5555556E 4	,7126605E 2	,1107497E 3

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3000000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,9625000E- 2
 HALF LIFE ,1199999E 1 MIN TC 103

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,2020360E- 6
 HALF LIFE ,3970000E 2 DAY RU 103

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,2026315E- 3
 HALF LIFE ,5700000E 2 MIN RH 103

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	,1317568E 5	,5812220E 4	,5804871E 4
,5555556E 3	,6273411E 2	,5811842E 4	,5805642E 4
,5555556E 4	,7890087E-19	,5805975E 4	,5807413E 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1800000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,4620000E- 2
 HALF LIFE ,2499999E 1 MIN MO 104

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,6416666E- 3
 HALF LIFE ,1800000E 2 MIN TC 104

TIME IN SECONDS	CURIES	CURIES
000000000000	,7905405E 4	,7905405E 4
,5555556E 3	,6070647E 3	,6329658E 4
,5555556E 4	,5636798E- 7	,2598278E 3

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,6000000E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,5775000E- 2
 HALF LIFE ,1999999E 1 MIN MO 105

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .2999999E 0 DECAY CONSTANT FOR ISOTOPE 2 = .1283333E- 2
 HALF LIFE .9000000E 1 MIN TC 105

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = .4325843E- 4
 HALF LIFE .4450000E 1 HRS RU 105

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .1823684E- 1
 HALF LIFE .3800000E 2 SEC RH 105

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000 DECAY CONSTANT FOR ISOTOPE 5 = .5347222E- 5
 HALF LIFE .3599999E 2 HRS RH 105

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	CURIES
000000000000	.2635134E 4	.3952703E 4	.3952702E 4	.3952702E 4	.3952702E 4
.5555556E 3	.1065225E 3	.2276201E 4	.3933311E 4	.3936870E 4	.3952688E 4
.5555556E 4	.3070353E-10	.3769260E 1	.3232780E 4	.3240496E 4	.3943454E 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .3800000E 0 DECAY CONSTANT FOR ISOTOPE 1 = .2174077E- 7
 HALF LIFE .1010001E 1 YRS RU 106

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .2389655E- 1
 HALF LIFE .2900000E 2 SEC RH 106

TIME IN SECONDS	CURIES	CURIES
000000000000	.1012924E 3	.1012910E 3
.5555556E 3	.1012913E 3	.1012914E 3
.5555556E 4	.1012803E 3	.1012804E 3

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1499999E 0 DECAY CONSTANT FOR ISOTOPE 1 = .1155000E- 1
 HALF LIFE .1000000E 1 MIN TC 107

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .3999999E- 1 DECAY CONSTANT FOR ISOTOPE 2 = .2510869E- 2
 HALF LIFE .4600000E 1 MIN RU 107

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = .5322581E- 3
 HALF LIFE .2170000E 2 MIN RH 107

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .6930001E 0
 HALF LIFE .1000000E 1 SEC PD 107

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000 DECAY CONSTANT FOR ISOTOPE 5 = .3136882E-14
 HALF LIFE .7000000E 7 YRS PD 107

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	CURIES
000000000000	.6587837E 3	.8344594E 3	.8344594E 3	.8344594E 3	.7532547E- 5
.5555556E 3	.1076515E 1	.2518782E 3	.7500842E 3	.7504665E 3	.7533951E- 5
.5555556E 4	.8943631E-25	.8900653E- 3	.5713712E 2	.5718104E 2	.7538354E- 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .3000000E- 1 DECAY CONSTANT FOR ISOTOPE 1 = .2772000E- 1
 HALF LIFE .2499999E 2 SEC RH 109

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .1436567E- 4
 HALF LIFE .1340000E 2 HRS PD 109

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = .1776923E- 1
 HALF LIFE .3900000E 2 SEC AG 109

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	.1317568E 3	.1317568E 3	.1317568E 3
.5555556E 3	.2701703E- 4	.1307772E 3	.1308830E 3
.5555556E 4	000000000000	.1217130E 3	.1218115E 3

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1800000E- 1 DECAY CONSTANT FOR ISOTOPE 1 = .5021739E- 3
 HALF LIFE .2299999E 2 MIN PD 111

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .9364865E- 2
 HALF LIFE .7399999E 2 SEC AG 111

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = .1055373E- 5
 HALF LIFE .7600001E 1 DAY AG 111

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	,7905405E 2	,7905405E 2	,7526212E 2
,5555556E 3	,5980842E 2	,6317260E 2	,7526023E 2
,5555556E 4	,4856300E 1	,5131464E 1	,7498572E 2
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01.0 E- 2			
HALF LIFE	,2100000E 2	MRS PD 112	DECAY CONSTANT FOR ISOTOPE 1 = ,9166666E- 5
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000			
HALF LIFE	,3200000E 1	MRS AG 112	DECAY CONSTANT FOR ISOTOPE 2 = ,6015625E- 4
TIME IN SECONDS	CURIES	CURIES	
000000000000	,4391892E 2	,4391892E 2	
,5555556E 3	,4369582E 2	,4391523E 2	
,5555556E 4	,4173830E 2	,4358932E 2	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01.0 E- 2			
HALF LIFE	,1400000E 1	MIN PD 113	DECAY CONSTANT FOR ISOTOPE 1 = ,8250001E- 2
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000			
HALF LIFE	,5300000E 1	MRS AG 113	DECAY CONSTANT FOR ISOTOPE 2 = ,3632075E- 4
TIME IN SECONDS	CURIES	CURIES	
000000000000	,4391891E 2	,4391891E 2	
,5555556E 3	,4488852E 0	,4322994E 2	
,5555556E 4	,5463712E-18	,3605247E 2	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01.0 E- 2			
HALF LIFE	,2399999E 1	MIN PD 114	DECAY CONSTANT FOR ISOTOPE 1 = ,4812500E- 2
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000			
HALF LIFE	,5000000E 1	SEC AG 114	DECAY CONSTANT FOR ISOTOPE 2 = ,1386000E 0
TIME IN SECONDS	CURIES	CURIES	
000000000000	,4391892E 2	,4391891E 2	
,5555556E 3	,3030520E 1	,3139531E 1	
,5555556E 4	,1074747E- 9	,1113406E- 9	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,7040000E- 2			
HALF LIFE	,2099999E 2	MIN AG 115	DECAY CONSTANT FOR ISOTOPE 1 = ,5500000E- 3
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000			
HALF LIFE	,5299999E 2	MRS CD 115	DECAY CONSTANT FOR ISOTOPE 2 = ,3632075E- 5
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000			
HALF LIFE	,4509999E 1	MRS IN 115	DECAY CONSTANT FOR ISOTOPE 3 = ,4268293E- 4
TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	,3091891E 2	,3091803E 2	,3091794E 2
,5555556E 3	,2277839E 2	,3090940E 2	,3091787E 2
,5555556E 4	,1456175E 1	,3049215E 2	,3088009E 2
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1630000E- 2			
HALF LIFE	,1999999E 2	SEC AG 115	DECAY CONSTANT FOR ISOTOPE 1 = ,3465000E- 1
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000			
HALF LIFE	,5299999E 2	MRS OD 115	DECAY CONSTANT FOR ISOTOPE 2 = ,3632075E- 5
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000			
HALF LIFE	,4509999E 1	MRS IN 115	DECAY CONSTANT FOR ISOTOPE 3 = ,4268293E- 4
TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	,7158784E 1	,7158578E 1	,7158560E 1
,5555556E 3	,3123708E- 7	,7144897E 1	,7158407E 1
,5555556E 4	000000000000	,7016314E 1	,7142978E 1
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1099999E- 1			
HALF LIFE	,3000000E 1	MRS CD 117	DECAY CONSTANT FOR ISOTOPE 1 = ,6416666E- 4

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .2310000E- 3
 HALF LIFE .4999999E 2 MIN CD 117

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = .9624999E- 4
 HALF LIFE .1999999E 1 HRS IN 117

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	.4831080E 2	.4831081E 2	.4831081E 2
.5555556E 3	.4661896E 2	.4820614E 2	.4830895E 2
.5555556E 4	.3382411E 2	.4168434E 2	.4714255E 2

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01.0 E- 2 DECAY CONSTANT FOR ISOTOPE 1 = .2309999E- 3
 HALF LIFE .5000000E 2 MIN CD 118

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .2566666E- 2
 HALF LIFE .4499999E 1 MIN IN 118

TIME IN SECONDS	CURIES	CURIES
000000000000	.4391891E 2	.4391891E 2
.5555556E 3	.3862433E 2	.4140609E 2
.5555556E 4	.1217046E 2	.1337413E 2

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01.0 E- 2 DECAY CONSTANT FOR ISOTOPE 1 = .1155000E- 2
 HALF LIFE 01.0 E 1 MIN CD 119

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .6600000E- 3
 HALF LIFE .1750000E 2 MIN IN 119

TIME IN SECONDS	CURIES	CURIES
000000000000	.4391892E 2	.4391891E 2
.5555556E 3	.2311955E 2	.4019498E 2
.5555556E 4	.7176765E- 1	.2523792E 1

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1500000E- 1 DECAY CONSTANT FOR ISOTOPE 1 = .6999999E- 5
 HALF LIFE .2750000E 2 HRS SN 121

TIME IN SECONDS	CURIES
000000000000	.6567837E 2
.5555556E 3	.6562268E 2
.5555556E 4	.6336562E 2

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1300000E- 2 DECAY CONSTANT FOR ISOTOPE 1 = .6416667E- 7
 HALF LIFE .1250000E 3 DAY SN 123

TIME IN SECONDS	CURIES
000000000000	.9633540E 0
.5555556E 3	.9633196E 0
.5555556E 4	.9630107E 0

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1400000E- 1 DECAY CONSTANT FOR ISOTOPE 1 = .2887500E- 3
 HALF LIFE .3999999E 2 MIN SN 123

TIME IN SECONDS	CURIES
000000000000	.6148649E 2
.5555556E 3	.5237349E 2
.5555556E 4	.1236229E 2

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .3900000E- 2 DECAY CONSTANT FOR ISOTOPE 1 = .8355034E- 6
 HALF LIFE .9600000E 1 DAY SN 125

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .2400000E- 2 DECAY CONSTANT FOR ISOTOPE 2 = .1097908E- 7
 HALF LIFE .2000000E 1 YRS SB 125

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = .1382903E- 6
 HALF LIFE .5800000E 2 DAY TE 125

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	.1558421E 2	.6607826E 0	.1041897E 0
.5555556E 3	.1557697E 2	.6608735E 0	.1042325E 0
.5555556E 4	.1551204E 2	.6616906E 0	.1046176E 0

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,9100000E- 2 DECAY CONSTANT FOR ISOTOPE 1 = ,8355034E- 6
 HALF LIFE ,9600000E 1 DAY SN 125

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,5599999E- 2 DECAY CONSTANT FOR ISOTOPE 2 = ,1097908E- 7
 HALF LIFE ,2000000E 1 YRS SB 125

TIME IN SECONDS	CURIES	CURIES
000000000000	,3636315E 2	,1541826E 1
,5555556E 3	,3634628E 2	,1542038E 1
,5555556E 4	,3619476E 2	,1543945E 1

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01.0 E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,2195817E-12
 HALF LIFE ,1000000E 6 YRS SN 126

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,6078948E- 3
 HALF LIFE ,1900000E 2 MIN SB 126

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,6416666E- 6
 HALF LIFE ,1250000E 2 DAY SB 126

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	,2777412E- 3	,2775824E- 3	,1509936E- 3
,5555556E 3	,2777412E- 3	,2776280E- 3	,1510387E- 3
,5555556E 4	,2777412E- 3	,2777357E- 3	,1514446E- 3

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2639999E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,1013157E- 3
 HALF LIFE ,1900000E 1 HRS SN 127

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2199999E- 2 DECAY CONSTANT FOR ISOTOPE 2 = ,2115385E- 5
 HALF LIFE ,9100000E 2 HRS SB 127

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,6400000E- 2 DECAY CONSTANT FOR ISOTOPE 3 = ,7638888E- 7
 HALF LIFE ,1049999E 3 DAY TE 127

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,2069893E- 4
 HALF LIFE ,9300000E 1 HRS TE 127

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	,1159460E 3	,1253186E 3	,2651759E 2	,2604762E 2
,5555556E 3	,1096000E 3	,1253039E 3	,2652178E 2	,2605303E 2
,5555556E 4	,6603986E 2	,1248898E 3	,2655944E 2	,2610099E 2

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,9349999E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,1013157E- 3
 HALF LIFE ,1900000E 1 HRS SN 127

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,7999999E- 2 DECAY CONSTANT FOR ISOTOPE 2 = ,2115385E- 5
 HALF LIFE ,9100000E 2 HRS SB 127

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,2069893E- 4
 HALF LIFE ,9300000E 1 HRS TE 127

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	,4106418E 3	,4447497E 3	,4446327E 3
,5555556E 3	,3881667E 3	,4446962E 3	,4446338E 3
,5555556E 4	,2338911E 3	,4432203E 3	,4445793E 3

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3699999E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,2026315E- 3
 HALF LIFE ,5700000E 2 MIN SN 128

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,1121360E- 2
 HALF LIFE ,1030000E 2 MIN SB 128

TIME IN SECONDS	CURIES	CURIES
000000000000	,1625000E 4	,1625000E 4
,5555556E 3	,1451989E 4	,1580007E 4
,5555556E 4	,5271748E 3	,6427406E 3

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .2529999E 0 DECAY CONSTANT FOR ISOTOPE 1 = .4184782E- 4
 HALF LIFE .4600000E 1 HRS SB 129

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .1030000E 0 DECAY CONSTANT FOR ISOTOPE 2 = .2167792E- 6
 HALF LIFE .3700001E 2 DAY TE 129

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = .1604167E- 3
 HALF LIFE .7200001E 2 MIN TE 129

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .1291658E-14
 HALF LIFE .1700000E 8 YRS I 129

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	.1111148E 4	.7229602E 3	.7218228E 3	.1468435E- 5
.5555556E 3	.1085614E 4	.7230054E 3	.7219217E 3	.1468952E- 5
.5555556E 4	.8806512E 3	.7232833E 3	.7226165E 3	.1473617E- 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .4500000E 0 DECAY CONSTANT FOR ISOTOPE 1 = .4184782E- 4
 HALF LIFE .4600000E 1 HRS SB 129

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .1604167E- 3
 HALF LIFE .7200001E 2 MIN TE 129

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = .1291658E-14
 HALF LIFE .1700000E 8 YRS I 129

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	.1976351E 4	.1976351E 4	.7275059E- 5
.5555556E 3	.1930934E 4	.1974378E 4	.7276476E- 5
.5555556E 4	.1566376E 4	.1833112E 4	.7288867E- 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .2000000E 1 DECAY CONSTANT FOR ISOTOPE 1 = .4442308E- 2
 HALF LIFE .2599999E 1 MIN SN 130

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .1626760E- 2
 HALF LIFE .7100000E 1 MIN SB 130

TIME IN SECONDS	CURIES	CURIES
000000000000	.8783783E 4	.8783784E 4
.5555556E 3	.7445007E 3	.5183312E 4
.5555556E 4	.1680802E 6	.1647273E 1

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .2210000E 1 DECAY CONSTANT FOR ISOTOPE 1 = .5021739E- 3
 HALF LIFE .2899999E 2 MIN SD 131

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .4812500E- 3
 HALF LIFE .2399999E 2 MIN TE 131

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .3060000E 0 DECAY CONSTANT FOR ISOTOPE 3 = .9963768E- 6
 HALF LIFE .8049999E 1 DAY I 131

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	.9706080E 4	.9706082E 4	.1042096E 5
.5555556E 3	.7343143E 4	.9403731E 4	.1042051E 5
.5555556E 4	.5962496E 3	.2360225E 4	.1039661E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .3900000E 0 DECAY CONSTANT FOR ISOTOPE 1 = .5021739E- 3
 HALF LIFE .2299999E 2 MIN SB 131

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .5000000E- 1 DECAY CONSTANT FOR ISOTOPE 2 = .6416666E- 5
 HALF LIFE .3000000E 2 HRS TE 131

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .5400000E- 1 DECAY CONSTANT FOR ISOTOPE 3 = .9963768E- 6
 HALF LIFE .8049999E 1 DAY I 131

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	.1712838E 4	.1932432E 4	.2026148E 4
.5555556E 3	.1295849E 4	.1930874E 4	.2026096E 4
.5555556E 4	.1052198E 3	.1884790E 4	.2025522E 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1300000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,5249999E- 2
 HALF LIFE ,2200000E 1 MIN SN 132

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2000000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,5500001E- 2
 HALF LIFE ,2100000E 1 MIN SB 132

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,1100000E 1 DECAY CONSTANT FOR ISOTOPE 3 = ,2500000E- 5
 HALF LIFE ,7699999E 2 HRS TE 132

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 01.0 E= 1 DECAY CONSTANT FOR ISOTOPE 4 = ,8369565E- 4
 HALF LIFE ,2300001E 1 HRS I 132

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	,5709460E 4	,1449325E 5	,1930988E 5	,1974864E 5
,5555556E 3	,3089603E 3	,1564001E 4	,1929153E 5	,1972835E 5
,5555556E 4	,1229341E- 8	,2107980E- 7	,1905273E 5	,1953534E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2880000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,2817073E- 2
 HALF LIFE ,4100000E 1 MIN SB 133

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2020000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,2221154E- 3
 HALF LIFE ,5200000E 2 MIN TE 133

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,9254807E- 5
 HALF LIFE ,2080000E 2 HRS I 133

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,1521979E- 5
 HALF LIFE ,5270000E 1 DAY XE 133

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	,1264864E 5	,2152026E 5	,2152026E 5	,2119641E 7
,5555556E 3	,2644574E 4	,1975264E 5	,2151615E 5	,2117867E 7
,5555556E 4	,2019105E- 2	,6580463E 4	,2108574E 5	,2101973E 7

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1120000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,2817073E- 2
 HALF LIFE ,4100000E 1 MIN SB 133

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,8800000E 0 DECAY CONSTANT FOR ISOTOPE 2 = ,5775000E- 2
 HALF LIFE ,1999999E 1 MIN TE 133

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,9254807E- 5
 HALF LIFE ,2080000E 2 HRS I 133

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,1521979E- 5
 HALF LIFE ,5270000E 1 DAY XE 133

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	,4918919E 4	,8783783E 4	,8783783E 4	,8652468E 6
,5555556E 3	,1028446E 4	,1974777E 4	,8762355E 4	,8645229E 6
,5555556E 4	,7852077E- 3	,1533024E- 2	,8372391E 4	,8580339E 6

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3200000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,1386000E- 1
 HALF LIFE ,5000000E 2 SEC SB 134

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3699999E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,2686047E- 3
 HALF LIFE ,4299999E 2 MIN TE 134

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,7999999E 0 DECAY CONSTANT FOR ISOTOPE 3 = ,2200000E- 3
 HALF LIFE ,9249999E 2 MIN I 134

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	,1405406E 5	,3030405E 5	,3381756E 5
,5555556E 3	,6364056E 1	,2634228E 5	,3318643E 5
,5555556E 4	,5094791E-29	,6876825E 4	,1960971E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1320000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,2310000E- 1
 HALF LIFE ,3000000E 2 SEC TE 135

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,5099999E 0 DECAY CONSTANT FOR ISOTOPE 2 = ,2873135E- 4
 HALF LIFE ,6700000E 1 HRS I 135

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000
 HALF LIFE .1529999E 2 MIN XE 135 DECAY CONSTANT FOR ISOTOPE 3 = .7549019E- 3

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = .6000000E- 1
 HALF LIFE .9200001E 1 HRS XE 135 DECAY CONSTANT FOR ISOTOPE 4 = .2092392E- 4

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = .3299999E- 1
 HALF LIFE .2000001E 7 YRS CS 135 DECAY CONSTANT FOR ISOTOPE 5 = .1097908E-13

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	CURIES
000000000000	.5797297E 4	.8037162E 4	.8037162E 6	.8300676E 6	.2595018E- 3
.5555556E 3	.1548032E- 1	.7916998E 4	.5311335E 6	.8280751E 6	.2645603E- 3
.5555556E 4	000000000000	.6857584E 4	.1912867E 5	.7596645E 6	.3083077E- 3

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .3080000E 1
 HALF LIFE .3000000E 2 SEC TE 135 DECAY CONSTANT FOR ISOTOPE 1 = .2310000E- 1

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .1190000E 1
 HALF LIFE .6700000E 1 HRS I 135 DECAY CONSTANT FOR ISOTOPE 2 = .2873135E- 4

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .1400000E 0
 HALF LIFE .9200001E 1 HRS XE 135 DECAY CONSTANT FOR ISOTOPE 3 = .2092392E- 4

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = .7699999E- 1
 HALF LIFE .2000001E 7 YRS CS 135 DECAY CONSTANT FOR ISOTOPE 4 = .1097908E-13

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	.1352702E 5	.1875338E 5	.1936824E 7	.6057770E- 3
.5555556E 3	.3612072E- 1	.1847300E 5	.1914656E 7	.6175229E- 3
.5555556E 4	000000000000	.1600103E 5	.1726175E 7	.7173663E- 3

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .3099999E 1
 HALF LIFE .8600000E 2 SEC I 136 DECAY CONSTANT FOR ISOTOPE 1 = .8058140E- 2

TIME IN SECONDS	CURIES
000000000000	.1361486E 5
.5555556E 3	.1848040E 5
.5555556E 4	.4917682E-15

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .4899999E 1
 HALF LIFE .2440000E 2 SEC I 137 DECAY CONSTANT FOR ISOTOPE 1 = .2840164E- 1

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .1100000E 1
 HALF LIFE .3900000E 1 MIN XE 137 DECAY CONSTANT FOR ISOTOPE 2 = .2961539E- 2

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .1499999E 0
 HALF LIFE .2999999E 2 YRS CS 137 DECAY CONSTANT FOR ISOTOPE 3 = .7319391E- 9

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000
 HALF LIFE .2570000E 1 MIN BA 137 DECAY CONSTANT FOR ISOTOPE 4 = .4494163E- 2

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	.2152026E 5	.2635134E 7	.5686992E 2	.5686554E 2
.5555556E 3	.3021693E- 2	.5089454E 6	.5739594E 2	.5725628E 2
.5555556E 4	000000000000	.1887002E 0	.5752151E 2	.5752153E 2

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .3399999E 1
 HALF LIFE .6300000E 1 SEC I 138 DECAY CONSTANT FOR ISOTOPE 1 = .1100000E 0

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .2089999E 1
 HALF LIFE .1699999E 2 MIN XE 138 DECAY CONSTANT FOR ISOTOPE 2 = .6794118E- 3

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000
 HALF LIFE .3220000E 2 MIN CS 138 DECAY CONSTANT FOR ISOTOPE 3 = .3586956E- 3

TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	.1493244E 5	.2411148E 7	.2411148E 5
.5555556E 3	.4304394E-22	.1653164E 7	.3803617E 6
.5555556E 4	000000000000	.5533397E 5	.3090243E 6

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1800000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,3465000E 0
 HALF LIFE ,1999999E 1 SEC I 139

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3599999E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,1690244E- 1
 HALF LIFE ,4100000E 2 SEC XE 139

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,1070000E 1 DECAY CONSTANT FOR ISOTOPE 3 = ,1215790E- 2
 HALF LIFE ,9499999E 1 MIN CS 139

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = ,7999999E- 1 DECAY CONSTANT FOR ISOTOPE 4 = ,1391567E- 3
 HALF LIFE ,8299999E 2 MIN BA 139

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	,7905405E 4	,2371622E 7	,2841554E 5	,2876688E 5
,5555556E 3	000000000000	,1981475E 3	,1080095E 6	,3664547E 5
,5555556E 4	000000000000	000000000000	,2474402E 3	,2520528E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3800000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,4331250E- 1
 HALF LIFE ,1599999E 2 SEC XE 140

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2200000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,1050000E- 1
 HALF LIFE ,6599999E 2 SEC CS 140

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,3500000E 0 DECAY CONSTANT FOR ISOTOPE 3 = ,6266276E- 6
 HALF LIFE ,1279999E 2 DAY BA 140

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,4788558E- 5
 HALF LIFE ,4019999E 2 HRS LA 140

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	,1668918E 7	,2635134E 5	,2329983E 5	,2260895E 5
,5555556E 3	,5918672E- 4	,1641035E 4	,2331734E 5	,2261084E 5
,5555556E 4	000000000000	,2598108E-19	,2324448E 5	,2262668E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1330000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,4076470E 0
 HALF LIFE ,1700000E 1 SEC XE 141

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3270000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,2772000E- 1
 HALF LIFE ,2499999E 2 SEC CS 141

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,1700000E 1 DECAY CONSTANT FOR ISOTOPE 3 = ,6416666E- 3
 HALF LIFE ,1800000E 2 MIN BA 141

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 01.0 E- 1 DECAY CONSTANT FOR ISOTOPE 4 = ,5065790E- 4
 HALF LIFE ,3800001E 1 HRS LA 141

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000 DECAY CONSTANT FOR ISOTOPE 5 = ,2430556E- 6
 HALF LIFE ,3300000E 2 DAY CE 141

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	CURIES
000000000000	,5841216E 6	,2020270E 5	,2766892E 5	,2810810E 5	,1407742E 5
,5555556E 3	000000000000	,1288160E- 1	,2036720E 5	,2800395E 5	,1407930E 5
,5555556E 4	000000000000	000000000000	,8233224E 3	,2302243E 5	,1409349E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3500000E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,4620001E 0
 HALF LIFE ,1500000E 1 SEC XE 142

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3050000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,8662500E- 1
 HALF LIFE ,8000000E 1 SEC CS 142

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,2200000E 1 DECAY CONSTANT FOR ISOTOPE 3 = ,1155000E- 2
 HALF LIFE 01.0 E 1 MIN BA 142

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = ,2999999E 0 DECAY CONSTANT FOR ISOTOPE 4 = ,1425926E- 3
 HALF LIFE ,8100000E 2 MIN LA 142

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES
000000000000	,1537163E 6	,1493244E 5	,2459460E 5	,2591216E 5
,5555556E 3	000000000000	,6339502E-16	,1325871E 5	,2534747E 5
,5555556E 4	000000000000	000000000000	,4115768E 2	,1333467E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1900000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,6930001E 0
 HALF LIFE ,9999999E 0 SEC CS 143

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3000000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,5330769E- 1
 HALF LIFE ,1299999E 2 SEC BA 143

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,1300000E 1 DECAY CONSTANT FOR ISOTOPE 3 = ,8250001E- 3
 HALF LIFE ,1400000E 2 MIN LA 143

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,5833333E- 5
 HALF LIFE ,3300001E 2 HRS CE 143

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000 DECAY CONSTANT FOR ISOTOPE 5 = ,5854623E- 6
 HALF LIFE ,1370000E 2 DAY PR 143

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	CURIES
000000000000	,8344595E 4	,2152026E 5	,2722973E 5	,2722973E 5	,2161909E 5
,5555556E 3	000000000000	,3053942E- 8	,1743866E 5	,2721315E 5	,2162093E 5
,5555556E 4	000000000000	000000000000	,2818696E 3	,2654950E 5	,2163638E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,9000000E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,2310000E 1
 HALF LIFE ,3000000E 0 SEC CS 144

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2500000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,1732500E 1
 HALF LIFE ,4000000E 0 SEC BA 144

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,2299999E 1 DECAY CONSTANT FOR ISOTOPE 3 = ,1386000E 1
 HALF LIFE ,4999999E 0 SEC LA 144

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = ,2999999E 0 DECAY CONSTANT FOR ISOTOPE 4 = ,2864583E- 7
 HALF LIFE ,2800000E 3 DAY CE 144

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000 DECAY CONSTANT FOR ISOTOPE 5 = ,6637931E- 3
 HALF LIFE ,1740000E 2 MIN PR 144

TIME IN SECONDS	CURIES	CURIES	CURIES	CURIES	CURIES
000000000000	,3952703E 4	,1493244E 5	,2503379E 5	,2086725E 4	,2085677E 4
,5555556E 3	000000000000	000000000000	000000000000	,2086693E 4	,2085996E 4
,5555556E 4	000000000000	000000000000	000000000000	,2086393E 4	,2086455E 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,4200000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,3850000E- 2
 HALF LIFE ,3000000E 1 MIN CE 145

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,3229866E- 4
 HALF LIFE ,5959999E 1 HRS PR 145

TIME IN SECONDS	CURIES	CURIES
000000000000	,1844594E 5	,1844594E 5
,5555556E 3	,2172668E 4	,1829280E 5
,5555556E 4	,9480353E- 5	,1554644E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3200000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,8309352E- 3
 HALF LIFE ,1390000E 2 MIN CE 146

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,4733606E- 3
 HALF LIFE ,2440000E 2 MIN PR 146

TIME IN SECONDS	CURIES	CURIES
000000000000	,1405406E 5	,1405406E 5
,5555556E 3	,8857638E 4	,1338102E 5
,5555556E 4	,1389840E 3	,2170532E 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2700000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,7229976E- 6
 HALF LIFE ,1110000E 2 DAY ND 147

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,8445452E- 8
 HALF LIFE ,2600001E 1 YRS PH 147

TIME IN SECONDS	CURIES	CURIES	
000000000000	.1037827E 5	.1655820E 3	
.5555556E 3	.1037411E 5	.1656300E 3	
.5555556E 4	.1033670E 5	.1660603E 3	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1300000E 1			DECAY CONSTANT FOR ISOTOPE 1 = .9624999E- 4
HALF LIFE	.1999999E 1	HRS ND 149	
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000			DECAY CONSTANT FOR ISOTOPE 2 = .3625236E- 5
HALF LIFE	.5309999E 2	HRS PM 149	
TIME IN SECONDS	CURIES	CURIES	
000000000000	.5709459E 4	.5709286E 4	
.5555556E 3	.5412181E 4	.5708985E 4	
.5555556E 4	.3344784E 4	.5683544E 4	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .4200000E 0			DECAY CONSTANT FOR ISOTOPE 1 = .8884615E- 3
HALF LIFE	.1300000E 2	MIN ND 151	
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .2000000E- 1			DECAY CONSTANT FOR ISOTOPE 2 = .6778168E- 5
HALF LIFE	.2840000E 2	HRS PM 151	
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000			DECAY CONSTANT FOR ISOTOPE 3 = .2439797E- 9
HALF LIFE	.9000001E 2	YRS SM 151	
TIME IN SECONDS	CURIES	CURIES	CURIES
000000000000	.1844594E 4	.1932432E 4	.1287351E 1
.5555556E 3	.1125998E 4	.1930640E 4	.1287613E 1
.5555556E 4	.1325158E 2	.1874571E 4	.1289935E 1
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1499999E 0			DECAY CONSTANT FOR ISOTOPE 1 = .4095745E- 5
HALF LIFE	.4699999E 2	HRS SM 153	
TIME IN SECONDS	CURIES		
000000000000	.6587788E 3		
.5555556E 3	.6572814E 3		
.5555556E 4	.6439580E 3		
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .3299999E- 1			DECAY CONSTANT FOR ISOTOPE 1 = .4812500E- 3
HALF LIFE	.2400001E 2	MIN SM 155	
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000			DECAY CONSTANT FOR ISOTOPE 2 = .1291657E- 7
HALF LIFE	.1700000E 1	YRS EU 155	
TIME IN SECONDS	CURIES	CURIES	
000000000000	.1449324E 3	.5288651E 1	
.5555556E 3	.1109308E 3	.5209585E 1	
.5555556E 4	.1000071E 2	.5291892E 1	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1300000E- 1			DECAY CONSTANT FOR ISOTOPE 1 = .2138889E- 4
HALF LIFE	.8999999E 1	HRS SM 156	
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .01.0 E- 2			DECAY CONSTANT FOR ISOTOPE 2 = .5208334E- 6
HALF LIFE	.1540000E 2	DAY EU 156	
TIME IN SECONDS	CURIES	CURIES	
000000000000	.5709459E 2	.7815639E 2	
.5555556E 3	.5642017E 2	.7815020E 2	
.5555556E 4	.5069779E 2	.7808611E 2	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .7800000E- 2			DECAY CONSTANT FOR ISOTOPE 1 = .1250000E- 4
HALF LIFE	.1540000E 2	HRS EU 157	
TIME IN SECONDS	CURIES		
000000000000	.3425675E 2		
.5555556E 3	.3401988E 2		
.5555556E 4	.3195853E 2		

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1999999E- 2 DECAY CONSTANT FOR ISOTOPE 1 = .1925000E- 3
 HALF LIFE 01.0 E 0 HRS EU 158

TIME IN SECONDS CURIES

000000000000 .8783783E 1
 .5555556E 3 .7892893E 1
 .5555556E 4 .3014587E 1

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1070000E- 2 DECAY CONSTANT FOR ISOTOPE 1 = .1069444E- 4
 HALF LIFE .1800000E 2 HRS GD 159

TIME IN SECONDS CURIES

000000000000 .4699324E 1
 .5555556E 3 .4671487E 1
 .5555556E 4 .4428252E 1

TIME TOTAL F.P.I.
 000000000000 .2841581E 8
 .5555556E 3 .1428975E 8
 .5555556E 4 .9812788E 7

TIME	CESIUM	NOBLE GASES	HALOGENS	SOLIDS
000000000000	.1263677E 6	.2658281E 8	.2494232E 6	.1457219E 7
.5555556E 3	.4900696E 6	.1198658E 8	.1288585E 6	.1684243E 7
.5555556E 4	.3093293E 6	.7659017E 7	.1060673E 6	.1738377E 7

CALCULATED DOSE FOR INHALATION

THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 DOSE IS DUE TO IN DOSE IN REMS = .8512910E- 8
 THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 DOSE IS DUE TO SN DOSE IN REMS = .2741537E- 7
 THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 DOSE IS DUE TO SB DOSE IN REMS = .4354554E-10
 THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 DOSE IS DUE TO TE DOSE IN REMS = .7621749E- 4
 THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 DOSE IS DUE TO I DOSE IN REMS = .4151294E- 1
 TIME OF INHALATION = .2159999E 5 SEC TOTAL TIME = .4103999E 6 SEC

THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 CROSSWIND DISTANCE DOSE IN REMS
 000000000000 .4158919E- 1

THIS DOWNWIND DISTANCE = .1000000E 5 DOSE IS TO THE THYROID
 DOSE IS DUE TO IN DOSE IN REMS = .1340118E- 9
 THIS DOWNWIND DISTANCE = .1000000E 5 DOSE IS TO THE THYROID
 DOSE IS DUE TO SN DOSE IN REMS = .4326930E- 9
 THIS DOWNWIND DISTANCE = .1000000E 5 DOSE IS TO THE THYROID
 DOSE IS DUE TO SB DOSE IN REMS = .6909930E-12
 THIS DOWNWIND DISTANCE = .1000000E 5 DOSE IS TO THE THYROID
 DOSE IS DUE TO TE DOSE IN REMS = .1192402E- 5
 THIS DOWNWIND DISTANCE = .1000000E 5 DOSE IS TO THE THYROID
 DOSE IS DUE TO I DOSE IN REMS = .6278775E- 3
 TIME OF INHALATION = .2159999E 5 SEC TOTAL TIME = .4103999E 6 SEC

THIS DOWNWIND DISTANCE = .1000000E 5 DOSE IS TO THE THYROID
 CROSSWIND DISTANCE DOSE IN REMS
 000000000000 .6290705E- 3

CALCULATED DOSE FOR INHALATION

TIME OF INHALATION = .2159999E 5 SEC TOTAL TIME = .4103999E 6 SEC
 THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE BODY
 CROSSWIND DISTANCE DOSE IN REMS
 000000000000 .4184435E- 3
 TIME OF INHALATION = .2159999E 5 SEC TOTAL TIME = .4103999E 6 SEC
 THIS DOWNWIND DISTANCE = .1000000E 5 DOSE IS TO THE BODY
 CROSSWIND DISTANCE DOSE IN REMS
 000000000000 .6476081E- 5

CALCULATED DOSE FOR INGESTION CHAIN NO. 131

TIME OF INHALATION = .2159999E 5 SEC TOTAL TIME = .4103999E 6 SEC
 THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 CROSSWIND DISTANCE DOSE IN REMS
 000000000000 .1545769E 2
 TIME OF INHALATION = .2159999E 5 SEC TOTAL TIME = .4103999E 6 SEC
 THIS DOWNWIND DISTANCE = .1000000E 5 DOSE IS TO THE THYROID
 CROSSWIND DISTANCE DOSE IN REMS
 000000000000 .2440314E 0

CALCULATED DOSE FOR INGESTION CHAIN NO. 133

TIME OF INHALATION = .2159999E 5 SEC TOTAL TIME = .4103999E 6 SEC
 THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 CROSSWIND DISTANCE DOSE IN REMS
 000000000000 .2128146E 1
 TIME OF INHALATION = .2159999E 5 SEC TOTAL TIME = .4103999E 6 SEC
 THIS DOWNWIND DISTANCE = .1000000E 5 DOSE IS TO THE THYROID
 CROSSWIND DISTANCE DOSE IN REMS
 000000000000 .3234626E- 1

EXTERNAL GAMMA DOSE CALCULATION

THE EXPOSURE TIME = .2159999E 5
 DOWNWIND DISTANCE NO. 1 = .1000000E 4
 CROSSWIND DISTANCE DOSE
 000000000000 .2168876E- 1
 DOWNWIND DISTANCE NO. 2 = .1000000E 5
 CROSSWIND DISTANCE DOSE
 000000000000 .5217002E- 3

DEPOSITION GAMMA DOSE CALCULATION

THE EXPOSURE TIME = .4103999E 6 THE DEPOSITION TIME = .2159999E 5
 DOWNWIND DISTANCE NO. 1 = .1000000E 4
 CROSSWIND DISTANCE DOSE
 000000000000 .4242961E- 2
 DOWNWIND DISTANCE NO. 2 = .1000000E 5
 CROSSWIND DISTANCE DOSE
 000000000000 .2673348E- 4

 *** 50 M-WATTS FOR 1 SECOND *****
 *** INSTANTANEOUS RELEASE *****
 *** EXPOSURE TIME = 1 YR. (3.1536*7 SECONDS) *****
 UBAR = .1000000E 1
 DOWNWIND DISTANCES = .1000000E 4 .1000000E 5

 W1 = .1800000E 1 W2 = .1800000E 1 W3 = .1800000E 1
 STACK HEIGHT = 000000000000 INVERSION HEIGHT = 000000000000
 WASHOUT FACTOR = 000000000000 EXPOSURE TIME = .3153600E 8
 DEPLETION FROM THE CLOUD DUE TO FALLOUT HAS BEEN NEGLECTED.
 DEPOSITION VELOCITIES.
 FOR CESIUM = .2000000E- 2
 FOR THE NOBLE GASES = 000000000000
 FOR THE HALOGENS = .1000000E- 1
 FOR THE SOLIDS = .2000000E- 2
 THERE ARE 1 SET(S) OF EXPONENTIALS FOR THE LEAK RATE,
 K = .1000000E 3 P = .1000000E 3
 CROSSWIND DISTANCES = 000000000000
 THERE IS ONE SET OF CY AND CZ VALUES.
 CY = .3340000E 0 CZ = .3340000E 0
 THE REACTOR HAS OPERATED AT .5000000E 8 WATTS FOR .1000000E 1 SECONDS
 THE CONVERSION FACTOR FROM WATTS TO FISSIONS PER SECOND IS .3250000E 11
 PER CENT OF THE FISSION PRODUCT INVENTORY RELEASED = .1000000E 3
 TOTAL FISSION PRODUCT RELEASE .3089646E 10 D/SEC OR .8350396E 7 CURIES

 FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1599999E- 4 DECAY UNSTANT FOR ISOTOPE 1 = .4008745E- 5
 HALF LIFE .4700001E 2 HRS ZN 72

 FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .1365248E- 4
 HALF LIFE .1410000E 2 HRS GA 72

TIME IN SECONDS	MEV/SEC	MEV/SEC
000000000000	.9690512E 6	.1962690E 2
.1000000E 4	.9650903E 6	.3892642E 5
.1000000E 5	.9301631E 6	.3593577E 6

 FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .9800000E- 4 DECAY CONSTANT FOR ISOTOPE 1 = .5775000E- 2
 HALF LIFE .2000001E 1 MIN ZN 73

 FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .1199999E- 4 DECAY CONSTANT FOR ISOTOPE 2 = .3928572E- 4
 HALF LIFE .4899999E 1 HRS GA 73

TIME IN SECONDS	MEV/SEC	MEV/SEC
000000000000	.9170182E-28	.5331787E 6
.1000000E 4	.2846606E-30	.4605886E 7
.1000000E 5	000000000000	.3243452E 7

 FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .7999999E- 3 DECAY CONSTANT FOR ISOTOPE 1 = .1408536E- 3
 HALF LIFE .8200001E 2 MIN GE 75

TIME IN SECONDS	MEV/SEC		
000000000000	.5309809E 9		
.1000000E 4	.4612187E 9		
.1000000E 5	.1298253E 9		
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .4208999E- 2		DECAY CONSTANT FOR ISOTOPE 1 =.1283333E- 1	
HALF LIFE	.5400000E 2 SEC GE 77		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .2000000E- 3		DECAY CONSTANT FOR ISOTOPE 2 =.4974160E- 5	
HALF LIFE	.3869999E 2 HRS AS 77		
TIME IN SECONDS	MEV/SEC	MEV/SEC	
000000000000	.3314145E 12	.1833971E 6	
.1000000E 4	.8849644E 6	.3547410E 7	
.1000000E 5	000000000000	.3392113E 7	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1186999E- 2		DECAY CONSTANT FOR ISOTOPE 1 =.1283333E- 1	
HALF LIFE	.5400000E 2 SEC GE 77		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .2087000E- 2		DECAY CONSTANT FOR ISOTOPE 2 =.1703539E- 4	
HALF LIFE	.1129999E 2 HRS GE 77		
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .4999999E- 3		DECAY CONSTANT FOR ISOTOPE 3 =.4974160E- 5	
HALF LIFE	.3869999E 2 HRS AS 77		
TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.9346378E 11	.5160475E 9	.4041639E 6
.1000000E 4	.2495729E 6	.7933797E 9	.4455073E 6
.1000000E 5	000000000000	.6806064E 9	.7876234E 6
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .2000000E- 1		DECAY CONSTANT FOR ISOTOPE 1 =.9166667E- 4	
HALF LIFE	.2100000E 1 HRS GE 78		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000		DECAY CONSTANT FOR ISOTOPE 2 =.1269230E- 3	
HALF LIFE	.9100000E 2 MIN AS 78		
TIME IN SECONDS	MEV/SEC	MEV/SEC	
000000000000	.2979030E-27	.1513238E 7	
.1000000E 4	.2718095E-27	.2713159E 10	
.1000000E 5	.1191164E-27	.1019317E 11	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .5599999E- 1		DECAY CONSTANT FOR ISOTOPE 1 =.1283333E- 2	
HALF LIFE	.9000000E 1 MIN AS 79		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000		DECAY CONSTANT FOR ISOTOPE 2 =.2961539E- 2	
HALF LIFE	.3900000E 1 MIN SE 79		
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000		DECAY CONSTANT FOR ISOTOPE 3 =.3136882E-12	
HALF LIFE	.7000001E 5 YRS SE 79		
TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.1120401E 12	.1657790E 9	000000000000
.1000000E 4	.3104765E 11	.4456878E 11	.1572290E-35
.1000000E 5	.2991766E 6	.5279587E 6	.2854548E-35
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1250000E 0		DECAY CONSTANT FOR ISOTOPE 1 =.2100000E- 1	
HALF LIFE	.3300000E 2 SEC AS 81		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .3299999E- 2		DECAY CONSTANT FOR ISOTOPE 2 =.6277174E- 3	
HALF LIFE	.1840000E 2 MIN SE 81		
TIME IN SECONDS	MEV/SEC	MEV/SEC	
000000000000	.4221148E-24	.4694279E-27	
.1000000E 4	.3200711E-33	.7193482E-26	
.1000000E 5	000000000000	.2531696E-28	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .8399999E- 2		DECAY CONSTANT FOR ISOTOPE 1 =.2026315E- 3	
HALF LIFE	.5700000E 2 MIN SE 81		

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3299999E- 2 DECAY CONSTANT FOR ISOTOPE 2 = ,6277174E- 3
 HALF LIFE ,1840000E 2 MIN SE 81

TIME IN SECONDS	MEV/SEC	MEV/SEC
000000000000	,2765641E 10	,3365945E-27
,1000000E 4	,2258365E 10	,2951598E-27
,1000000E 5	,3645676E 9	,5370019E-28

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3799999E- 4 DECAY CONSTANT FOR ISOTOPE 1 = ,5362116E- 5
 HALF LIFE ,3589999E 2 HRS BR 82

TIME IN SECONDS	MEV/SEC
000000000000	,1191995E 8
,1000000E 4	,1185621E 8
,1000000E 5	,1129763E 8

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2700000E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,1004347E- 1
 HALF LIFE ,6900001E 2 SEC SE 83

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,01,0 E- 2 DECAY CONSTANT FOR ISOTOPE 2 = ,8020833E- 4
 HALF LIFE ,2400000E 1 HRS BR 83

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,1013157E- 3
 HALF LIFE ,1140000E 3 MIN KR 83

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,8769041E 14	,7545249E 9	,3055123E 5
,1000000E 4	,3811756E 10	,1730965E 11	,1292704E 10
,1000000E 5	000000000000	,8410109E 10	,6271166E 10

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3000000E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,1004347E- 1
 HALF LIFE ,6900001E 2 SEC SE 83

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,1900000E 0 DECAY CONSTANT FOR ISOTOPE 2 = ,4619999E- 3
 HALF LIFE ,2500000E 2 MIN SE 83

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,2000000E- 1 DECAY CONSTANT FOR ISOTOPE 3 = ,8020833E- 4
 HALF LIFE ,2400000E 1 HRS RR 83

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = ,000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,1013157E- 3
 HALF LIFE ,1140000E 3 MIN KR 83

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,9743380E 13	,4424380E 13	,1332318E 10	,5107600E 5
,1000000E 4	,4235283E 9	,3246215E 13	,6356759E 10	,3247032E 9
,1000000E 5	000000000000	,5076742E 11	,8363912E 10	,4968431E 10

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,9199999E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,3500000E- 2
 HALF LIFE ,3300000E 1 MIN SE 84

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,3632075E- 3
 HALF LIFE ,3179999E 2 MIN BR 84

TIME IN SECONDS	MEV/SEC	MEV/SEC
000000000000	,5223354E-24	,1992949E 11
,1000000E 4	,1577316E-25	,8463129E 13
,1000000E 5	000000000000	,3366111E 12

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1899999E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,1925000E- 2
 HALF LIFE ,6000000E 1 MIN BR 84

TIME IN SECONDS	MEV/SEC
000000000000	,1425053E 13
,1000000E 4	,2078807E 12
,1000000E 5	,6218164E 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,8519999E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,1776923E- 1
 HALF LIFE ,3900000E 2 SEC SE 85

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,7699999E- 1 DECAY CONSTANT FOR ISOTOPE 2 = ,3850000E- 2
 HALF LIFE ,3000001E 1 MIN BR 85

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,4375000E- 4
 HALF LIFE ,4400000E 1 HRS KR 85

TIME IN SECONDS MEV/SEC MEV/SEC MEV/SEC

000000000000 ,2438422E-23 ,5278232E-25 ,2018186E 8
 ,1000000E 4 ,4677673E-31 ,1547545E-25 ,1121581E 12
 ,1000000E 5 000000000000 000000000000 ,7781292E 11

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2480000E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,1776923E- 1
 HALF LIFE ,3900000E 2 SEC SE 85

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3500000E- 1 DECAY CONSTANT FOR ISOTOPE 2 = ,3850000E- 2
 HALF LIFE ,3000001E 1 MIN BR 85

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,4375000E- 4
 HALF LIFE ,4400000E 1 HRS KR 85

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,2071525E- 8
 HALF LIFE ,1060000E 2 YRS KR 85

TIME IN SECONDS MEV/SEC MEV/SEC MEV/SEC MEV/SEC

000000000000 ,7097752E-24 ,2322337E-25 ,8971152E 7 ,390723E- 3
 ,1000000E 4 ,1361577E-31 ,4671839E-26 ,3417183E 11 ,1487850E 4
 ,1000000E 5 000000000000 000000000000 ,2370165E 11 ,1711659E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2800000E- 4 DECAY CONSTANT FOR ISOTOPE 1 = ,4113248E- 6
 HALF LIFE ,1950000E 2 DAY RB 86

TIME IN SECONDS MEV/SEC

000000000000 ,2432986E 5

,1000000E 4 ,2431984E 5
 ,1000000E 5 ,2422999E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2000000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,4331250E- 1
 HALF LIFE ,1600000E 2 SEC SE 87

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,4899999E 0 DECAY CONSTANT FOR ISOTOPE 2 = ,1271559E- 1
 HALF LIFE ,5449999E 2 SEC BR 87

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,1480770E- 3
 HALF LIFE ,7800001E 2 MIN KR 87

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,4391634E-18
 HALF LIFE ,5000000E 11 YRS RB 87

TIME IN SECONDS MEV/SEC MEV/SEC MEV/SEC MEV/SEC

000000000000 ,1377607E-22 ,4156870E 15 ,4423892E 9 000000000000
 ,1000000E 4 000000000000 ,7783825E 10 ,2939398E 12 000000000000
 ,1000000E 5 000000000000 000000000000 ,7742625E 11 000000000000

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2899999E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,4251534E- 1
 HALF LIFE ,1629999E 2 SEC BR 88

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,7999999E 0 DECAY CONSTANT FOR ISOTOPE 2 = ,6875000E- 4
 HALF LIFE ,2800000E 1 HRS KR 88

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,6488764E- 3
 HALF LIFE ,1780000E 2 MIN RB 88

TIME IN SECONDS MEV/SEC MEV/SEC MEV/SEC

000000000000 ,1961541E-22 ,2019409E 12 ,1432086E 9
 ,1000000E 4 000000000000 ,8113820E 12 ,AA20382E 12
 ,1000000E 5 000000000000 ,4370243E 12 ,1090672E 13

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .2500000E 1 DECAY CONSTANT FOR ISOTOPE 1 = .1575000E 0
 HALF LIFE .4399999E 1 SEC BR 89

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .1900000E 1 DECAY CONSTANT FOR ISOTOPE 2 = .3609374E- 2
 HALF LIFE .3200000E 1 MIN KR 89

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .3999999E 0 DECAY CONSTANT FOR ISOTOPE 3 = .7500000E- 3
 HALF LIFE .1539999E 2 MIN RB 89

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .1588283E- 6
 HALF LIFE .5050000E 2 DAY SR 89

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.5920003E-22	.1221894E-23	.1524479E 14	.3893995E-32
.1000000E 4	000000000000	.7065975E-25	.1007444E 15	.5195116E-28
.1000000E 5	000000000000	000000000000	.1246869E 12	.1236356E-27

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .5000000E 1 DECAY CONSTANT FOR ISOTOPE 1 = .4331250E 0
 HALF LIFE .1599999E 1 SEC BR 90

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = .2100000E- 1
 HALF LIFE .3300000E 2 SEC KR 90

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .7700000E 0 DECAY CONSTANT FOR ISOTOPE 3 = .4277777E- 2
 HALF LIFE .2699999E 1 MIN RB 90

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .7842205E- 9
 HALF LIFE .2800000E 2 YRS SR 90

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000 DECAY CONSTANT FOR ISOTOPE 5 = .2993779E- 5
 HALF LIFE .6430000E 2 HRS Y 90

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.2856104E-21	.3191553E-23	.5388276E-24	.2105382E-33	.4616493E- 2
.1000000E 4	000000000000	.1345521E-31	.6843863E-25	.7227577E-30	.8957161E 3
.1000000E 5	000000000000	000000000000	000000000000	.7352991E-30	.1181368E 6

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .2070000E 1 DECAY CONSTANT FOR ISOTOPE 1 = .6930000E- 1
 HALF LIFE .1000000E 2 SEC KR 91

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .1190000E 1 DECAY CONSTANT FOR ISOTOPE 2 = .9624999E- 2
 HALF LIFE .7200000E 2 SEC RB 91

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .2280000E 0 DECAY CONSTANT FOR ISOTOPE 3 = .1984537E- 4
 HALF LIFE .9700001E 1 HRS SR 91

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .2264706E- 3
 HALF LIFE .5100001E 2 MIN Y 91

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000 DECAY CONSTANT FOR ISOTOPE 5 = .1382903E- 6
 HALF LIFE .5800001E 2 DAY Y 91

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.2252141E-22	.1961589E-23	.6412401E 11	.4655255E 7	.1657994E- 1
.1000000E 4	000000000000	.3695249E-27	.9392178E 12	.1122937E 12	.4779519E 5
.1000000E 5	000000000000	000000000000	.7856475E 12	.4850419E 12	.3090566E 7

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1380000E 1 DECAY CONSTANT FOR ISOTOPE 1 = .6930000E- 1
 HALF LIFE .1000000E 2 SEC KR 91

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .7899999E 0 DECAY CONSTANT FOR ISOTOPE 2 = .9624999E- 2
 HALF LIFE .7200000E 2 SEC RB 91

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .1520000E 0 DECAY CONSTANT FOR ISOTOPE 3 = .1984537E- 4
 HALF LIFE .9700001E 1 HRS SR 91

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = .1382903E- 6
 HALF LIFE .5800001E 2 DAY Y 91

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	
000000000000	.1501427E-22	.1302537E-23	.4274497E 11	.1250689E 2	
.1000000E 4	000000000000	.2460072E-27	.6252477E 12	.3305839E 6	
.1000000E 5	000000000000	000000000000	.5230143E 12	.3346745E 7	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1870000E 1					
HALF LIFE	.3000000E 1	SEC KR 92	DECAY CONSTANT FOR ISOTOPE 1 = .2310000E 0		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .2830000E 1					
HALF LIFE	.5299999E 1	SEC RB 92	DECAY CONSTANT FOR ISOTOPE 2 = .1307548E 0		
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .6000000E 0					
HALF LIFE	.2699999E 1	HRS SR 92	DECAY CONSTANT FOR ISOTOPE 3 = .7129629E- 4		
FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000					
HALF LIFE	.3600000E 1	HRS Y 92	DECAY CONSTANT FOR ISOTOPE 4 = .5347223E- 4		
TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	
000000000000	.6267742E-22	.6043790E-22	.1183510E 13	.9522529E 7	
.1000000E 4	000000000000	000000000000	.7437342E 13	.1286150E 12	
.1000000E 5	000000000000	000000000000	.3915124E 13	.7397557E 12	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .4800000E 0					
HALF LIFE	.2000001E 1	SEC KR 93	DECAY CONSTANT FOR ISOTOPE 1 = .3465000E 0		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .3520000E 1					
HALF LIFE	.5600000E 1	SEC RB 93	DECAY CONSTANT FOR ISOTOPE 2 = .1237500E 0		
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .2000000E 1					
HALF LIFE	.7899999E 1	MIN SR 93	DECAY CONSTANT FOR ISOTOPE 3 = .1462026E- 2		
FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 01.0 E- 1					
HALF LIFE	.1030000E 2	HRS Y 93	DECAY CONSTANT FOR ISOTOPE 4 = .1868932E- 4		
FISSION YIELD IN PERCENT FOR ISOTOPE 5 = .3500000E 0					
HALF LIFE	.1000000E 7	YRS ZR 93	DECAY CONSTANT FOR ISOTOPE 5 = .2195817E-13		
TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.2284161E-22	.6801371E-22	.5251871E-24	.2159172E 11	.8742120E 0
.1000000E 4	000000000000	000000000000	.3328803E-24	.9874002E 12	.1009751E 1
.1000000E 5	000000000000	000000000000	.6423064E-30	.1089544E 13	.3309317E 1
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01.0 E- 1					
HALF LIFE	.1400000E 1	SEC KR 94	DECAY CONSTANT FOR ISOTOPE 1 = .4950001E 0		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .2299999E 1					
HALF LIFE	.2900000E 1	SEC RB 94	DECAY CONSTANT FOR ISOTOPE 2 = .2389655E 0		
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .2299999E 1					
HALF LIFE	.1300000E 1	MIN SR 94	DECAY CONSTANT FOR ISOTOPE 3 = .8884615E- 2		
FISSION YIELD IN PERCENT FOR ISOTOPE 4 = .6999999E 0					
HALF LIFE	.1999999E 2	MIN Y 94	DECAY CONSTANT FOR ISOTOPE 4 = .5775000E- 3		
TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	
000000000000	.6344472E-23	.8019988E-22	.3674139E-23	.9337955E 13	
.1000000E 4	000000000000	000000000000	.9544974E-27	.4225670E 14	
.1000000E 5	000000000000	000000000000	000000000000	.2337467E 12	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .6999999E- 2					
HALF LIFE	.4999999E 0	SEC KR 95	DECAY CONSTANT FOR ISOTOPE 1 = .1386000E 1		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .4490000E 1					
HALF LIFE	.4000000E 2	SEC SR 95	DECAY CONSTANT FOR ISOTOPE 2 = .1732500E- 1		
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .1700000E 1					
HALF LIFE	.1000000E 2	MIN Y 95	DECAY CONSTANT FOR ISOTOPE 3 = .1155000E- 2		

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000
 HALF LIFE .6500001E 2 DAY ZR 95 DECAY CONSTANT FOR ISOTOPE 4 = .1233975E- 6

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000
 HALF LIFE .3500001E 2 DAY NB 95 DECAY CONSTANT FOR ISOTOPE 5 = .2291667E- 6

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.8530412E-24	.1254087E-22	.3261436E-24	.1458491E 7	-.467394E 3
.1000000E 4	000000000000	.3754477E-30	.3852152E-24	.6066405E 10	.8098807E 6
.1000000E 5	000000000000	000000000000	.1178182E-28	.9060915E 10	.1938821E 8

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .5700000E- 3
 HALF LIFE .2340000E 2 HRS NB 96 DECAY CONSTANT FOR ISOTOPE 1 = .8226495E- 5

TIME IN SECONDS	MEV/SEC
000000000000	.1828743E 9
.1000000E 4	.1813759E 9
.1000000E 5	.1684323E 9

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1400000E 1
 HALF LIFE .4100000E 0 SEC SR 97 DECAY CONSTANT FOR ISOTOPE 1 = .1678024E 1

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .3099999E 1
 HALF LIFE .5100000E 0 SEC Y 97 DECAY CONSTANT FOR ISOTOPE 2 = .1358823E 1

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .1400000E 1
 HALF LIFE .1700000E 2 HRS ZH 97 DECAY CONSTANT FOR ISOTOPE 3 = .1132352E- 4

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000
 HALF LIFE .1000000E 1 MIN NB 97 DECAY CONSTANT FOR ISOTOPE 4 = .1159000E- 1

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000
 HALF LIFE .7300000E 2 MIN NB 97 DECAY CONSTANT FOR ISOTOPE 5 = .1582192E- 3

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.1855320E-21	.4757323E-21	.4236771E 12	.2052838E 10	.8157623E 5
.1000000E 4	000000000000	000000000000	.8050663E 12	.8058484E 12	.9727828E 11
.1000000E 5	000000000000	000000000000	.7270628E 12	.7277762E 12	.5370039E 12

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .6400000E- 1
 HALF LIFE .5200000E 2 MIN NB 98 DECAY CONSTANT FOR ISOTOPE 1 = .2221154E- 3

TIME IN SECONDS	MEV/SEC
000000000000	.2309743E-26
.1000000E 4	.1849695E-26
.1000000E 5	.2505698E-27

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .5272199E 1
 HALF LIFE .3299999E 2 SEC ZR 99 DECAY CONSTANT FOR ISOTOPE 1 = .2100000E- 1

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000
 HALF LIFE .2399999E 1 MIN NB 99 DECAY CONSTANT FOR ISOTOPE 2 = .4812500E- 2

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000
 HALF LIFE .6650000E 2 HRS MO 99 DECAY CONSTANT FOR ISOTOPE 3 = .2894737E- 5

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000
 HALF LIFE .6000000E 1 HRS TC 99 DECAY CONSTANT FOR ISOTOPE 4 = .3208334E- 4

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000
 HALF LIFE .2000001E 6 YRS TC 99 DECAY CONSTANT FOR ISOTOPE 5 = .1097908E-12

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.1780378E-22	.4292125E-25	.9971614E 6	000000000000	000000000000
.1000000E 4	.1349983E-31	.4336792E-25	.5876569E 11	.8208390E 9	.2595290E-38
.1000000E 5	000000000000	000000000000	.5786479E 11	.9184643E 10	.3713048E-36

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,7877999E 0		DECAY CONSTANT FOR ISOTOPE 1 = ,2100000E- 1	
HALF LIFE	,3299999E 2 SEC ZR 99		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000		DECAY CONSTANT FOR ISOTOPE 2 = ,4812500E- 2	
HALF LIFE	,2399999E 1 MIN NB 99		
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000		DECAY CONSTANT FOR ISOTOPE 3 = ,2894737E- 5	
HALF LIFE	,6650000E 2 HRS MO 99		
FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000		DECAY CONSTANT FOR ISOTOPE 4 = ,1097908E-12	
HALF LIFE	,2000001E 6 YRS TC 99		
TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,2660335E-23	,6413521E-26	,1490012E 6
,1000000E 4	,2017215E-32	,6480264E-26	,8781081E 10
,1000000E 5	000000000000	000000000000	,8646464E 10
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,6299999E 1		DECAY CONSTANT FOR ISOTOPE 1 = ,3850000E- 2	
HALF LIFE	,3000000E 1 MIN NB 100		
TIME IN SECONDS	MEV/SEC		
000000000000	,3933859E-23		
,1000000E 4	,8371148E-25		
,1000000E 5	000000000000		
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,5599999E 1		DECAY CONSTANT FOR ISOTOPE 1 = ,1155000E- 1	
HALF LIFE	01,0 E 0 MIN NB 101		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000		DECAY CONSTANT FOR ISOTOPE 2 = ,7910958E- 3	
HALF LIFE	,1459999E 2 MIN MO 101		
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000		DECAY CONSTANT FOR ISOTOPE 3 = ,8250001E- 3	
HALF LIFE	,1400000E 2 MIN TC 101		
TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,1045004E-22	,3560708E 12	,2572395E 8
,1000000E 4	,1006970E-27	,3011850E 14	,7745659E 13
,1000000E 5	000000000000	,2436270E 11	,5900130E 11
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,4300000E 1		DECAY CONSTANT FOR ISOTOPE 1 = ,1004347E- 2	
HALF LIFE	,1149999E 2 MIN MO 102		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000		DECAY CONSTANT FOR ISOTOPE 2 = ,2817073E- 2	
HALF LIFE	,4100000E 1 MIN TC 102		
TIME IN SECONDS	MEV/SEC	MEV/SEC	
000000000000	,7014357E-24	,9872120E-27	
,1000000E 4	,2569242E-24	,3341681E-24	
,1000000E 5	,3049022E-28	,4738345E-28	
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3000000E 1		DECAY CONSTANT FOR ISOTOPE 1 = ,9625000E- 2	
HALF LIFE	,1199999E 1 MIN TC 103		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000		DECAY CONSTANT FOR ISOTOPE 2 = ,2020360E- 6	
HALF LIFE	,3970000E 2 DAY RU 103		
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000		DECAY CONSTANT FOR ISOTOPE 3 = ,2026315E- 3	
HALF LIFE	,5700000E 2 MIN RH 103		
TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,4669679E-23	,2220653E 8	,3226561E-34
,1000000E 4	,3084626E-27	,4628009E 10	,1634290E-28
,1000000E 5	000000000000	,4619906E 10	,8511953E-28
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1800000E 1		DECAY CONSTANT FOR ISOTOPE 1 = ,4620000E- 2	
HALF LIFE	,2499999E 1 MIN MO 104		
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000		DECAY CONSTANT FOR ISOTOPE 2 = ,6416666E- 3	
HALF LIFE	,1800000E 2 MIN TC 104		

TIME IN SECONDS	MEV/SEC	MEV/SEC			
000000000000	.1348233E-23	.3029581E 11			
.1000000E 4	.1328387E-25	.7879040E 13			
.1000000E 5	000000000000	.2492366E 11			
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .6000000E 0			DECAY CONSTANT FOR ISOTOPE 1 = .5775000E- 2		
HALF LIFE	.1999999E 1	MIN MO 105			
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .2999999E 0			DECAY CONSTANT FOR ISOTOPE 2 = .1283333E- 2		
HALF LIFE	.9000000E 1	MIN TC 105			
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000			DECAY CONSTANT FOR ISOTOPE 3 = .4325843E- 4		
HALF LIFE	.4450000E 1	HRS RU 105			
FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000			DECAY CONSTANT FOR ISOTOPE 4 = .1823684E- 1		
HALF LIFE	.3800000E 2	SEC RH 105			
FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000			DECAY CONSTANT FOR ISOTOPE 5 = .5347222E- 5		
HALF LIFE	.3599999E 2	HRS RH 105			
TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.5614397E-24	.6288282E-25	.9912901E 8	.1084483E 6	.4700154E 2
.1000000E 4	.1742819E-26	.6137956E-25	.3027094E 12	.5200045E 11	.3487691E 8
.1000000E 5	000000000000	.5962542E-30	.3116594E 12	.5563292E 11	.7890554E 9
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .3800000E 0			DECAY CONSTANT FOR ISOTOPE 1 = .2174077E- 7		
HALF LIFE	.1010001E 1	YRS RU 106			
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000			DECAY CONSTANT FOR ISOTOPE 2 = .2389655E- 1		
HALF LIFE	.2900000E 2	SEC RH 106			
TIME IN SECONDS	MEV/SEC	MEV/SEC			
000000000000	.3356231E 8	.3978367E 6			
.1000000E 4	.3356157E 8	.3356161E 8			
.1000000E 5	.3355501E 8	.3355504E 8			
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1499999E 0			DECAY CONSTANT FOR ISOTOPE 1 = .1155000E- 1		
HALF LIFE	.1000000E 1	MIN TC 107			
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .3999999E- 1			DECAY CONSTANT FOR ISOTOPE 2 = .2510869E- 2		
HALF LIFE	.4600000E 1	MIN RU 107			
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000			DECAY CONSTANT FOR ISOTOPE 3 = .5322581E- 3		
HALF LIFE	.2170000E 2	MIN RH 107			
FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000			DECAY CONSTANT FOR ISOTOPE 4 = .6930001E 0		
HALF LIFE	.1000000E 1	SEC PD 107			
FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000			DECAY CONSTANT FOR ISOTOPE 5 = .3136882E-14		
HALF LIFE	.7000000E 7	YRS PD 107			
TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.2799116E-24	.1165637E 13	.1768568E 9	.8597246E-30	000000000000
.1000000E 4	.2697240E-29	.5365308E 12	.4259546E 12	.1065114E-25	.2446709E-37
.1000000E 5	000000000000	.8232391E 2	.4224985E 10	.1057058E-27	.9622823E-37
FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .3000000E- 1			DECAY CONSTANT FOR ISOTOPE 1 = .2772000E- 1		
HALF LIFE	.2499999E 2	SEC RH 109			
FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000			DECAY CONSTANT FOR ISOTOPE 2 = .1436567E- 4		
HALF LIFE	.1340000E 2	HRS PD 109			
FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000			DECAY CONSTANT FOR ISOTOPE 3 = .1776923E- 1		
HALF LIFE	.3900000E 2	SEC AG 109			
TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC		
000000000000	.1332792E-24	.8463328E 7	.5682577E-32		
.1000000E 4	.1219325E-36	.6078077E 9	.6912495E-28		
.1000000E 5	000000000000	.5340918E 9	.6074135E-28		

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1800000E- 1 DECAY CONSTANT FOR ISOTOPE 1 =.5021739E- 3
 HALF LIFE .2299999E 2 MIN PD 111

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 =.9364865E- 2
 HALF LIFE .7399999E 2 SEC AG 111

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 =.1055373E- 5
 HALF LIFE .7600001E 1 DAY AG 111

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.1027943E 11	.4798669E 8	.7400448E 1
.1000000E 4	.6221249E 10	.6572828E 10	.3338315E 7
.1000000E 5	.6777279E 8	.7161291E 8	.9119364E 7

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01.0 E- 2 DECAY CONSTANT FOR ISOTOPE 1 =.9166666E- 5
 HALF LIFE .2100000E 2 MRS PD 112

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 =.6019625E- 4
 HALF LIFE .3200000E 1 MRS AG 112

TIME IN SECONDS	MEV/SEC	MEV/SEC
000000000000	.2681238E 8	.7168620E 5
.1000000E 4	.2656772E 8	.1385700E 9
.1000000E 5	.2446386E 8	.1024807E 10

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01.0 E- 2 DECAY CONSTANT FOR ISOTOPE 1 =.8250001E- 2
 HALF LIFE .1400000E 1 MIN PD 113

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 =.3632075E- 4
 HALF LIFE .5300000E 1 MRS AG 113

TIME IN SECONDS	MEV/SEC	MEV/SEC
000000000000	.1335110E-25	.1699551E 8
.1000000E 4	.3488088E-29	.4000584E 10
.1000000E 5	000000000000	.2885861E 10

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01.0 E- 2 DECAY CONSTANT FOR ISOTOPE 1 =.4812500E- 2
 HALF LIFE .2399999E 1 MIN PD 114

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 =.1386000E 0
 HALF LIFE .5000000E 1 SEC AG 114

TIME IN SECONDS	MEV/SEC	MEV/SEC
000000000000	.7801523E-26	.3618408E 11
.1000000E 4	.6340700E-28	.4598149E 10
.1000000E 5	000000000000	.7115465E- 9

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .7040000E- 2 DECAY CONSTANT FOR ISOTOPE 1 =.5500000E- 3
 HALF LIFE .2099999E 2 MIN AG 115

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 =.3632075E- 5
 HALF LIFE .5299999E 2 MRS CD 115

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 =.4268293E- 4
 HALF LIFE .4509229E 1 MRS IN 115

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.4403189E 11	.3656148E 5	000000000000
.1000000E 4	.2540418E 11	.5615968E 8	.1370873E 7
.1000000E 5	.1799482E 9	.1285257E 9	.4070204E 8

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1630000E- 2 DECAY CONSTANT FOR ISOTOPE 1 =.3465000E- 1
 HALF LIFE .1999999E 2 SEC AG 115

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 =.3632075E- 5
 HALF LIFE .5299999E 2 MRS CD 115

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 =.4268293E- 4

HALF LIFE .4509999E 1 HRS IN 115

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.9020731E-26	.5272516E 6	.7936728E 1
.1000000E 4	000000000000	.3067701E 8	.1326417E 7
.1000000E 5	000000000000	.2969044E 8	.1112112E 8

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1099999E- 1 DECAY CONSTANT FOR ISOTOPE 1 =.6416666E- 4
 HALF LIFE .3000000E 1 HRS CD 117

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 =.2310000E- 3
 HALF LIFE .4999999E 2 MIN CD 117

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 =.9624999E- 4
 HALF LIFE .1999999E 1 HRS IN 117

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.9060843E 10	.9271062E 6	000000000000
.1000000E 4	.8497701E 10	.1602780E 10	.2129692E 8
.1000000E 5	.4769758E 10	.4748547E 10	.6986295E 9

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01.0 E- 2 DECAY CONSTANT FOR ISOTOPE 1 =.2309999E- 3
 HALF LIFE .5000000E 2 MIN CD 118

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 =.2566666E- 2
 HALF LIFE .4499999E 1 MIN IN 118

TIME IN SECONDS	MEV/SEC	MEV/SEC
000000000000	.3753315E-27	.4812901E-30
.1000000E 4	.2979154E-27	.2957440E-27
.1000000E 5	.3725588E-28	.4094054E-28

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01.0 E- 2 DECAY CONSTANT FOR ISOTOPE 1 =.1155000E- 2
 HALF LIFE 01.0 E 1 MIN CD 119

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 =.6600000E- 3
 HALF LIFE .1750000E 2 MIN IN 119

TIME IN SECONDS	MEV/SEC	MEV/SEC
000000000000	.1875791E-26	.6190095E-30
.1000000E 4	.5909822E-27	.5050174E-27
.1000000E 5	.1807521E-31	.3379097E-29

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1500000E- 1 DECAY CONSTANT FOR ISOTOPE 1 =.6999999E- 5
 HALF LIFE .2750000E 2 HRS SN 121

TIME IN SECONDS	MEV/SEC
000000000000	.1706244E-28
.1000000E 4	.1694341E-28
.1000000E 5	.1590891E-28

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1300000E- 2 DECAY CONSTANT FOR ISOTOPE 1 =.6416667E- 7
 HALF LIFE .1250000E 3 DAY SN 123

TIME IN SECONDS	MEV/SEC
000000000000	.2982145E 5
.1000000E 4	.2981955E 5
.1000000E 5	.2980233E 5

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1400000E- 1 DECAY CONSTANT FOR ISOTOPE 1 =.2887500E- 3
 HALF LIFE .3999999E 2 MIN SN 123

TIME IN SECONDS	MEV/SEC
000000000000	.9852171E 10
.1000000E 4	.7381242E 10
.1000000E 5	.5489170E 9

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3900000E- 2 DECAY CONSTANT FOR ISOTOPE 1 = ,8355034E- 6
 HALF LIFE ,9600000E 1 DAY SN 125

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2400000E- 2 DECAY CONSTANT FOR ISOTOPE 2 = ,1097908E- 7
 HALF LIFE ,2000000E 1 YRS SB 125

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,1382903E- 6
 HALF LIFE ,5800000E 2 DAY TE 125

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,5030251E 7	,1969649E 6	,4829619E- 2
,1000000E 4	,5026049E 7	,1972301E 6	,8594870E 1
,1000000E 5	,4988398E 7	,1996062E 6	,8638099E 2

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,9100000E- 2 DECAY CONSTANT FOR ISOTOPE 1 = ,8355034E- 6
 HALF LIFE ,9600000E 1 DAY SN 125

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,5599999E- 2 DECAY CONSTANT FOR ISOTOPE 2 = ,1097908E- 7
 HALF LIFE ,2000000E 1 YRS SB 125

TIME IN SECONDS	MEV/SEC	MEV/SEC
000000000000	,1173726E 8	,4595848E 6
,1000000E 4	,1172745E 8	,4602035E 6
,1000000E 5	,1163960E 8	,4657479E 6

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = 01.0 E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,2195817E-12
 HALF LIFE ,1000000E 6 YRS SN 126

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,6078948E- 3
 HALF LIFE ,1900000E 2 MIN SB 126

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,6416666E- 6
 HALF LIFE ,1250000E 2 DAY SB 126

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,3568202E-35	,4987998E- 1	,2048779E- 5
,1000000E 4	,3568202E-35	,7479238E 2	,2642455E- 1
,1000000E 5	,3568202E-35	,1637614E 3	,8779665E 0

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2639999E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,1013157E- 3
 HALF LIFE ,1900000E 1 HRS SN 127

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2199999E- 2 DECAY CONSTANT FOR ISOTOPE 2 = ,2115385E- 5
 HALF LIFE ,9100000E 2 HRS SB 127

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,6400000E- 2 DECAY CONSTANT FOR ISOTOPE 3 = ,7638888E- 7
 HALF LIFE ,1049999E 3 DAY TE 127

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,2069893E- 4
 HALF LIFE ,9300000E 1 HRS TE 127

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,4346226E-27	,5448305E 8	,7070558E 6	,3309864E 0
,1000000E 4	,3927458E-27	,1172536E 9	,7078177E 6	,6516389E 3
,1000000E 5	,1577988E-27	,4643975E 9	,7343346E 6	,6033875E 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,9349999E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,1013157E- 3
 HALF LIFE ,1900000E 1 HRS SN 127

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,7999999E- 2 DECAY CONSTANT FOR ISOTOPE 2 = ,2115385E- 5
 HALF LIFE ,9100000E 2 HRS SB 127

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,2069893E- 4
 HALF LIFE ,9300000E 1 HRS TE 127

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,1539288E-26	,1981171E 9	,1096415E 2
,1000000E 4	,1390975E-26	,4204188E 9	,3547069E 5
,1000000E 5	,5588705E-27	,1649789E 10	,1114909E 7

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3699999E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,2026319E- 3
 HALF LIFE ,5700000E 2 MIN SN 128

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,1121360E- 2
 HALF LIFE ,1030000E 2 MIN SB 128

TIME IN SECONDS MEV/SEC MEV/SEC
 000000000000 ,4872795E 12 ,4779431E 9
 ,1000000E 4 ,3979022E 12 ,5109286E 12
 ,1000000E 5 ,6423333E 11 ,1371866E 12

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2529999E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,4184782E- 4
 HALF LIFE ,4600000E 1 HRS SB 129

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,1030000E 0 DECAY CONSTANT FOR ISOTOPE 2 = ,2167792E- 6
 HALF LIFE ,3700001E 2 DAY TE 129

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,1604167E- 3
 HALF LIFE ,7200001E 2 MIN TE 129

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,1291658E-14
 HALF LIFE ,1700000E 8 YRS I 129

TIME IN SECONDS MEV/SEC MEV/SEC MEV/SEC MEV/SEC
 000000000000 ,1204303E 12 ,3991382E 8 ,2445602E 5 ,1501204E- 8
 ,1000000E 4 ,1154946E 12 ,4392256E 8 ,4754017E 8 ,1445858E- 5
 ,1000000E 5 ,7924883E 11 ,7331142E 8 ,3783218E 9 ,1232000E- 3

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,4500000E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,4184782E- 4
 HALF LIFE ,4600000E 1 HRS SB 129

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,1604167E- 3
 HALF LIFE ,7200001E 2 MIN TE 129

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,1291658E-14
 HALF LIFE ,1700000E 8 YRS I 129

TIME IN SECONDS MEV/SEC MEV/SEC MEV/SEC
 000000000000 ,2142040E 12 ,9817891E 5 ,494572E- 8
 ,1000000E 4 ,2054251E 12 ,1776547E 9 ,1157598E- 2
 ,1000000E 5 ,1409565E 12 ,7568102E 9 ,6655417E- 1

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2000000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,4442308E- 2
 HALF LIFE ,2599999E 1 MIN SN 130

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,1626760E- 2
 HALF LIFE ,7100000E 1 MIN SB 130

TIME IN SECONDS MEV/SEC MEV/SEC
 000000000000 ,1440547E-23 ,1171953E-26
 ,1000000E 4 ,1695345E-25 ,1540396E-24
 ,1000000E 5 000000000000 ,7177417E-31

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2210000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,5021739E- 3
 HALF LIFE ,2299999E 2 MIN SB 131

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,4812500E- 3
 HALF LIFE ,2399999E 2 MIN TE 131

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,3060000E 0 DECAY CONSTANT FOR ISOTOPE 3 = ,9963768E- 6
 HALF LIFE ,8049999E 1 DAY I 131

TIME IN SECONDS MEV/SEC MEV/SEC MEV/SEC
 000000000000 ,1A02980E-24 ,7818742E- 9 ,1932243E 10
 ,1000000E 4 ,1091187E-24 ,9556826E 12 ,3154244E 10
 ,1000000E 5 ,1188713E-26 ,1145439E 12 ,1517880E 11

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3900000E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,5021739E- 3
 HALF LIFE ,2299999E 2 MIN SB 131

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .5000000E- 1 DECAY CONSTANT FOR ISOTOPE 2 =.6416666E- 5
 HALF LIFE .3000000E 2 HRS TE 131

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .5400000E- 1 DECAY CONSTANT FOR ISOTOPE 3 =.9963768E- 6
 HALF LIFE .8049999E 1 DAY I 131

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.3181727E-25	.2507393E 10	.3409859E 9
.1000000E 4	.1925624E-25	.1016874E 11	.3460384E 9
.1000000E 5	.2097729E-27	.2075985E 11	.4799871E 9

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1300000E 1 DECAY CONSTANT FOR ISOTOPE 1 =.5249999E- 2
 HALF LIFE .2200000E 1 MIN SN 132

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .2000000E 1 DECAY CONSTANT FOR ISOTOPE 2 =.5500001E- 2
 HALF LIFE .2100000E 1 MIN SB 132

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = .1100000E 1 DECAY CONSTANT FOR ISOTOPE 3 =.2500000E- 5
 HALF LIFE .7699999E 2 HRS TE 132

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 01.0 E- 1 DECAY CONSTANT FOR ISOTOPE 4 =.8369565E- 4
 HALF LIFE .2300001E 1 HRS I 132

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.1106156E-23	.1785632E-23	.1257501E 11	.2720032E 12
.1000000E 4	.5804575E-26	.3554475E-25	.4941896E 11	.2735114E 12
.1000000E 5	000000000000	000000000000	.4883772E 11	.3151729E 12

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .2880000E 1 DECAY CONSTANT FOR ISOTOPE 1 =.2817073E- 2
 HALF LIFE .4100000E 1 MIN SB 133

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .2020000E 1 DECAY CONSTANT FOR ISOTOPE 2 =.2221154E- 3
 HALF LIFE .5200000E 2 MIN TE 133

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 =.9254807E- 5
 HALF LIFE .2080000E 2 HRS I 133

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 =.1521979E- 5
 HALF LIFE .5270000E 1 DAY XE 133

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.1316535E-23	.2921902E 13	.1891942E 8	.6842485E 2
.1000000E 4	.7870331E-25	.5680212E 13	.6656101E 11	.6793462E 7
.1000000E 5	.7674304E-36	.8059758E 12	.3442494E 12	.5062736E 9

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1120000E 1 DECAY CONSTANT FOR ISOTOPE 1 =.2817073E- 2
 HALF LIFE .4100000E 1 MIN SB 133

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .8800000E 0 DECAY CONSTANT FOR ISOTOPE 2 =.5775000E- 2
 HALF LIFE .1999999E 1 MIN TE 133

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 =.9254807E- 5
 HALF LIFE .2080000E 2 HRS I 133

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 =.1521979E- 5
 HALF LIFE .5270000E 1 DAY XE 133

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	.5119857E-24	.1072398E 15	.2138432E 9	.2355533E 2
.1000000E 4	.3060684E-25	.7697821E 13	.1564804E 12	.2406259E 8
.1000000E 5	.2984451E-36	.7574824E 2	.1540782E 12	.3390338E 9

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .3200000E 1 DECAY CONSTANT FOR ISOTOPE 1 =.1386000E- 1
 HALF LIFE .5000000E 2 SEC SB 134

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = .3699999E 1 DECAY CONSTANT FOR ISOTOPE 2 =.2686047E- 3
 HALF LIFE .4299999E 2 MIN TE 134

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,7999999E 0 DECAY CONSTANT FOR ISOTOPE 3 = ,2200000E- 3
 HALF LIFE ,5249999E 2 MIN I 134

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,7157483E-23	,1624403E-24	,3719915E 13
,1000000E 4	,6846030E-29	,2323090E-24	,9559436E 13
,1000000E 5	000000000000	,2071023E-25	,8006442E 13

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1320000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,2310000E- 1
 HALF LIFE ,3000000E 2 SEC TE 135

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,5099999E 0 DECAY CONSTANT FOR ISOTOPE 2 = ,2873135E- 4
 HALF LIFE ,6700000E 1 HRS I 135

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,7549019E- 3
 HALF LIFE ,1929999E 2 MIN XE 135

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = ,6000000E- 1 DECAY CONSTANT FOR ISOTOPE 4 = ,2092392E- 4
 HALF LIFE ,9200001E 1 HRS XE 135

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = ,3299999E- 1 DECAY CONSTANT FOR ISOTOPE 5 = ,1097908E-13
 HALF LIFE ,2000001E 7 YRS CS 135

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,4898158E-23	,3677566E 12	,4765291E 8	,5508168E 10	,5887635E-37
,1000000E 4	,4548103E-33	,1246400E 13	,2268715E 12	,6733313E 10	,6128046E-37
,1000000E 5	000000000000	,9624024E 12	,3465842E 12	,3798834E 11	,1438838E-36

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3080000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,2310000E- 1
 HALF LIFE ,3000000E 2 SEC TE 135

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,1190000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,2873135E- 4
 HALF LIFE ,6700000E 1 HRS I 135

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,1400000E 0 DECAY CONSTANT FOR ISOTOPE 3 = ,2092392E- 4
 HALF LIFE ,9200001E 1 HRS XE 135

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = ,7699999E- 1 DECAY CONSTANT FOR ISOTOPE 4 = ,1097908E-13
 HALF LIFE ,2000001E 7 YRS CS 135

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,1142903E-22	,8580989E 12	,1289399E 11	,1373781E-36
,1000000E 4	,1001224E-32	,2900267E 13	,2824294E 11	,1116709E 36
,1000000E 5	000000000000	,2245605E 13	,9811012E 11	,3778591E-36

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3099999E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,8058140E- 2
 HALF LIFE ,8600000E 2 SEC I 136

TIME IN SECONDS	MEV/SEC
000000000000	,2830084E 15
,1000000E 4	,8957642E 11
,1000000E 5	,2855906E-20

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,4899999E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,2840164E- 1
 HALF LIFE ,2440000E 2 SEC I 137

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,1100000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,2961539E- 2
 HALF LIFE ,3900000E 1 MIN XE 137

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,1499999E 0 DECAY CONSTANT FOR ISOTOPE 3 = ,7319391E- 9
 HALF LIFE ,2999999E 2 YRS CS 137

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,4494163E- 2
 HALF LIFE ,2570000E 1 MIN BA 137

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,2229668E-22	,5617315E-24	,1100603E 7	,2662701E 4
,1000000E 4	,1031727E-34	,1633583E-24	,4219756E 8	,4162145E 8
,1000000E 5	000000000000	,4340330E-36	,4462006E 8	,4827746E 8

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3399999E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,1100000E 0
 HALF LIFE ,6300000E 1 SEC 1 138

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2000000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,6704111E- 3
 HALF LIFE ,1699999E 2 MIN XE 138

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,3588956E- 3
 HALF LIFE ,3220000E 2 MIN CS 138

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,5755162E-22	,2505714E 14	,8753900E 9
,1000000E 4	000000000000	,3083292E 14	,2592056E 13
,1000000E 5	000000000000	,6814464E 11	,3607674E 12

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1800000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,3465000E 0
 HALF LIFE ,1999999E 1 SEC 1 139

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3599999E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,1690244E- 1
 HALF LIFE ,4100000E 2 SEC XE 139

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,1070000E 1 DECAY CONSTANT FOR ISOTOPE 3 = ,1215790E- 2
 HALF LIFE ,9499999E 1 MIN CS 139

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = ,7999999E- 1 DECAY CONSTANT FOR ISOTOPE 4 = ,1391567E- 3
 HALF LIFE ,8299999E 2 MIN BA 139

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,8565604E-22	,1056603E-22	,2175591E-24	,6930837E 11
,1000000E 4	000000000000	,6827416E-30	,4036395E-24	,3578007E 13
,1000000E 5	000000000000	000000000000	,7143280E-29	,1589242E 13

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3800000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,4331250E- 1
 HALF LIFE ,1599999E 2 SEC XE 140

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2200000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,1050000E- 1
 HALF LIFE ,6599999E 2 SEC CS 140

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,3500000E 0 DECAY CONSTANT FOR ISOTOPE 3 = ,6266276E- 6
 HALF LIFE ,1279999E 2 DAY BA 140

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = ,000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,4788558E- 5
 HALF LIFE ,4019999E 2 HRS LA 140

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,2617454E-22	,3872035E-23	,8841689E 9	,1662027E 5
,1000000E 4	000000000000	,3372632E-27	,1550924E 11	,5816161E 9
,1000000E 5	000000000000	000000000000	,1542250E 11	,6265312E 10

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1330000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,4076470E 0
 HALF LIFE ,1700000E 1 SEC XE 141

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3270000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,2772000E- 1
 HALF LIFE ,2499999E 2 SEC CS 141

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,1700000E 1 DECAY CONSTANT FOR ISOTOPE 3 = ,6416666E- 3
 HALF LIFE ,1800000E 2 MIN BA 141

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 01.0 E- 1 DECAY CONSTANT FOR ISOTOPE 4 = ,5065790E- 4
 HALF LIFE ,3800001E 1 HRS LA 141

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = ,000000000000 DECAY CONSTANT FOR ISOTOPE 5 = ,2430556E- 6
 HALF LIFE ,3300000E 2 DAY CE 141

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,7235569E-22	,1558808E-22	,1274838E 14	,6208061E 10	,9569282E 3
,1000000E 4	000000000000	,1909071E-34	,2462551E 14	,1816902E 12	,3191088E 8
,1000000E 5	000000000000	000000000000	,7644245E 11	,2578147E 12	,8471295E 9

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3500000E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,4620001E 0
 HALF LIFE ,1500000E 1 SEC XE 142

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3050000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,8662500E- 1
 HALF LIFE ,8000000E 1 SEC CS 142

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,2200000E 1 DECAY CONSTANT FOR ISOTOPE 3 = ,1155000E- 2
 HALF LIFE 01,0 E 1 MIN BA 142

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = ,2999999E 0 DECAY CONSTANT FOR ISOTOPE 4 = ,1425926E- 3
 HALF LIFE ,8100000E 2 MIN LA 142

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,2104247E-22	,4207908E-22	,3059989E 14	,4607783E 12
,1000000E 4	000000000000	000000000000	,2336025E 14	,5775584E 13
,1000000E 5	000000000000	000000000000	,7144740E 9	,2460036E 13

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1900000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,6930001E 0
 HALF LIFE ,9999999E 0 SEC CS 143

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,3000000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,5330769E- 1
 HALF LIFE ,1299999E 2 SEC BA 143

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,1300000E 1 DECAY CONSTANT FOR ISOTOPE 3 = ,8250001E- 3
 HALF LIFE ,1400000E 2 MIN LA 143

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = 000000000000 DECAY CONSTANT FOR ISOTOPE 4 = ,5833333E- 5
 HALF LIFE ,3300001E 2 MRS CE 143

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000 DECAY CONSTANT FOR ISOTOPE 5 = ,5854623E- 6
 HALF LIFE ,1370000E 2 DAY PR 143

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,1543523E-21	,2980768E-22	,1860503E-24	,1751694E 8	,8799610E-35
,1000000E 4	000000000000	000000000000	,3687637E-24	,1075479E 12	,1083489E-29
,1000000E 5	000000000000	000000000000	,2198425E-27	,1842210E 12	,2933675E-28

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,9000000E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,2310000E 1
 HALF LIFE ,3000000E 0 SEC CS 144

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2500000E 1 DECAY CONSTANT FOR ISOTOPE 2 = ,1732500E 1
 HALF LIFE ,4000000E 0 SEC BA 144

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = ,2299999E 1 DECAY CONSTANT FOR ISOTOPE 3 = ,1386000E 1
 HALF LIFE ,9999999E 0 SEC LA 144

FISSION YIELD IN PERCENT FOR ISOTOPE 4 = ,2999999E 0 DECAY CONSTANT FOR ISOTOPE 4 = ,2864583E- 7
 HALF LIFE ,2800000E 3 DAY CE 144

FISSION YIELD IN PERCENT FOR ISOTOPE 5 = 000000000000 DECAY CONSTANT FOR ISOTOPE 5 = ,6637931E- 3
 HALF LIFE ,1740000E 2 MIN PR 144

TIME IN SECONDS	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC	MEV/SEC
000000000000	,1317331E-21	,4207565E-21	,5035084E-21	,3841033E 8	,1722717E 5
,1000000E 4	000000000000	000000000000	000000000000	,1200943E 9	,1083448E 9
,1000000E 5	000000000000	000000000000	000000000000	,1200632E 9	,2230904E 9

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,4200000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,3850000E- 2
 HALF LIFE ,3000000E 1 MIN CE 145

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,3229866E- 4
 HALF LIFE ,5959999E 1 MRS PR 145

TIME IN SECONDS	MEV/SEC	MEV/SEC
000000000000	,2622573E-23	,2966554E 10
,1000000E 4	,5580766E-25	,1473591E 13
,1000000E 5	000000000000	,1126589E 13

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3200000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,8309352E- 3
 HALF LIFE ,1390000E 2 MIN CE 146

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,4733606E- 3
 HALF LIFE ,2440000E 2 MIN PR 146

TIME IN SECONDS MEV/SEC MEV/SEC
 000000000000 ,1425292E 14 ,6440025E 10
 ,1000000E 4 ,6209168E 13 ,6749444E 13
 ,1000000E 5 ,3509118E 10 ,3079820E 12

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,2700000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,7225976E- 6
 HALF LIFE ,1110000E 2 DAY ND 147

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,8445452E- 8
 HALF LIFE ,2600001E 1 YRS PM 147

TIME IN SECONDS MEV/SEC MEV/SEC
 000000000000 ,7608949E 10 ,1296935E-35
 ,1000000E 4 ,7603453E 10 ,2677919E-32
 ,1000000E 5 ,7554165E 10 ,2667912E-31

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1300000E 1 DECAY CONSTANT FOR ISOTOPE 1 = ,9624999E- 4
 HALF LIFE ,1999999E 1 HRS ND 149

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,3625236E- 5
 HALF LIFE ,5309999E 2 HRS PM 149

TIME IN SECONDS MEV/SEC MEV/SEC
 000000000000 ,4066366E 12 ,1068552E 7
 ,1000000E 4 ,3693224E 12 ,2035193E 10
 ,1000000E 5 ,1553096E 12 ,1344260E 11

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,4200000E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,8884615E- 3
 HALF LIFE ,1300000E 2 MIN ND 151

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = ,2000000E- 1 DECAY CONSTANT FOR ISOTOPE 2 = ,6778168E- 5
 HALF LIFE ,2840000E 2 HRS PM 151

FISSION YIELD IN PERCENT FOR ISOTOPE 3 = 000000000000 DECAY CONSTANT FOR ISOTOPE 3 = ,2439797E- 9
 HALF LIFE ,9000001E 2 YRS SM 151

TIME IN SECONDS MEV/SEC MEV/SEC MEV/SEC
 000000000000 ,5515561E 13 ,1111722E 10 ,5085964E- 2
 ,1000000E 4 ,2268484E 13 ,1466263E 11 ,8242174E 2
 ,1000000E 5 ,7639243E 9 ,2280677E 11 ,1945004E 4

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1499999E 0 DECAY CONSTANT FOR ISOTOPE 1 = ,4095745E- 5
 HALF LIFE ,4699999E 2 HRS SM 153

TIME IN SECONDS MEV/SEC
 000000000000 ,1497504E 10
 ,1000000E 4 ,1491383E 10
 ,1000000E 5 ,1437409E 10

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,3299999E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,4812500E- 3
 HALF LIFE ,2400001E 2 MIN SM 155

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 000000000000 DECAY CONSTANT FOR ISOTOPE 2 = ,1291657E- 7
 HALF LIFE ,1700000E 1 YRS EU 155

TIME IN SECONDS MEV/SEC MEV/SEC
 000000000000 ,9030287E 11 ,1166542E 4
 ,1000000E 4 ,5580812E 11 ,1852806E 7
 ,1000000E 5 ,7339379E 9 ,4808664E 7

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = ,1300000E- 1 DECAY CONSTANT FOR ISOTOPE 1 = ,2138889E- 4
 HALF LIFE ,8999999E 1 HRS SM 156

FISSION YIELD IN PERCENT FOR ISOTOPE 2 = 01.0 E- 2 DECAY CONSTANT FOR ISOTOPE 2 =,5208334E- 6
 HALF LIFE .1540000E 2 DAY EU 156

TIME IN SECONDS	MEV/SEC	MEV/SEC
000000000000	.4518354E-28	.1015638E 9
.1000000E 4	.4422737E-28	.1043042E 9
.1000000E 5	.3648291E-28	.1263917E 9

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .7800000E- 2 DECAY CONSTANT FOR ISOTOPE 1 =,1250000E- 4
 HALF LIFE .1540000E 2 HRS EU 157

TIME IN SECONDS	MEV/SEC
000000000000	.1267492E 10
.1000000E 4	.1251747E 10
.1000000E 5	.1118557E 10

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1999999E- 2 DECAY CONSTANT FOR ISOTOPE 1 =,1925000E- 3
 HALF LIFE 01.0 E 0 HRS EU 158

TIME IN SECONDS	MEV/SEC
000000000000	.6255647E-28
.1000000E 4	.5160247E-28
.1000000E 5	.9125472E-29

FISSION YIELD IN PERCENT FOR ISOTOPE 1 = .1070000E- 2 DECAY CONSTANT FOR ISOTOPE 1 =,1069444E- 4
 HALF LIFE .1800000E 2 HRS GD 159

TIME IN SECONDS	MEV/SEC
000000000000	.8553638E 8
.1000000E 4	.8462649E 8
.1000000E 5	.7686091E 8

TIME	TOTAL F,P,I.
000000000000	.1036196E 16
.1000000E 4	.3547174E 15
.1000000E 5	.3321186E 14

TIME	CESIUM	NOBLE GASES	HALOGENS	SOLIDS
000000000000	.8764905E 9	.2527795E 14	.7053627E 15	.3055539E 15
.1000000E 4	.2592098E 13	.3234268E 14	.2300220E 14	.2967806E 15
.1000000E 5	.3608121E 12	.1178877E 13	.1239701E 14	.1927514E 14

CALCULATED DOSE FOR INHALATION

THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 DOSE IS DUE TO IN DOSE IN REMS = .1949164E- 9
 THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 DOSE IS DUE TO SN DOSE IN REMS = .3102286E- 7
 THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 DOSE IS DUE TO SB DOSE IN REMS = .5364793E-11
 THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 DOSE IS DUE TO TE DOSE IN REMS = .9810149E- 4
 THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 DOSE IS DUE TO I DOSE IN REMS = .1501830E 0
 TIME OF INHALATION = .1000000E 1 SEC TOTAL TIME =,3153600E 8 SEC
 THIS DOWNWIND DISTANCE = .1000000E 4 DOSE IS TO THE THYROID
 CROSSWIND DISTANCE. DOSE IN REMS
 000000000000 .1502811E 0

THIS DOWNWIND DISTANCE = ,1000000E 5 DOSE IS TO THE THYROID
DOSE IS DUE TO IN DOSE IN REMS = ,5935243E-10
THIS DOWNWIND DISTANCE = ,1000000E 5 DOSE IS TO THE THYROID
DOSE IS DUE TO SN DOSE IN REMS = ,4879959E-9
THIS DOWNWIND DISTANCE = ,1000000E 5 DOSE IS TO THE THYROID
DOSE IS DUE TO SB DOSE IN REMS = ,8605059E-13
THIS DOWNWIND DISTANCE = ,1000000E 5 DOSE IS TO THE THYROID
DOSE IS DUE TO TE DOSE IN REMS = ,1643598E-5
THIS DOWNWIND DISTANCE = ,1000000E 5 DOSE IS TO THE THYROID
DOSE IS DUE TO I DOSE IN REMS = ,2831422E-2
TIME OF INHALATION = ,1000000E 1 SEC TOTAL TIME = ,3153600E 8 SEC
THIS DOWNWIND DISTANCE = ,1000000E 5 DOSE IS TO THE THYROID
CROSSWIND DISTANCE DOSE IN REMS
000000000000 ,2833067E-2

CALCULATED DOSE FOR INGESTION CHAIN NO. 131
TIME OF INHALATION = ,1000000E 1 SEC TOTAL TIME = ,3153600E 8 SEC
THIS DOWNWIND DISTANCE = ,1000000E 4 DOSE IS TO THE THYROID
CROSSWIND DISTANCE DOSE IN REMS
000000000000 ,3407520E 1
TIME OF INHALATION = ,1000000E 1 SEC TOTAL TIME = ,3153600E 8 SEC
THIS DOWNWIND DISTANCE = ,1000000E 5 DOSE IS TO THE THYROID
CROSSWIND DISTANCE DOSE IN REMS
000000000000 ,2415967E 0

CALCULATED DOSE FOR INGESTION CHAIN NO. 133
TIME OF INHALATION = ,1000000E 1 SEC TOTAL TIME = ,3153600E 8 SEC
THIS DOWNWIND DISTANCE = ,1000000E 4 DOSE IS TO THE THYROID
CROSSWIND DISTANCE DOSE IN REMS
000000000000 ,3349973E 1
TIME OF INHALATION = ,1000000E 1 SEC TOTAL TIME = ,3153600E 8 SEC
THIS DOWNWIND DISTANCE = ,1000000E 5 DOSE IS TO THE THYROID
CROSSWIND DISTANCE DOSE IN REMS
000000000000 ,1186230E 0

DEPOSITION GAMMA DOSE CALCULATION

THE EXPOSURE TIME = ,3153600E 8 THE DEPOSITION TIME = ,1000000E 1
DOWNWIND DISTANCE NO. 1 = ,1000000E 4
CROSSWIND DISTANCE DOSE
000000000000 ,4172947E-1
DOWNWIND DISTANCE NO. 2 = ,1000000E 5
CROSSWIND DISTANCE DOSE
000000000000 ,9559743E-4

EXTERNAL GAMMA DOSE CALCULATION

THE EXPOSURE TIME = .1000000E 1

DOWNWIND DISTANCE NO. 1 = .1000000E 4

CROSSWIND DISTANCE DOSE
000000000000 .4472958E- 1

DOWNWIND DISTANCE NO. 2 = .1000000E 5

CROSSWIND DISTANCE DOSE
000000000000 .3707480E- 3

5. FLOW CHARTS AND SYMBOLIC LISTING OF THE RSAC PROGRAM

The following flow charts show the general flow of the program and the methods involved in programming the mathematical models which were described in the previous section. The Data Editing Program (DEP) follows the flow, which is shown in the flow chart for the input to RSAC.

Following the flow charts are the symbolic listings of the RSAC and DEP programs. These listings are supplied for the convenience of the users who may desire to examine the program more closely or compare their decks for sequence.

5.1 RSAC Program Flow Charts

PPCo-B- 7863

PPCo-B-7877

5.2 Program Listing for DEP

SIBMAP	STDATA		STDA0020	TIX	**1,T,1	STDA0610
EXTERN	STM,BCDOU,FIXTR,DTRANP,NPG,SKP,DTRANS,FIXPL,FINEN,BCD		STDA0030	ENDM	ZERO	STDA0620
EXTERN	INT,DECIM,FIL		STDA0040			STDA0630
EXTERN	EXIT		STDA0050	WRITE MACRO	FMT,COUNT	STDA0640
EXTERN	DATA		STDA0060	AXT	0,4	STDA0650
ENTRY	STDATA		STDA0070	CAL	FMT,4	STDA0660
	FOLLOWING IS A SMALL SET OF MACRO INSTRUCTIONS DEF NED FOR RSAC		STDA0080	TSL	BCDOU	STDA0670
SPACE	MACRO	SPACE ONE LINE ON OUTPUT TAPE	STDA0090	TXI	**1,4,-1	STDA0680
TSX	STM,4		STDA0100	TXM	**3,4,-COUNT	STDA0690
TSX	FIL,4		STDA0110	ENDM	WRITE	STDA0700
ENDM	SPACE		STDA0120	SCRIBE MACRO	FMT,COUNT,OP	STDA0710
SUM	MACRO	SUM A BLOCK OF FLOATING POINT NUMBERS	STDA0130	SXA	**9,4	STDA0720
AXT	BLOCK,SIZE,T		STDA0140	TSX	STM,4	STDA0730
ZAC	SIZE,T		STDA0150	TSL	OP	STDA0740
FAD	BLOCK,T		STDA0160	WRITE	FMT,COUNT	STDA0750
TIX	**1,T,1		STDA0170	TSX	FIL,4	STDA0760
ENDM	SUM		STDA0180	AXT	**4	STDA0770
			STDA0190	ENDM	SCRIBE	STDA0780
	SUM MUST BE STORED BY A STO INSTRUCTION		STDA0200			STDA0790
			STDA0210	END OF MACRO PACKAGE, BEGINNING OF CODING		STDA0800
SUMI	MACRO	SUM A BLOCK OF FIXED OF INTEGERS	STDA0220	STDATA	TSL INT	STDA0810
LXD	BLOCK,SIZE,T		STDA0230	SCRIBE	FMT00,9,NPG	STDA0820
ZAC	SIZE,T		STDA0240	READI	TEMP,0	STDA0830
ADD	BLOCK*1,T		STDA0250	CLA	TEMP	STDA0840
TIX	**1,T,1		STDA0260	TZE	DATA-1	STDA0850
ENDM	SUMI		STDA0270	READI	MYOT,0	STDA0860
			STDA0280	READI	NEG,0	STDA0870
READ	MACRO	STORE MAY BE A LIST ENCLOSED IN PARENTHESES. READ WILL READ THE ENTIRE LIST THROUGH #1#	STDA0290	CLA	NEG	NUMBER OF GAMMA ENERGY GROUPS
IRP	STORE		STDA0300	STD	RZR	STDA0880
TSL	IN		STDA0310	AXT	1,4	STDA0890
STQ	STORE,T		STDA0320	RR3	READ DECIM,(ENE,MU,NU),4	ENERGY GROUP VALUES
IRP			STDA0330	TXI	**1,4,1	STDA0910
ENDM	READ		STDA0340	RR3	TXL RR3,4,**	STDA0920
			STDA0350	CLA	MYOT	STDA0930
READI	MACRO	SPECIAL TREATMENT FOR INTEGERS	STDA0360	STD	MYTST	SET UP MAXIMUM FOR READ LOOP
IRP	DATA	DATA MAY BE A LIST IN PARENTHESES	STDA0370	AXT	0,3	STDA0940
TSL	FIXIN		STDA0380			STDA0950
LLS	18	PUT INTEGER IN DECREMENT PORTION	STDA0390			STDA0960
STQ	DATA,T		STDA0400			STDA0970
IRP			STDA0410			STDA0980
ENDM	READI		STDA0420	DLOOP	READ FIXIN,MMH,1	PUT INTO ADDRESS PORTION
			STDA0430	READI	NNM,1	STDA1000
			STDA0440	SXA	TEMP,2	STDA1010
			STDA0450	CLA	NNM,1	SAVE XR2
			STDA0460	PDX	4	NUMBER OF ISOTOPIES IN THIS CHAIN.
			STDA0470	RRR1	READ DECIM,HALM,2	STDA1040
			STDA0480	READI	LONGH,2	STDA1050
			STDA0490	READ	BCD,ELEHM,2	STDA1060
			STDA0500	TXI	**1,2,1	STDA1070
			STDA0510	TIX	RRR1,4,1	STDA1080
			STDA0520	CLA	NNM,1	STDA1090
			STDA0530	PDX	4	RESTORE XR1
			STDA0540	LXA	TEMP,2	STDA1100
			STDA0550	RRR2	READI NPROTH,2	STDA1110
			STDA0560	TSL	DECIM	RESTORE XR2
			STDA0570	FHP	4,31	STDA1130
			STDA0580	STO	YIELDH,2	STDA1140
			STDA0590	READI	JGASH,2	STDA1150
			STDA0600	TXI	**1,2,1	STDA1160
				TIX	RRR2,4,1	STDA1170
						STDA1180
						STDA1190

CLA	NNM,1		STDA1200				
PDX	,4		STDA1210	SIBMAP DATA			DATA0010
LXA	TEMP,2		STDA1220	EXTERN	STH,BCDOU,FIXTR,DTRANP,NPG,SKP,DTRANS,FIXPL,FIXIN,BCD		DATA0020
RRR3 TSL	FIXIN	READ THE GAMMA ENERGY GROUP NUMBER,	STDA1230	EXTERN	INT,DECIM,FIL		DATA0030
LLS	35		STDA1240	EXTERN	EXIT		DATA0040
STA	JGASH,2		STDA1250	EXTERN	STDATA		DATA0050
READ	DECIM,GDMPY,2	AND THE GAMMA MULTIPLIER	STDA1260	ENTRY	DATA		DATA0060
TXI	**1,2,1		STDA1270	* SPACE	FOLLOWING IS A SMALL SET OF MACRO INSTRUCTIONS DEFINED FOR RSAC		DATA0070
TXI	RRR3,4,1		STDA1280	MACRO	SPACE ONE LINE ON OUTPUT TAPE		DATA0080
CLA	NNM,1		STDA1290	TSX	STH,4		DATA0090
PDX	,4		STDA1300	TSX	FIL,4		DATA0100
LXA	TEMP,2		STDA1310	ENDM	SPACE		DATA0110
RRF8 READ	DECIM,(EONE,G1,KIDNEY,LIVER,LUNG,MUSCLE,TESTES),2		STDA1320	SUM	MACRO BLOCK,SIZE,T	SUM A BLOCK OF FLOATING POINT NUMBERS	DATA0120
READ	DECIM,(THYROID,BODY),2		STDA1330	AXT	SIZE,T		DATA0130
TXI	**1,2,1		STDA1340	ZAC			DATA0140
TXI	RRR8,4,1		STDA1350	FAD	BLOCK,T		DATA0150
TXI	**1,1,2		STDA1360	TXI	**1,T,1		DATA0160
MTTST TXM	**2,1,**	SEE IF ALL CHAINS HAVE BEEN DULY READ	STDA1370	ENDM	SUM		DATA0170
TXI	DL00P,1,1	NO, GO READ ANOTHER	STDA1380				DATA0180
TXI	**1,2,-1		STDA1390		SUM MUST BE STORED BY A STO INSTRUCTION		DATA0190
SXA	XR4,2		STDA1400				DATA0200
SCRIBE	FMTSD,8,SKP		STDA1410	SUMI	MACRO BLOCK,SIZE,T	SUM A BLOCK OF FIXED OR INTEGERS	DATA0210
TRA	DATA		STDA1420	LXD	SIZE,T		DATA0220
FM-00 BCI	9, RADIOLOGICAL SAFETY ANALYSIS CODE... EDIT DATA ...		STDA1430	ZAC			DATA0230
FM-SD BCI	8, STANDARD DATA DECK HAS BEEN READ CORRECTLY,		STDA1440	ADD	BLOCK*1,T		DATA0240
CONTRL	//		STDA1450	TXI	**1,T,1		DATA0250
USE	//		STDA1460	ENDM	SUMI		DATA0260
DEF	MYOT,40		STDA1470				DATA0270
DEF	FRACT,1		STDA1480	READ	MACRO IN,STORE,T	STORE MAY BE A LIST ENCLOSED IN	DATA0280
DEF	(ADD,AK1,AK2,AMBDA,ANSW,BREATH,CHI,CHIY,CNTRL,CONV),1		STDA1490	IRP	STORE	PARENTHESES. READ WILL READ THE	DATA0290
DEF	(O,DET,DOOTOT,EXTRM,EXX,FISS,G,H,IE,K,LB,LONG,LT,M,MUR),1		STDA1500	TSL	IN	ENTIRE LIST THROUGH #IN#	DATA0300
DEF	(INCH,NEG,NK1,NREG,NUI,ORGAN,PART,POWER,R,SAVE4,SH,T),1		STDA1510	STO	STORE,T		DATA0310
DEF	(TCY,TCZ,TDEPOS,TEMF,TEMPO,TEMP1,TEMP2,TEMP3,TEMP4),1		STDA1520	IRP			DATA0320
DEF	(TENE,THISD,THISE,THISX,TIM,TINHA,TMU,TNU,TOTAL,TOTAL1),1		STDA1530	ENDM	READ		DATA0330
DEF	(J,UBAR,V,VE,W1,W2,W3,X,XMAX,XMAXP,XMIN,XMINP,XR4,Y,Z),1		STDA1540				DATA0340
DEF	(ZE,TROP,TTROP),3		STDA1550	READI	MACRO DATA,T	SPECIAL TREATMENT FOR INTEGERS	DATA0350
DEF	(XK1,A1,KX,VG),4		STDA1560	IRP	DATA	DATA MAY BE A LIST IN PARENTHESES	DATA0360
DEF	(SUM1,K1,K2,MU,NU),11		STDA1570	TSL	FIXIN		DATA0370
DEF	(ENE,XK,HXKP,HAKP,DOSE,ELB,CZ,CY,STORE,TIME,DIE),25		STDA1580	LLS	18	PUT INTEGER IN DECREMENT PORTION	DATA0380
DEF	(SUM,LONGB,CHN,NNM),100		STDA1590	STO	DATA,T		DATA0390
DEF	(MMH,BODY,BONE,G1,KIDNEY,LIVER,LUNG,MUSCLE,TESTES),450		STDA1600	IRP			DATA0400
DEF	(THYROID,YIELDM,NPROTH,LONGH,JGASH,MALH,ELEMM,GDMPY),450		STDA1610	ENDM	READI		DATA0410
DEF	(ATOM,GAMEN),450		STDA1620	*CALLP	IS TO SIMULATE THE FORTRAN II CALLING SEQUENCE		DATA0420
DEF	FPI,10000		STDA1630				DATA0430
DEF	FPIC,1		STDA1640	CALLP	MACRO ROUTE,PPZ		DATA0440
USE			STDA1650	TSX	ROUTE,4		DATA0450
END			STDA1660	IRP	PPZ	PPZ IS THE ARGUMENT LIST	DATA0460
				PZE	PPZ		DATA0470
				IRP			DATA0480
				ENDM	CALLP		DATA0490
							DATA0500
				DEF	MACRO LIST,SIZE	DEFINE A GROUP OF VARIABLES WHICH	DATA0510
				IRP	LIST	HAVE THE SAME BLOCK SIZE WITH ONE	DATA0520
				LIST	BSS SIZE	COMMAND	DATA0530
				IRP			DATA0540
				ENDM	DEF		DATA0550
							DATA0560
				ZERO	MACRO BLOCK,SIZE,T	ZERO A BLOCK OF CORE	DATA0570
				AXT	SIZE,T		DATA0580
				STZ	BLOCK*1,T		DATA0590

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TIX      **1,T,1
ENDM     ZERO

WRITE MACRO FMT,COUNT
  AXT     0,4
  CAL     FMT,4
  TSL     BCDOU
  TXI     **1,4,*1
  TXH     **3,4,-COJNT
ENDM     WRITE
SCRIBE MACRO FMT,COUNT,OP
  SXA     **9,4
  TSX     STM,4
  TSL     OP
  WRITE   FMT,COUNT
  TSX     FIL,4
  AXT     **4
ENDM     SCRIBE

*
END OF MACRO PACKAGE, BEGINNING OF CODING
DATA     TRA      DETIN
        STZ      NUI
        TSL      DATAIN
        STZ      LINE
        CLA      #031
        STO      TSEC
        F        CLA      TTROP
        TNZ      G1
        READ     DECIM,(TEMP,TTROP),0
        G1      CLS      TTROP
        TH1      MRJP
        READI    NCH,0
        CLA      NCH
        TZE      FRC
        TH1      FRCP
        READ     DECIM,FRACT,0
        LXD      NCH,4
        READI    CMN,4
        READ     DECIM,LONGB,4
        TIX      1,*,1
        TRA      SUMOU
        FRCP     AXT     4,4
        READ     DECIM,CMN*1,4
        TIX      FRCP*1,4,1
        TRA      SUMOU
        FRC      READ     DECIM,FRACT,0
        SUMOU    CLA      LINE
        ADD      #012
        STO      LINE
        CLA      TSEC
        ADD      #0120
        STO      TSEC
        TSL      FROUT
        TRA      DETIN
        MRJP     READ     DECIM,POWER,0
        CLA      POWER
        TZE      DECAY1
        READ     DECIM,(CONV,ADD,TFOP),0
        DECAY1  READ     DECIM,TTROP,0

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DATA0600 CLA      LINE
DATA0610 ADD      #03
DATA0620 STO      LINE
DATA0630 CLA      TSEC
DATA0640 ADD      #03
DATA0650 STO      TSEC
DATA0660 CLA      POWER
DATA0670 TZE      F
DATA0680 TRA      F
DATA0690 DETIN READI DET,0
DATA0700 READI    NCH,0
DATA0710 CLA      TSEC
DATA0720 TSL      FIXTR
DATA0730 STO      CUT*5
DATA0740 CLA      LINE
DATA0750 LRS      5
DATA0760 ADD      LINE
DATA0770 TSL      FIXTR
DATA0780 STO      OUT*11
DATA0790 SCRIBE   OUT,12,SKP
DATA0800 CLA      NCH
DATA0810 TZE      TRANS
DATA0820 PDX      ,4
DATA0830 TXH      DIAG1,4,20
DATA0840 READI    CMN*1,4
DATA0850 TIX      **3,4,1
DATA0860 TRANS LXI DET,4
DATA0870 TRA      **10,4
DATA0880 TRA      RTAPE
DATA0890 TRA      WTAPE
DATA0900 TRA      METER
DATA0910 TRA      NEW
DATA0920 TRA      DECAY
DATA0930 TRA      GAMMA
DATA0940 TRA      INHAL
DATA0950 TRA      DEPOS
DATA0960 TRA      BETAD
DATA0970 DIAS1 SCRIBE DFMT1,13,SKP
DATA0980 TRA      EXIT
DATA0990 DFMT0 BCI  9, A GAMMA ENERGY OF ZERO HAS BEEN ENCOUNTERED, EXECUTIC
DATA1000 BCI      3,N TERMINATED,
DATA1010 DFMT1 BCI  9, MORE THAN 20 CHAINS WERE REQUESTED TO BE PRINTED OUT,
DATA1020 BCI      4, EXECUTION TERM NATED,
DATA1030 FMT01 BCI  9, DET= 1 ENTRY TO BETAD TO CALCULATE GAMMA HEATING
DATA1040 FMT02 BCI  9, DET= 2 ENTRY TO DEPOS TO CALCULATE DEPOSITION GAMMA
DATA1050 BCI      1,DOSE,
DATA1060 FMT03 BCI  9, DET= 3 ENTRY TO INHAL TO CALCULATE THE INHALATION DO
DATA1070 BCI      3,SE TO THE
DATA1080 FMT04 BCI  9, DET= 4 ENTRY TO GAMMA TO CALCULATE THE CLOUD GAMMA C
DATA1090 BCI      3,OSE TO THE BODY,
DATA1100 FMT05 BCI  9, DET= 5 ENTRY TO DECAY TO PRINT OUT THE FISSION PRODU
DATA1110 BCI      2,CT INVENTORY
DATA1120 FMT06 BCI  9, DET= 6 ENTRY TO NEW TO READ IN NEW CONDITIONS FOR A
DATA1130 BCI      2,NEW PROBLEM
DATA1140 FMT07 BCI  9, DET= 7 ENTRY TO METER TO READ IN NEW WEATHER CONDITI
DATA1150 BCI      1,ONS
DATA1160 FMT08 BCI  9, DET= 8 ENTRY TO WTAPE TO WRITE FISSION PRODUCT INVEN
DATA1170 BCI      3,TORY OUT ON TAPE,
DATA1180 FMT09 BCI  9, DET= 9 ENTRY TO RTAPE TO READ FISSION PRODUCT INVENT

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DATA1190
DATA1200
DATA1210
DATA1220
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DATA1280
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DATA1480
DATA1490
DATA1500
DATA1510
DATA1520
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DATA1580
DATA1590
DATA1600
DATA1610
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DATA1700
DATA1710
DATA1720
DATA1730
DATA1740
DATA1750
DATA1760
DATA1770

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FMT17 BCI	3, DRY FROM TAPE.	DATA1780	LDQ	TEMP	DATA2340
FMT18 BCI	4, THE DEPOSITION TIME =	DATA1790	MPY	#0110	DATA2350
FMT30 BCI	4, THE EXPOSURE TIME =	DATA1800	STG	TEMP	DATA2360
FMT31 BCI	2, UBAR =	DATA1810	CLA	NK1	DATA2370
FMT32 BCI	4, DOWNWIND DISTANCES =	DATA1820	LRS	53	DATA2380
FMT33 BCI	1, W1 =	DATA1830	FMP	TEMP	DATA2390
FMT34 BCI	1, W2 =	DATA1840	STQ	TEMP	DATA2400
FMT35 BCI	1, W3 =	DATA1850	CLA	XR4	DATA2410
FMT36 BCI	3, STACK HEIGHT =	DATA1860	LRS	53	DATA2420
FMT37 BCI	4, INVERSION HEIGHT =	DATA1870	MPY	TEMP	DATA2430
FMT38 BCI	3, WASHOUT FACTOR =	DATA1880	LRS	35	DATA2440
FMT39 BCI	3, EXPOSURE TIME =	DATA1890	ADD	TSEC	DATA2450
BCI	9, DEPLETION FROM THE CLOUD DUE TO FALLOUT HAS BEEN NEGL	DATA1900	STO	TSEC	DATA2460
BCI	1, ECTED.	DATA1910	CLA	XR4	DATA2470
FMT40 BCI	9, DEPLETION FROM THE CLOUD DUE TO FALLOUT HAS BEEN INCL	DATA1920	LRS	53	DATA2480
BCI	1, UDED.	DATA1930	MPY	#03	DATA2490
FMT41 BCI	4, DEPOSITION VELOCITIES,	DATA1940	LRS	35	DATA2500
FMT42 BCI	4, FOR CESIUM =	DATA1950	ADD	#01	DATA2510
FMT43 BCI	4, FOR THE NOBLE GASES =	DATA1960	ADD	LINE	DATA2520
FMT44 BCI	4, FOR THE HALOGENS =	DATA1970	STO	LINE	DATA2530
FMT45 BCI	4, FOR THE SOLIDS =	DATA1980	TSX	STM,4	DATA2540
FMT46 BCI	2, THERE ARE	DATA1990	TSL	SKP	DATA2550
FMT47 BCI	7, SET(S) OF EXPONENTIALS FOR THE LEAK RATE.	DATA2000	WRITE	FMT18,4	DATA2560
FMT48 BCI	1, K =	DATA2010	CLA	T	DATA2570
FMT49 BCI	1, P =	DATA2020	TSL	DTRANP	DATA2580
FMT50 BCI	4, CROSSWIND DISTANCES =	DATA2030	WRITE	FMT17,4	DATA2590
FMT51 BCI	7, THERE IS ONE SET OF CY AND CZ VALUES.	DATA2040	CLA	TDEPOS	DATA2600
FMT52 BCI	1, CY =	DATA2050	TSL	DTRANP	DATA2610
FMT53 BCI	1, CZ =	DATA2060	TSX	FIL,4	DATA2620
FMT54 BCI	3, TIME IN SECONDS =	DATA2070	TRA	DETIN	DATA2630
FMT55 BCI	9, PER CENT OF THE FISSION PRODUCT INVENTORY RELEASED =	DATA2080	INHAL READ	BCD,ORGAN,0	DATA2640
FMT56 BCI	6, FRACTIONATION BY ELEMENT GROUP.	DATA2090	READ	FIXIN,CNTRL,0	DATA2650
FMT61 BCI	6, FRACTIONATION FOR	DATA2100	CAL	ORGAN	DATA2660
FMT62 BCI	9, FRACTIONATION FOR THE REST OF THE FISSION PRODUCT INV	DATA2110	SLW	FMT03+11	DATA2670
BCI	2, ENTORY =	DATA2120	SCRIBE	FMT03,12,SKP	DATA2680
BETAD	SCRIBE FMT01,9,SKP	DATA2130	READ	DECIM,(TINHA,BREATH),0	DATA2690
SUMI	NNM,MTOT,4	DATA2135	READI	CNTRL1,0	DATA2700
STD	BETAD1	DATA2140	CLA	CNTRL1	DATA2710
AXT	1,4	DATA2145	TNZ	INGEST	DATA2720
AB	READ DECIM,GAMEN+1,4	DATA2150	READI	NCH,0	DATA2730
CLA	GAMEN+1,4	DATA2160	LXD	NCH,4	DATA2740
TZE	ERROR	DATA2170	AD READI	CHN+1,4	DATA2750
TXI	**1,4,1	DATA2180	READ	DECIM, LONG8+1,4	DATA2760
BETAD1	TXL AB,4,**	DATA2185	TXI	AD,4,1	DATA2770
CLA	TSEC	DATA2190	LXD	XR4,1	DATA2780
ADD	#04	DATA2200	PXA	.1	DATA2790
STO	TSEC	DATA2210	ALS	1	DATA2800
TRA	DECAY	DATA2220	STO	TEMP	DATA2810
ERROR	SCRIBE DFMT0,12,SKP	DATA2230	ADD	TSEC	DATA2820
TRA	EXIT	DATA2240	STO	TSEC	DATA2830
DEPOS	SCRIBE FMT02,10,SKP	DATA2250	CLA	CNTRL	DATA2840
READ	DECIM,(TDEPOS,T),0	DATA2260	CAS	#01	DATA2850
READI	NREG,0	DATA2270	TRA	ELAB	DATA2860
LXD	NREG,4	DATA2280	TRA	SIMP	DATA2870
AC	READ DECIM,(HAKP+1,HXKP+1),4	DATA2290	TOT	CLA	DATA2880
TXI	AC,4,1	DATA2300	ALS	1	DATA2890
CLA	NREG	DATA2310	ADD	#01	DATA2900
LRS	18	DATA2320	ADD	LINE	DATA2910
STO	TEMP	DATA2330	STO	LINE	DATA2920

INGEST TRA DETIN
 READI CHN,0
 READ FIXIN,ATOM,0
 READ DECIM,(LONGB-1,FRACT),0
 TRA TOT-4
 ELAB LDO NCH
 ZAC
 LRS 17
 MPY TEMP
 LLS 35
 ADD LINE
 STO LINE
 TRA TOT
 SIMP LDO NCH
 ZAC
 LRS 18
 MPY TEMP
 LLS 35
 ADD LINE
 STO LINE
 TRA TOT
 GAMMA SCRIBE FMT04,12,SKP
 READ DECIM,T,0
 READI NREG,0
 LXD NREG,4
 AE READ DECIM,(HAKP+1,HXKP+1),4
 TIX AE,4,1
 CLA NREG
 LRS 18
 STO TEMP
 LDO TEMP
 MPY TEMP
 MPY #010
 STO TEMP
 CLA NK1
 LRS 53
 MPY TEMP
 STO TEMP
 CLA XR4
 LRS 53
 MPY TEMP
 LLS 35
 ADD TSEC
 STO TSEC
 CLA XR4
 LRS 53
 MPY #03
 LLS 35
 ADD #01
 ADD LINE
 STO LINE
 TSX STM,4
 TSL SKP
 WRITE FMT18,4
 CLA T
 TSL DTRANP
 TSX FIL,4
 TRA DETIN
 DECAY SCRIBE FMT05,11,SKP

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DATA2930 CLA TSEC
 DATA2940 ADD #0360 24C.
 DATA2950 STO TSEC
 DATA2960 CLA XR4
 DATA2970 LRS 18
 DATA2980 STO TEMP
 DATA2990 ZAC
 DATA3000 LRS 17
 DATA3010 MPY #03 3.
 DATA3020 LLS 35
 DATA3030 ADD LINE
 DATA3040 STO LINE
 DATA3050 CLA TEMP
 DATA3060 ALS 2
 DATA3070 ADD #010 E
 DATA3080 ADD LINE
 DATA3090 STO LINE
 DATA3100 CLA MTOT
 DATA3110 LRS 18
 DATA3120 STO SAVE4
 DATA3130 CLA TEMP
 DATA3140 ADD #01
 DATA3150 STO TEMP
 DATA3160 LDO TEMP
 DATA3170 MPY SAVE4
 DATA3180 STO TEMP
 DATA3190 CLA TEMP
 DATA3200 ADD LINE
 DATA3210 STO LINE
 DATA3220 CLA NCH
 DATA3230 TNZ DETIN
 AF READI NCH,0
 CLA NCH
 THI AF
 TZE DETIN
 LXD NCH,4
 AG READI CHN+1,4
 TIX AG,4,1
 TRA DETIN
 DATA3310 NEW SCRIBE FMT06,11,SKP
 DATA3320 CLA TSEC
 DATA3330 ADD #01
 DATA3340 STO TSEC
 DATA3350 CLA LINE
 DATA3360 ADD #05
 DATA3370 STO LINE
 DATA3380 STZ NUI
 DATA3390 TSL DATAIN
 DATA3400 TRA F
 DATA3410 METER SCRIBE FMT07,10,SKP
 DATA3420 CLA TSEC
 DATA3430 ADD #01 1.
 DATA3440 STO TSEC
 DATA3450 CLA #01
 DATA3460 STO NUI
 DATA3470 TSL DATAIN
 DATA3480 TRA DETIN
 DATA3490 WTape SCRIBE FMT08,12,SKP
 DATA3500 CLA TSEC
 DATA3510

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 DATA3990
 DATA4000
 DATA4010
 DATA4020
 DATA4030
 DATA4040
 DATA4050
 DATA4060
 DATA4070
 DATA4080
 DATA4090
 DATA4100

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      ADD      =07      7,
      STO      TSEC
      TRA      DETIN
RTAPE SCRIBE  FMT09,12,SKP
      CLA      TSEC
      ADD      =010     8,
      STO      TSEC
      TRA      DETIN
OUT      BCI      9,ESTIMATED TIME IN SECONDS =
      BCI      3,F OUTPUT =
TSEC
LINE
DATAIN PZE      **
      READ     DECIM,UBAR,0
      CLA      UBAR
      TZE      CURY
      AXT      0,1
A      READ     DECIM,DIE,1
      CLA      DIE,1
      TZE      **2
      TXI      A,1,1
      SXD      XR4,1
      TXI      **1,1,1
      SXA      IE,1
      CLA      NUI
      TNZ      RRA
      READ     DECIM,(POWER,CONV,ADD,TROP,TTROP),0
RRA      READ     DECIM,(W1,W2,W3,SH,M,AMRDA,T),0
      READI    MTOT+8,0
      AXT      4,4
B      READ     DECIM,VG+1,4
      TIX      B,4,1
      READI    NK1,0
      LXD      NK1,4
C      READ     DECIM,(K1,K2),4
      TIX      C,4,1
      READI    LB,0
      LXD      LR,4
D1      READ     DECIM,ELB,4
      TIX      D1,4,1
      READI    CNTRL,0
      CLA      IE
      SUB      =01
      ALS      18
      STD      RRR8
      STD      RRR10
      AXT      1,1
      CLA      CNTRL
      TMI      DIF
RRR7      READ     DECIM,(CY+1,CZ+1),1
      TXI      **1,1,1
RRR8      TXL      RRR7,1,**
      TRA      DATAUS
DIF      READ     DECIM,(TEMP,TEMP1),0
      CLA      TEMP
      STO      CY+1,1
      CLA      TEMP1
      STO      CZ+1,1
      TXI      **1,1,1

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ESTIMATED LINES C

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DATA4110 RRR10 TXL      **5,1,**
DATA4120      TRA      DATAUS
DATA4130      CURY      0,1
DATA4140      READ     DECIM,TIME,1
DATA4150      CLA      TIME,1
DATA4160      TZE      **2
DATA4170      TXI      CURY+1,1,1
DATA4180      SXD      XR4,1
DATA4190      READ     DECIM,(POWER,CONV,ADD,TROP,TTROP),0
DATA4200      DATAUS  UBAR
DATA4210      TZE      CURY1
DATA4220      TSX      STM,4
DATA4230      TSL      NPG
DATA4240      WRITE    FMT30,2
DATA4250      CLA      UBAR
DATA4260      TSL      DTRANP
DATA4270      TSX      FIL,4
DATA4280      TSX      STM,4
DATA4290      TSL      SKP
DATA4300      WRITE    FMT31,4
DATA4310      AXT      5,4
DATA4320      AXT      0,1
DATA4330      CLA      DIE,1
DATA4340      TZE      **5
DATA4350      TSL      DTRANP
DATA4360      TIX      **2,4,1
DATA4370      TXI      **2,1,1
DATA4380      TXI      **5,1,1
DATA4390      TSX      FIL,4
DATA4400      TSX      STM,4
DATA4410      AXT      5,4
DATA4420      CLA      DIE,1
DATA4430      TZE      **7
DATA4440      TSL      DTRANP
DATA4450      TIX      **2,4,1
DATA4460      TXI      **2,1,1
DATA4470      TXI      **5,1,1
DATA4480      TSX      FIL,4
DATA4490      TRA      IDA
DATA4500      TSX      FIL,4
DATA4510      TSX      STM,4
DATA4520      TSL      SKP
DATA4530      CAL      FMT32
DATA4540      TSL      BCDOU
DATA4550      CLA      W1
DATA4560      TSL      DTRANP
DATA4570      CAL      FMT33
DATA4580      TSL      BCDOU
DATA4590      CLA      W2
DATA4600      TSL      DTRANP
DATA4610      CAL      FMT34
DATA4620      TSL      BCDOU
DATA4630      CLA      W3
DATA4640      TSL      DTRANP
DATA4650      TSX      FIL,4
DATA4660      TSX      STM,4
DATA4670      TSL      SKP
DATA4680      WRITE    FMT35,3
DATA4690      CLA      SH

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DATA4700
DATA4710
DATA4720
DATA4730
DATA4740
DATA4750
DATA4760
DATA4770
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DATA4990
DATA5000
DATA5010
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DATA5120
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DATA5230
DATA5240
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DATA5270
DATA5280

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ORK
 ORK1
 TSL DTRANP
 WRITE FMT36,4
 CLA M
 TSL DTRANP
 TSX FIL,4
 TSX STM,4
 TSL SKP
 WRITE FMT37,3
 CLA AMBDA
 TSL DTRANP
 WRITE FMT38,3
 CLA T
 TSL DTRANP
 TSX FIL,4
 CLA MTD1*8
 TZE ORK
 SCRIBE FMT39,10,SKP
 TRA ORK1
 SCRIBE FMT40,10,SKP
 TSX STM,4
 TSL SKP
 WRITE FMT41,4
 TSX FIL,4
 AXT 4,1
 TSX STM,4
 TSL SKP
 WRITE FMT42,4
 CLA VG*1,1
 TSL DTRANP
 TIX **1,1,1
 TSX FIL,4
 TSX STM,4
 TSL SKP
 WRITE FMT43,4
 CLA VG*1,1
 TSL DTRANP
 TIX **1,1,1
 TSX FIL,4
 TSX STM,4
 TSL SKP
 WRITE FMT44,4
 CLA VG*1,1
 TSL DTRANP
 TIX **1,1,1
 TSX FIL,4
 TSX STM,4
 TSL SKP
 WRITE FMT45,4
 CLA VG*1,1
 TSL DTRANP
 TSX FIL,4
 TSX STM,4
 TSL SKP
 WRITE FMT46,2
 LXD NK1,1
 PXA ,1
 TSL FIXTR
 LGL 36
 TSL BCD0U

DATA5290
 DATA5300
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 DATA5860
 DATA5870

WRITE FMT47,7
 TSX FIL,4
 TSX STM,4
 TSL SKP
 CAL FMT48
 TSL BCD0U
 CLA K1,1
 TSL DTRANP
 CAL FMT49
 TSL BCD0U
 CLA K2,1
 TSL DTRANP
 TIX **8,1,1
 TSX FIL,4
 TSX STM,4
 TSL SKP
 WRITE FMT50,4
 LXD LB,1
 CLA ELB,1
 TSL DTRANP
 TIX **2,1,1
 TSX FIL,4
 CLA CNTRL
 TPL ORK2
 TSX STM,4
 TSL SKP
 WRITE FMT51,7
 TSX FIL,4
 TSX STM,4
 TSL SKP
 CAL FMT52
 TSL BCD0U
 CLA TEMP
 TSL DTRANP
 CAL FMT53
 TSL BCD0U
 CLA TEMP1
 TSL DTRANP
 TSX FIL,4
 TRA* DATAIN
 ORK2 TSX STM,4
 TSL SKP
 AXT 1,1
 CAL FMT52
 TSL BCD0U
 CLA CY*1,1
 TSL DTRANP
 CAL FMT53
 TSL BCD0U
 CLA CZ*1,1
 TSL DTRANP
 TXI **1,1,1
 ORK3 TXL **9,1,1
 TSX FIL,4
 TRA* DATAIN
 CURY1 TSX STM,4
 TSL SKP
 WRITE FMT54,3
 AXT 0,1

DATA5880
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AXT 6,4
 CLA TIME,1
 TZE **5
 TSL DTRANP
 TIX **2,4,1
 TXI **2,1,1
 TXI **5,1,1
 IDA1 TSX FIL,4
 TSX STH,4
 AXT 6,4
 CLA TIME,1
 TZE **7
 TSL DTRANP
 TIX **2,4,1
 TXI **2,1,1
 TXI **5,1,1
 TSX FIL,4
 TRA IDA1
 TSX FIL,4
 FROUT TRA* DATAIN
 PZE **
 CLA NCH
 TZE FRC1
 TMI FRCP1
 LXD NCH,2
 CLA CHN,2
 TSX DSCL6,4
 SLW FMT61,3
 TSX STH,4
 TSL SKP
 WRITE FMT61,6
 CLA LONGB,2
 TSL DTRANP
 TSX FIL,4
 TIX **13,2,1
 TSX STH,4
 TSL SKP
 WRITE FMT62,11
 CLA FRACT
 TSL DTRANP
 TSX FIL,4
 TRA* FROUT
 FRC: TSX STH,4
 TSL SKP
 WRITE FMT55,9
 CLA FRACT
 TSL DTRANP
 TSX FIL,4
 TRA* FROUT
 FRC:1 AXT 4,2
 TSX STH,4
 TSL SKP
 WRITE FMT56,6
 TSX FIL,4
 TSX STH,4
 TSL SKP
 WRITE FMT42,4
 CLA CHN*1,2
 TSL DTRANP

DATA6470 TSX FIL,4
 DATA6480 TIX **1,2,1
 DATA6490 TSX STH,4
 DATA6500 TSL SKP
 DATA6510 WRITE FMT43,4
 DATA6520 CLA CHN*1,2
 DATA6530 TSL DTRANP
 DATA6540 TSX FIL,4
 DATA6550 TIX **1,2,1
 DATA6560 TSX STH,4
 DATA6570 TSL SKP
 DATA6580 WRITE FMT44,4
 DATA6590 CLA CHN*1,2
 DATA6600 TSL DTRANP
 DATA6610 TSX FIL,4
 DATA6620 TIX **1,2,1
 DATA6630 TSX STH,4
 DATA6640 TSL SKP
 DATA6650 WRITE FMT45,4
 DATA6660 CLA CHN*1,2
 DATA6670 TSL DTRANP
 DATA6680 TSX FIL,4
 DATA6690 TRA* FROUT
 DATA6700 DSCL6 SYA ELMH4,4
 DATA6710 SUB #036000000
 DATA6720 PDX ,4
 DATA6730 CAL ELEM,4
 DATA6740 ELMH4 AXT **4
 DATA6750 TRA 1,4
 DATA6760 BCI 1, GD
 DATA6770 BCI 1, EU
 DATA6780 BCI 1, SM
 DATA6790 BCI 1, PM
 DATA6800 BCI 1, ND
 DATA6810 BCI 1, PR
 DATA6820 BCI 1, CE
 DATA6830 BCI 1, LA
 DATA6840 BCI 1, BA
 DATA6850 BCI 1, CS
 DATA6860 BCI 1, XE
 DATA6870 BCI 1, I
 DATA6880 BCI 1, TE
 DATA6890 BCI 1, SB
 DATA6900 BCI 1, SN
 DATA6910 BCI 1, IN
 DATA6920 BCI 1, CO
 DATA6930 BCI 1, AG
 DATA6940 BCI 1, PD
 DATA6950 BCI 1, RH
 DATA6960 BCI 1, RU
 DATA6970 BCI 1, TC
 DATA6980 BCI 1, MO
 DATA6990 BCI 1, NB
 DATA7000 BCI 1, ZR
 DATA7010 BCI 1, Y
 DATA7020 BCI 1, SR
 DATA7030 BCI 1, RB
 DATA7040 BCI 1, KR
 DATA7050 BCI 1, BR

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	BCI	1, SE	DATA7650
	BCI	1, AS	DATA7660
	BCI	1, GE	DATA7670
	BCI	1, GA	DATA7680
ELEM	BCI	1, ZN	DATA7690
CNTRL1	BSS	1	DATA7700
	CONTRL	//	DATA7710
	USE	//	DATA7720
	DEF	MTCT,40	DATA7730
	DEF	FRACT,1	DATA7740
	DEF	(ADD,AK1,AK2,AMBD,ANSH,BREATH,CHI,CHIY,CNTRL,CONV),1	DATA7750
	DEF	(D,DET,NOTOT,EXTRM,EXX,FISS,G,H,IE,M,LB,LONG,LT,M,MUR),1	DATA7760
	DEF	(NCH,NEG,NK1,NREG,NUI,ORGAN,PART,POWER,R,SA7E4,SH,T),1	DATA7770
	DEF	(TCY,TCZ,TDEPOS,TEMP,TEMP0,TEMP1,TEMP2,TEMP3,TEMP4),1	DATA7780
	DEF	(TENE,THISD,THISE,THISX,TIM,TJNHA,TMU,TNU,TOTAL,TOTAL1),1	DATA7790
	DEF	(U,UBAR,V,VE,W1,W2,W3,X,XMAX,XMAXP,XMIN,XMINP,XR4,Y,Z),1	DATA7800
	DEF	(ZE,TROP,TTROP),3	DATA7810
	DEF	(XK1,A1,KX,VG),4	DATA7820
	DEF	(SUM1,K1,K2,MU,NU),11	DATA7830
	DEF	(ENE,XK,HXKP,HAKP,DOSE,ELB,CZ,CY,STORE,TIME,DIE),25	DATA7840
	DEF	(SUM,LongB,CHN,NNH),100	DATA7850
	DEF	(MM,BODY,BONE,GI,KIDNEY,LIVER,LUNG,MUSCLE,TESTES),450	DATA7860
	DEF	(THYROID,YIELD,NPROTH,LongH,JGSM,HALH,ELEM,GMPIY),450	DATA7870
	DEF	(ATM,GAMEN),450	DATA7880
	DEF	FPI,10000	DATA7890
	DEF	FPIG,1	DATA7900
	USE		DATA7910
	END		DATA7920

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[illegible]

DLOOP	READ	FIXIN,MMH,1	PUT INTO ADDRESS PORTION	RSAC1160	USE	FMTCR	RSAC1740
	READI	NNM,1		RSAC1170	DIAG1	DFMT1,8,SKP	RSAC1750
	SXA	TEMP,2	SAVE XR2	RSAC1180	TRA	EXIT	RSAC1760
	CLA	NNM,1	NUMBER OF ISOTOPIES IN THIS CHAIN	RSAC1190	DFMT1	BCI	8,ILLEGAL HALF-LIFE CODE. EXECUTION TERMINATED
	PDX	,4		RSAC1200	USE		RSAC1770
RRR1	READ	DECIM,HALM,2		RSAC1210	CLA	HALM,2	RSAC1780
	READI	LONGM,2		RSAC1220	ANA	=037777777770	RSAC1790
	READ	BCD,ELEMM,2		RSAC1230	SXA	TEMP,4	RSAC1800
	TXI	**1,2,1		RSAC1240	ORA	TEMP	RSAC1810
	TIX	RRR1,4,1		RSAC1250	STO	HALM,2	RSAC1820
	CLA	NNM,1	RESTORE XR1	RSAC1260	CLA	MTOT+1	RSAC1830
	PDX	,4		RSAC1270	FDP	CONVL+1,4	RSAC1840
	LXA	TEMP,2	RESTORE XR2	RSAC1280	STO	LONGM,2	FINISH CALCULATING THE DECAY CONSTANT
RRR2	READI	NPROTN,2		RSAC1290	USE	FMTCR	STORE WHERE CODE NUMBER USED TO BE
	TSL	DECIM		RSAC1300	DEC	3,156E+07,8.64E-04,3.6E+03,60,0	RSAC1860
	FMP	=,01	CONVERT FROM PERCENT	RSAC1310	CONVL	DEC	RSAC1870
	STO	YIELDM,2		RSAC1320	USE		RSAC1880
	READI	JGASM,2		RSAC1330	LDO	FISS	RSAC1890
	TXI	**1,2,1		RSAC1340	FMP	YIELDM,2	CALCULATE THE BUILDUP SOURCE TERM
	TIX	RRR2,4,1		RSAC1350	STO	FPI,2	RSAC1900
	CLA	NNM,1		RSAC1360	TXI	**1,2,1	STORE FOR DEC ROUTINE
	PDX	,4		RSAC1370	TXH	**3,2,450	CHANGE XR2 FOR NEXT ISOTOPE
	LXA	TEMP,2		RSAC1380	CLA	HALM,2	CHECK TO SEE THAT ITS NOT TOO LARGE
RRR3	TSL	FIXIN	READ THE GAMMA ENERGY GROUP NUMBER,	RSAC1390	TNZ	LANDC	RSAC1910
	LLS	35		RSAC1400	TRA	SCAL-1	IF THERE IS A NEXT ISOTOPE
	STA	JGASM,2		RSAC1410	NEW	STZ	RSAC1920
	READ	DECIM,GDMPY,2	AND THE GAMMA MULTIPLIER	RSAC1420	TSL	DATAIN	RSAC1930
	TXI	**1,2,1		RSAC1430	ZERO	FPIC,10000,1	STORE WHERE CODE NUMBER USED TO BE
	TIX	RRR3,4,1		RSAC1440	CLA	ADD	YES, CLEAN CORE (REACTOR TYPE)
	CLA	NNM,1		RSAC1450	TNZ	RER	RSAC1940
	PDX	,4		RSAC1460	LDO	POWER	CHECK TO SEE THAT ITS NOT TOO LARGE
	LXA	TEMP,2		RSAC1470	FMP	CONV	RSAC1950
RRR8	READ	DECIM,(BONE,GI,KIDNEY,LIVER,LUNG,MUSCLE,TESTES),2		RSAC1480	STO	FISS	RSAC1960
	READ	DECIM,(T-HYPOD,BODY),2		RSAC1490	NEWC	AXT	IF THERE IS A NEXT ISOTOPE
	TXI	**1,2,1		RSAC1500	LDO	FISS	RSAC1970
	TIX	RRR8,4,1		RSAC1510	FMP	YIELDM,2	RSAC1980
	TXI	**1,1,2		RSAC1520	STO	FPI,2	RSAC1990
MTTST	TXH	**2,1,**	SEE IF ALL CHAINS HAVE BEEN FULLY READ	RSAC1530	TXI	**1,2,1	STORE FOR DEC ROUTINE
	TIX	DLOOP,1,1	NO, GO READ ANOTHER	RSAC1540	TXH	**3,2,450	CHANGE XR2 FOR NEXT ISOTOPE
	STZ	TROP-1		RSAC1550	CLA	HALM,2	CHECK TO SEE THAT ITS NOT TOO LARGE
	STZ	TTROP-1		RSAC1560	TNZ	NEHC+1	RSAC2000
CDECAY	STZ	NUI		RSAC1570			RSAC2010
	TSL	DATAIN	READ INPUT,	RSAC1580			YES, CLEAN CORE (REACTOR TYPE)
	LDO	POWER		RSAC1590			TEST FOR NEW CORE
	FMP	CONV		RSAC1600	AXT	0,7	RSAC2020
	STO	FISS		RSAC1610	CLA	VNM,1	RSAC2030
				RSAC1620	SCAL		RSAC2040
				RSAC1630	CALLP	DEC,(FPI,TROP,OMEX,FPIC)	CALCULATE THE BUILDUP, CHAIN BY
				RSAC1640	PXD	,1	CHAIN
				RSAC1650	CAS	MTOT	CHECK TO SEE IF ALL CHAINS ARE
				RSAC1660	TRA	**3	THROUGH YET
				RSAC1670	TRA	**2	RSAC2050
				RSAC1680	TRA	SCAL	NO, CALCULATE ANOTHER
				RSAC1690	TSX	STH,4	YES, ANNOUNCEMENTS, PLEASE
				RSAC1700	WRITE	FMT04,5	RSAC2060
				RSAC1710	CLA	POWER	RSAC2070
				RSAC1720	TSL	DTRANP	RSAC2080
				RSAC1730	WRITE	FMT05,2	RSAC2090
					CLA	TROP	RSAC2100
							RSAC2110
							RSAC2120
							RSAC2130
							RSAC2140
							RSAC2150
							RSAC2160
							RSAC2170
							RSAC2180
							RSAC2190
							RSAC2200
							RSAC2210
							RSAC2220
							RSAC2230
							RSAC2240
							RSAC2250
							RSAC2260
							RSAC2270
							RSAC2280
							RSAC2290
							RSAC2300
							RSAC2310

INPUT IS FINISHED, TEMPORARILY. NOW BEGIN THE PRELIMINARY

CALCULATE THE DECAY CONSTANTS FROM
HALF LIVES
TEMPORARY STORAGE

CHECK CODE NUMBER FOR VALIDITY

PRELIMS ARE OVER, NOW WE GO TO BIGGER THINGS

DEC,(FPI,TROP,OMEX,FPIC) CALCULATE THE BUILDUP, CHAIN BY

CHECK TO SEE IF ALL CHAINS ARE
THROUGH YET

NO, CALCULATE ANOTHER
YES, ANNOUNCEMENTS, PLEASE

TSL	DTRANP		RSAC2320	CLA	CHN,4	RSAC2900
WRITE	FMT06,2		RSAC2330	STO	TEMP	RSAC2910
TSX	FIL,4		RSAC2340	AXT	1,2	RSAC2920
TSX	STH,4		RSAC2350	RLC	CLA	RSAC2930
WRITE	FMT07,10		RSAC2360	CAS	NPROTH+1,2	RSAC2940
CLA	CONV		RSAC2370	TRA	TEMP	RSAC2945
TSL	DTRANP		RSAC2380	TRA	++2	RSAC2950
TSX	FIL,4		RSAC2390	TXI	FIT	RSAC2960
AXT	450,4		RSAC2400	RLC1	++1,2,1	RSAC2960
CLA	FPI+1,4	MOVE THE FISSION PRODUCT INVENTORY	RSAC2410	TXL	RLC,2,**	RSAC2970
STO	FPI+1,4	AT REACTOR SHUTDOWN INTO SOURCE FOR	RSAC2420	TIX	RLC-3,4,1	RSAC2980
STZ	FPI+1,4	STRAIGHT DECAY, AND ZERO F.P.I.C.	RSAC2430	AXT	1,2	RSAC2990
TIX	++3,4,1	FOR DECAY RUN	RSAC2440	CLA	ATOM+1,2	RSAC3000
FER	CLA		RSAC2450	TZE	++5	RSAC3010
TNZ	TTROP		RSAC2460	LDO	FPI+1,2	RSAC3020
READ	ROPST	IS REFUELING SCHEDULED	RSAC2470	FMP	FRACT	RSAC3030
AXT	DECIM,(TEMP,TTROP),0	YES, READ FRACTION OF F.P.I LEFT,	RSAC2480	STO	FPI+1,2	RSAC3040
LDO	450,4	AND NEW TTROP	RSAC2490	STZ	ATOM+1,2	RSAC3050
FMP	FPI+1,4	SIMULATE REFUELING	RSAC2500	TXI	++1,2,1	RSAC3060
FDP	TEMP		RSAC2510	RLC2	++7,2,**	RSAC3070
STO	=100.		RSAC2520	TRA	SUMOU	RSAC3080
TIX	FPI+1,4		RSAC2530	FIT	FPI+1,2	RSAC3090
LDO	++4,4,1		RSAC2540	FMP	LONG8,4	RSAC3100
FMP	TEMP	CHANGE TO PERCENT	RSAC2550	FDP	=100.	RSAC3110
STO	=100.0		RSAC2560	STO	FPI+1,2	RSAC3120
TSX	TEMP		RSAC2570	STZ	ATOM+1,2	RSAC3130
CLA	STH,4	WRITE OUT THE REFUELING CONSTANT	RSAC2580	TRA	RLC1-1	RSAC3140
TSL	TEMP		RSAC2590	FRC	TSL	RSAC3150
WRITE	DTRANP		RSAC2600	FMP	=,01	RSAC3160
TSX	FMT08,9		RSAC2610	STO	FRACT	RSAC3170
	FIL,4		RSAC2620	AXT	450,4	RSAC3180
			RSAC2630	LDO	FPI+1,4	RSAC3190
			RSAC2640	FMP	FRACT	RSAC3200
			RSAC2650	STO	FPI+1,4	RSAC3210
			RSAC2660	TIX	++3,4,1	RSAC3220
			RSAC2670	TRA	SUMOU	RSAC3230
			RSAC2680	AXT	4,4	RSAC3240
			RSAC2690	FRCP	TSL	RSAC3250
			RSAC2700	FMP	DECIM	RSAC3260
			RSAC2710	STO	=,01	RSAC3270
			RSAC2720	TIX	CHN+1,4	RSAC3280
			RSAC2730	AXT	++3,4,1	RSAC3290
			RSAC2740	FRLP4	450,4	RSAC3300
			RSAC2750	CLA	JGASH+1,4	RSAC3310
			RSAC2760	PDX	,1	RSAC3320
			RSAC2770	LDO	FPI+1,4	RSAC3330
			RSAC2780	FMP	CHN,1	RSAC3340
			RSAC2790	STO	FPI+1,4	RSAC3350
			RSAC2800	TIX	FRLP4,4,1	RSAC3360
			RSAC2810	SUMOU	450,4	RSAC3370
			RSAC2820	LDO	FPI+1,4	RSAC3380
			RSAC2830	FMP	LONGH+1,4	RSAC3390
			RSAC2840	STO	FPIC+1,4	RSAC3400
			RSAC2850	TIX	++3,4,1	RSAC3410
			RSAC2860	TSL	FROUT	RSAC3420
			RSAC2870	SUM	FPIC,450,4	RSAC3430
			RSAC2880	STO	SUM	RSAC3440
			RSAC2890	TSX	STH,4	RSAC3450
				WRITE	FMT09,5	RSAC3460
				CLA	SUM	

REFUELING COMPLETE, GO BACK TO MAIN LINE AND SEE IF THERE IS MORESAC2630

ROPS1 CLS TTROP
THI MROP TTROP POSITIVE, ANOTHER RUN

READY TO READ RELEASE FRACTIONATION DATA

READ1 NCH,0 DETERMINES THE POSSIBLE TYPE OF FRAC,RSAC2700
CLA NCH RSAC2710
TZE FRC RSAC2720
THI FRCP A CERTAIN PERCENT OF THE TOTAL F.P.I,RSAC2730
STZ TEMP FRACTIONATION BY ELEMENT GROUP
TSL DECIM READ FRACTIONATION FOR ALL BUT AFEW
FMP =,01 ELEMENTS,
STO FRACT,
LXD NCH,4
RDC1 READ1 CHN,4 READ ELEMENT AND FRACTIONATION
READ DECIM, LONG8,4
TIX RDC1,4,1
AXT 450,4
CLA =1
STO ATOM+1,4 SET FRACTIONATION BIT
TIX ++1,4,1
SUMI NNM,MTUT,4
STD RLC1
RDC2 RLC2
LXD NCH,4

THE FRACTIONATION CONSTANT FOR ALL ISOTOPES

MULTIPLY IT IN

GET OUT

READ FRACTIONATION CONSTANTS FOR THERSAC3250
FOUR ELEMENT GROUPS, CONVERT FROM PERCENT.

CHECK TO SEE WHICH TYPE FITS THIS ISOTOPE

MULTIPLY IN ITS CONSTANT
STORE IT, THANK YOU

CALCULATED, CHANGE FROM ATOMS TO D/SEC

WRITE IT OUT

TOTAL D/SEC

```

TSL  DTRANP
WRITE FMT10,2
CLA  SUM
FDP  =3.7E+10
ZAC
LLS  35          TOTAL CURIES
TSL  DTRANP
WRITE FMT11,1
TSX  FIL,4

*
* ALL FINISHED HERE, GO FIND OUT WHAT COMES NEXT
*
TRA  DETIN

*
* TTROP WAS POSITIVE, MUST CALCULATE DECAY BETWEEN REACTOR OPERATIONS. I.E., REACTOR IS SHUT DOWN NOW, BUT NOT FOREVER.
*
MRPOP AXT  0,3
      READ DECIM,POWER,0
      CLA  POWER
      TZE  DECAY1-1
      READ DECIM,(CCNV,ADD,TROP),0
      TRA  DECAY1
      STZ  TRJP
      TSX  STH,4
      AXT  0,4          WRITE SOME OUTPUT
      CAL  FMT12,4
      TSL  BCDOU
      TXI  **1,4,-1
      TXH  **3,4,-6
      CLA  TTROP
      TSL  DTRANP
      CAL  FMT12,4
      TSL  BCDOU
      TXI  **1,4,-1
      TXH  **3,4,-8
      TSX  FIL,4
      CLA  TTROP
      FAD  TROP
      STO  TTROP

*
* CALCULATE THE FISSION PRODUCT INVENTORY WHICH EMERGED FROM THE LAST REACTOR OPERATION AFTER IT HAS DECAYED THROUGH SHUTDOWN
*
* TIME PLUS THE NEXT REACTOR OPERATION TIME. AFTER THIS IS DONE, THE BUILDUP FROM THE NEXT REACTOR OPERATION WILL BE ADDED IN
*
MRCPD CLA  NNM,1
      CALLP DEC,(FPI,TTROP,EXPP,FPIC)
      PXD  ,1
      CAS  MTOT          IS THIS THE LAST CHAIN
      TRA  **3          YES
      TRA  **2          YES
      TRA  MRPOP        NO, GO BACK AND CALCULATE ANOTHER
      READ DECIM,TTROP,0
      CLA  POWER
      TZE  RER=5
      LDQ  FOWER
      FMP  CONV

RSAC3470 STO  FISS
RSAC3480 CLA  ADD
RSAC3490 TZE  ZADD
RSAC3500 AXT  450,4
RSAC3510 LDQ  FISS
RSAC3520 FMP  YIELDM*1,4
RSAC3530 STO  FPI*1,4
RSAC3540 TIX  **3,4,1
RSAC3550 AXT  0,7
RSAC3560 TRA  SCAL
RSAC3570 ZADD AXT  450,4
RSAC3580 LDQ  FISS
RSAC3590 FMP  YIELDM*1,4
RSAC3600 STO  FPI*1,4
RSAC3610 STZ  FPIC*1,4
RSAC3620 TIX  **4,4,1
RSAC3630 AXT  0,7
RSAC3640 TRA  SCAL
RSAC3650 *
RSAC3660 * THAT FINISHES THE INITIAL FISSION PRODUCT INVENTORY CALCULATION
RSAC3670 * THE NEXT BLOCK OF CODING DETERMINES WHICH CALCULATION SHOULD BE
RSAC3680 * EXECUTED NEXT
RSAC3690 *
      DETIN READI  DET,0
      CLA  DET
      TZE  START
      READI NCH,0
      CLA  NCH
      TZE  TRANS
      PDX  ,4
      TXH  DIAG3,4,20
      READI CHN*1,4
      TIX  **3,4,1

*
* GO TO THE BLOCK OF CODING POINTED OUT BY DET
*
TRANS LXQ  DET,4
      TRA  **10,4
      TRA  RTAPE          DET=9
      TRA  WTAPE          DET=8
      TRA  METER          DET=7
      TRA  NEM            DET=6
      TRA  DECAY          DET=5
      TRA  GAMMA          DET=4
      TRA  INHAL          DET=3
      TRA  DEPOS          DET=2
      TRA  BETAD          DET=1
      USE  FMTCR
      DIAG3 SCRIBE DFMT3,7,SKP
      TRA  EXIT
      DFMT3 BCI  ,7,THE NUMBER OF CHAINS INPUT IS TOO LARGE
      USE

*
* SET UP AND CALCULATE THE RELEASED FISSION PRODUCT INVENTORY.
* AT EACH TIME CORRESPONDING TO THE INPUT DOWNWIND DETECTOR
* PCSITIONS WHERE T=X/U
*
      DECAY CLA  NCH
      TNZ  INDCO          ARE ALL CHAINS REQUESTED

RSAC4050
RSAC4060
RSAC4070
RSAC4080
RSAC4090
RSAC4100
RSAC4110
RSAC4120
RSAC4130
RSAC4140
RSAC4150
RSAC4160
RSAC4170
RSAC4180
RSAC4190
RSAC4200
RSAC4210
RSAC4220
RSAC4230
RSAC4240
RSAC4250
RSAC4260
RSAC4270
RSAC4280
RSAC4290
RSAC4300
RSAC4320
RSAC4330
RSAC4340
RSAC4350
RSAC4360
RSAC4370
RSAC4380
RSAC4390
RSAC4400
RSAC4410
RSAC4420
RSAC4430
RSAC4440
RSAC4450
RSAC4460
RSAC4470
RSAC4480
RSAC4490
RSAC4500
RSAC4510
RSAC4520
RSAC4530
RSAC4540
RSAC4550
RSAC4560
RSAC4570
RSAC4580
RSAC4590
RSAC4600
RSAC4610
RSAC4620
RSAC4630
RSAC4640

```



```

TXI      **1,1,1
TXH      **3,1,49
CLA      TIME,1
TNZ      THRLP
LXA      PPPRN,1
TXI      DECAP,1,1
METER    CLA      =01
          STO      NUI
          TSL      DATAIN
          TRA      DETIN
TAPE     SCRIBE    FMT00,12,NPG
          SCRIBE    FMT01,11,SKP
          TRA      DETIN
WTAPE    TSX      S,100P,4
          IOSKP    REW
          PZE      S,SU05
          TSX      S,100P,4
          IOWBP    OUTBU1
          PZE      S,SU05
          TSX      S,100P,4
          IOSKP    REWUNL
          PZE      S,SU05
          SCRIBE    FMT63,9,SKP
          TRA      DETIN
REWUNL   MZE      0,,=1
          REW      PZE      0,,=1
OUTBU1   PZE      MTOT,,-TOT=2
RTAPE    TSX      S,100P,4
          IOSKP    REW
          PZE      S,SU05
          TSX      S,100P,4
          IOWBP    OUTBU1
          MZE      S,SU05
          PZE      **,CHET
          TSX      S,100P,4
          IOSKP    REWUNL
          PZE      S,SU05
          TRA      DETIN
CHK      CLA      S,SSCH
          ADD      =1
          ANA      =077777
          TZE      1,4
          BRN      ER
          MSB      **1
          TSX      S,XPRT,4
          PZE      MES,,78
          TSX      S,XPSE,4
          TRA      RTAPE
MES      BCI      9,CHECK TAPE ON S,SU05 AND SEE IF IT IS THE RIGHT NO.
          BCI      4,READY S,SU05 IF OKAY.
EP      PZE
*
* THE FOLLOWING BLOCK OF CODING IS DESIGNED TO PUT OUT THE TOTAL
* OF ALL FISSION CHAINS WHICH HAVE BEEN WRITTEN OUT, PLUS SUB-
* TOTALS OF VARIOUS ISOTOPES.
DOSEC    SCRIBE    FMT17,6,NPG
          LXN      MTOT,4

```

```

NEXT TIME VALUE
IS THIS THE FIFTIETH TIME VALUE
NO, GET ANOTHER
IS THIS TIME EQUAL TO ZERO
YES, ALL THROUGH WITH THIS CHAIN
RETURN,PREPARING XR1 FOR THE NEXT

```

```

RSAC5810 ZAC
RSAC5820 ADD      NNH*1,4
RSAC5830 TIX      **1,4,1
RSAC5840 PDX      ,4
RSAC5850 SXA      XR4,4
RSAC5860 AXT      0,2
RSAC5870 STZ      R
RSAC5880 CLA      FPI,2
RSAC5890 FDP      =3,7E+10
RSAC5900 FMP      LONGM,2
RSAC5910 FAD      R
RSAC5920 STO      R
RSAC5930 TXI      **1,2,1
RSAC5940 TIX      **6,4,1
RSAC5950 TSX      STH,4
RSAC5960 ZAC
RSAC5970 TSL      DTRANP
RSAC5980 CLA      R
RSAC5990 TSL      DTRANP
RSAC6000 TSX      FIL,4
RSAC6010 LXA      XR4,4
RSAC6020 AXT      0,3
DSCLP    ZAC
          FAD*    STORE,1
          TXI      **1,2,1
          TIX      **2,4,1
          TZE      DSCL
          STO      SUM,1
          TSX      STH,4
          CLA      TIME,1
          TSL      DTRANP
          CLA      SUM,1
          TSL      DTRANP
          TSX      FIL,4
          LXA      XR4,4
          AXT      0,2
          TXI      **1,1,1
          TXL      DSCLP,1,49
DSCL      READI    NCH,0
          CLA      NCH
          TMI      GPOUT
          LXN      NCH,4
          TXL      DETIN,4,0
DSCL1     READI    CHN,4
          TIX      DSCL1,4,1
          LXN      NCH,4
DSCL2     CLA      CHN,4
          STO      TEMP
          SXD      XR4,4
          CLA      TEMP
          TSX      DSCL6,4
          SLW      FMT18+6
          SCRIBE    FMT18,7,NPG
          AXT      0,2
          LXA      XR4,4
          STZ      R
DSCL0     CLA      TEMP
          CAS      NPROTH,2

```

CALCULATE THE TOTAL NUMBER OF ISOTOPES

SAVE TOTAL IN XR4

CALCULATE THE SUM

WRITE IT OUT

GET READY FOR NEW DECAY TIME

GO GET IT, IF ITS THERE
CONTROL WORD FOR ISOTOPE SUMMATION

IF ZERO, ALL FINISHED HERE
READ THE ELEMENT NUMBERS

PICK UP THE CURRENT ELEMENT NUMBER

SAVE THE ELEMENT INDEX

```

RSAC6390
RSAC6400
RSAC6410
RSAC6420
RSAC6430
RSAC6440
RSAC6450
RSAC6460
RSAC6470
RSAC6480
RSAC6490
RSAC6500
RSAC6510
RSAC6520
RSAC6530
RSAC6540
RSAC6550
RSAC6560
RSAC6570
RSAC6580
RSAC6590
RSAC6600
RSAC6610
RSAC6620
RSAC6630
RSAC6640
RSAC6650
RSAC6660
RSAC6670
RSAC6680
RSAC6690
RSAC6700
RSAC6710
RSAC6720
RSAC6730
RSAC6740
RSAC6750
RSAC6760
RSAC6770
RSAC6780
RSAC6790
RSAC6800
RSAC6810
RSAC6820
RSAC6830
RSAC6840
RSAC6850
RSAC6860
RSAC6870
RSAC6880
RSAC6890
RSAC6900
RSAC6910
RSAC6920
RSAC6930
RSAC6940
RSAC6950
RSAC6960

```

TRA	**6	RSAC6970	SXD	P3,4	RSAC7550
TRA	**2	RSAC6980	SXD	P5,4	RSAC7560
TRA	**4	RSAC6990	AXT	0,3	RSAC7570
CLA	FPI,2	RSAC7000	CLA	JGASH,2	RSAC7580
FDP	=3.7E+10	RSAC7010	PDX	,4	RSAC7590
FMP	LONGM,2	RSAC7020	CLA	FPI,2	RSAC7600
FAD	R	RSAC7030	FDP	=3.7E+10	RSAC7610
STO	R	RSAC7040	FMP	LONGM,2	RSAC7620
TXI	**1,2,1	RSAC7050	FAD*	SUM1,4	RSAC7630
TIK	DSC,0,4,1	RSAC7060	STO*	SUM1,4	RSAC7640
TSX	STH,4	RSAC7070	TXI	**1,2,1	RSAC7650
ZAC		RSAC7080	P5 TXL	P1,2,**	RSAC7660
TSL	DTRANP	RSAC7090	OUT	SCRIBE	RSAC7670
CLA	R	RSAC7100		SPACE	RSAC7680
TSL	DTRANP	RSAC7110	TSX	STH,4	RSAC7690
TSX	FIL,4	RSAC7120	ZAC		RSAC7700
AXT	0,1	RSAC7130	TSL	DTRANP	RSAC7710
DSCL3 LXA	XR4,4	RSAC7140	CLA	HAKP	RSAC7720
AXT	0,2	RSAC7150	STZ	HAKP	RSAC7730
STZ	SUM,1	RSAC7160	TSL	DTRANP	RSAC7740
DSCL4 CLA	TEMP	RSAC7170	CLA	HAKP	RSAC7750
CAS	NPROTM,2	RSAC7180	STZ	HAKP	RSAC7760
TRA	**6	RSAC7190	TSL	DTRANP	RSAC7770
TRA	**2	RSAC7200	CLA	DOSE	RSAC7780
TRA	**4	RSAC7210	STZ	DOSE	RSAC7790
CLA	SUM,1	RSAC7220	TSL	DTRANP	RSAC7800
FAD*	STORE,1	RSAC7230	CLA	SUM	RSAC7810
STO	SUM,1	RSAC7240	STZ	SUM	RSAC7820
TXI	**1,2,1	RSAC7250	TSL	DTRANP	RSAC7830
TIK	DSCL4,4,1	RSAC7260	TSX	FIL,4	RSAC7840
CLA	TIME,1	RSAC7270	AXT	0,1	RSAC7850
TZE	DSCL5	RSAC7280	P2 AXT	C,2	RSAC7860
TSX	STH,4	RSAC7290	CLA	JGASH,2	RSAC7870
CLA	TIME,1	RSAC7300	PDX	,4	RSAC7880
TSL	DTRANP	RSAC7310	CLA*	SUM1,4	RSAC7890
CLA	SUM,1	RSAC7320	FAD*	STORE,1	RSAC7900
TSL	DTRANP	RSAC7330	STO*	SUM1,4	RSAC7910
TSX	FIL,4	RSAC7340	TXI	**1,2,1	RSAC7920
TXI	**1,1,1	RSAC7350	P3 TXL	P2+1,2,**	RSAC7930
TXL	DSCL3,1,49	RSAC7360	CLA	TIME,1	RSAC7940
DSCL5 LXD	XR4,4	RSAC7370	TZE	**2	RSAC7950
TIK	DSCL2,4,1	RSAC7380	TXI	P2,1,1	RSAC7960
TRA	DETIV	RSAC7390	AXT	0,1	RSAC7970
GPOUT ZERO	SUM,24,4	RSAC7400	SPACE		RSAC7980
ZERO	DOSE,24,4	RSAC7410	TSX	STH,4	RSAC7990
ZERO	HAKP,24,4	RSAC7420	CLA	TIME,1	RSAC8000
ZERO	HAKP,24,4	RSAC7430	TZE	DSCL	RSAC8010
TRA	**5	RSAC7440	TSL	DTRANP	RSAC8020
PZE	HAKP,1	RSAC7450	CLA	HAKP,1	RSAC8030
PZE	HAKP,1	RSAC7460	TSL	DTRANP	RSAC8040
PZE	DOSE,1	RSAC7470	CLA	HAKP,1	RSAC8050
P4 PZE	SUM,1	RSAC7480	TSL	DTRANP	RSAC8060
AXT	4,4	RSAC7490	CLA	DOSE,1	RSAC8070
CLA	P4+1,4	RSAC7500	TSL	DTRANP	RSAC8080
STO	SUM1+1,4	RSAC7510	CLA	SUM,1	RSAC8090
TIK	**2,4,1	RSAC7520	TSL	DTRANP	RSAC8100
LXA	XR4,4	RSAC7530	TSX	FIL,4	RSAC8110
TXI	**1,4,-1	RSAC7540	TXI	**15,1,1	RSAC8120

PICK UP TOTAL NUMBER OF ISOTOPES

CHECK TO SEE IF CURRENT ISOTOPE IS ONE OF THE ISOTOPES OF THE CURRENT ELEMENT

YES, ADD IT IN

NOT ZERO, SO WRITE IT OUT

SOLIDS
HALOGENS
NOBLE GASES
CS

```

DATAIN PZE  **
      READ  DECIM,UBAR,0      READ WIND VELOCITY
      CLA   UBAR
      TZE   CURY
      CLA   =1.0
      FDP   UBAR
      STO   TEMP
      AXT   0.1
      TSL   DECIM              READ DOWNWIND DISTANCES
      STO   DIE,1
      FMP   TEMP              CONVERT TO SECONDS FOR TIMES
      STO   TIME,1
      TZE   **2
      TXI   **5,1,1
      TXI   **1,1,1
      SXA   IE,1
      CLA   NUI
      TNZ   RRA
      READ  DECIM,(POWER,CURV,ADD,TROP,TTRUP),0  READ AFEW
      RRA  READ  DECIM,(W1,W2,W3,SH,H,AMBDA,T),0
      READI MTOT+8,0
      AXT   4,4
      RRR0  READ  DECIM,VG+1,4
      TIX   RRR0,4,1
      READI NK1,0
      LXD   NK1,4
      RRR4  READ  DECIM,(K1,K2),4
      TIX   RRR4,4,1
      READI LB,0
      LXD   LB,4
      RRR5  READ  DECIM,ELB,4
      TIX   RRR5,4,1
      READI CNTRL,0
      CLA   IE
      SUB   =01
      ALS   18
      STD   RRR9
      STD   RRR10
      STD   ORK3
      AXT   1,1
      CLA   CNTRL
      TMI   DIF
      RRR7  READ  DECIM,(CY+1,CZ+1),1
      TXI   **1,1,1
      RRR9  TXL   RRR7,1,**
      TRA   DATAUS
      DIF  READ  DECIM,(TEMP,TEMP1),0
      CLA   TEMP
      STO   CY+1,1
      CLA   TEMP1
      STO   CZ+1,1
      TXI   **1,1,1
      RRR10 TXL   **5,1,**
      TRA   DATAUS
      CURY  AXT   0.1
      READ  DECIM,TIME,1
      CLA   TIME,1
      TZE   **2

```

TAKE ITS INVERSE

READ DOWNWIND DISTANCES

CONVERT TO SECONDS FOR TIMES

KEEP GOING UNTIL A ZERO IS READ

PARAMETERS

ALL CY SAME AND ALL CZ SAME

```

RSAC8130 TXI   CURY+1,1,1
RSAC8140 TXI   **1,1,1
RSAC8150 SXA   IE,1
RSAC8160 READ  DECIM,(POWER,CONV,ADD,TROP,TTRUP),0
RSAC8170 *
RSAC8180 *   THE FOLLOWING BLOCK OF CODING WRITES OUT THE INPUT VALUES.
RSAC8190 *
      DATAUS CLA   UBAR
      TZE   CURY1
      TSX   STH,4
      TSL   NPG
      RSAC8240 WRITE FMT30,2
      RSAC8250 CLA   UBAR
      RSAC8260 TSL   DTRANP
      RSAC8270 TSX   FIL,4
      RSAC8280 TSX   STH,4
      RSAC8290 TSL   SKP
      RSAC8300 WRITE FMT31,4
      RSAC8310 AXT   5,4
      RSAC8320 AXT   0,1
      RSAC8330 CLA   DIE,1
      RSAC8340 TZE   **5
      RSAC8350 TSL   DTRANP
      RSAC8360 TIX   **2,4,1
      RSAC8370 TXI   **2,1,1
      RSAC8380 TXI   **5,1,1
      RSAC8390 TSX   FIL,4
      IDA  RSAC8400 TSX   STH,4
      RSAC8410 AXT   5,4
      RSAC8420 CLA   DIE,1
      RSAC8430 TZE   **7
      RSAC8440 TSL   DTRANP
      RSAC8450 TIX   **2,4,1
      RSAC8460 TXI   **2,1,1
      RSAC8470 TXI   **5,1,1
      RSAC8480 TSX   FIL,4
      RSAC8490 TRA   IDA
      RSAC8500 TSX   FIL,4
      RSAC8510 TSX   STH,4
      RSAC8520 TSL   SKP
      RSAC8530 CAL   FMT32
      RSAC8540 TSL   BCD00
      RSAC8550 CLA   W1
      RSAC8560 TSL   DTRANP
      RSAC8570 CAL   FMT33
      RSAC8580 TSL   BCD00
      RSAC8590 CLA   W2
      RSAC8600 TSL   DTRANP
      RSAC8610 CAL   FMT34
      RSAC8620 TSL   BCD00
      RSAC8630 CLA   W3
      RSAC8640 TSL   DTRANP
      RSAC8650 TSX   FIL,4
      RSAC8660 TSX   STH,4
      RSAC8670 TSL   SKP
      RSAC8680 WRITE FMT35,3
      RSAC8690 CLA   SH
      RSAC8700 TSL   DTRANP

```

```

RSAC8710
RSAC8720
RSAC8730
RSAC8740
RSAC8742
RSAC8744
RSAC8746
RSAC8750
RSAC8760
RSAC8770
RSAC8780
RSAC8790
RSAC8800
RSAC8810
RSAC8820
RSAC8830
RSAC8840
RSAC8850
RSAC8860
RSAC8870
RSAC8880
RSAC8890
RSAC8900
RSAC8910
RSAC8920
RSAC8930
RSAC8940
RSAC8950
RSAC8960
RSAC8970
RSAC8980
RSAC8990
RSAC9000
RSAC9010
RSAC9020
RSAC9030
RSAC9040
RSAC9050
RSAC9060
RSAC9070
RSAC9080
RSAC9090
RSAC9100
RSAC9110
RSAC9120
RSAC9130
RSAC9140
RSAC9150
RSAC9160
RSAC9170
RSAC9180
RSAC9190
RSAC9200
RSAC9210
RSAC9220
RSAC9230
RSAC9240
RSAC9250

```


WRITE FMT36,4
 CLA H
 TSL DTPANP
 TSX FIL,4
 TSX STH,4
 TSL SKP
 WRITE FMT37,3
 CLA AMBDA
 TSL DTRANP
 WRITE FMT38,3
 CLA T
 TSL DTRANP
 TSX FIL,4
 CLA MTOT+8
 TZE ORK
 SCRIBE FMT39,10,SKP
 TRA URK1
 ORK SCRIBE FMT40,10,SKP
 ORK1 TSX STH,4
 TSL SKP
 WRITE FMT41,4
 TSX FIL,4
 AXI 4,1
 TSX STH,4
 TSL SKP
 WRITE FMT42,4
 CLA VG+1,1
 TSL DTRANP
 TIX ++1,1,1
 TSX FIL,4
 TSX STH,4
 TSL SKP
 WRITE FMT43,4
 CLA VG+1,1
 TSL DTRANP
 TIX ++1,1,1
 TSX FIL,4
 TSX STH,4
 TSL SKP
 WRITE FMT44,4
 CLA VG+1,1
 TSL DTRANP
 TIX ++1,1,1
 TSX FIL,4
 TSX STH,4
 TSL SKP
 WRITE FMT45,4
 CLA VG+1,1
 TSL DTRANP
 TSX FIL,4
 TSX STH,4
 TSL SKP
 WRITE FMT46,2
 LXD NK1,1
 PXA 1
 TSL FIXTP
 LGL 36
 TSL BCDOL

RSAC9260
 RSAC9270
 RSAC9280
 RSAC9290
 RSAC9300
 RSAC9310
 RSAC9320
 RSAC9330
 RSAC9340
 RSAC9350
 RSAC9360
 RSAC9370
 RSAC9380
 RSAC9390
 RSAC9400
 RSAC9410
 RSAC9420
 RSAC9430
 RSAC9440
 RSAC9450
 RSAC9460
 RSAC9470
 RSAC9480
 RSAC9490
 RSAC9500
 RSAC9510
 RSAC9520
 RSAC9530
 RSAC9540
 RSAC9550
 RSAC9560
 RSAC9570
 RSAC9580
 RSAC9590
 RSAC9600
 RSAC9610
 RSAC9620
 RSAC9630
 RSAC9640
 RSAC9650
 RSAC9660
 RSAC9670
 RSAC9680
 RSAC9690
 RSAC9700
 RSAC9710
 RSAC9720
 RSAC9730
 RSAC9740
 RSAC9750
 RSAC9760
 RSAC9770
 RSAC9780
 RSAC9790
 RSAC9800
 RSAC9810
 RSAC9820
 RSAC9830

WRITE FMT47,7
 TSX FIL,4
 TSX STH,4
 TSL SKP
 CAL FMT48
 TSL BCDOL
 CLA K1,1
 TSL DTRANP
 CAL FMT49
 TSL BCDOL
 CLA K2,1
 TSL DTRANP
 TIX ++8,1,1
 TSX FIL,4
 TSX STH,4
 TSL SKP
 WRITE FMT50,4
 LXD LB,1
 CLA ELB,1
 TSL DTRANP
 TIX ++2,1,1
 TSX FIL,4
 CLA CNTRL
 TPL ORK2
 TSX STH,4
 TSL SKP
 WRITE FMT51,7
 TSX FIL,4
 TSX STH,4
 TSL SKP
 CAL FMT52
 TSL BCDOL
 CLA TEMP
 TSL DTRANP
 CAL FMT53
 TSL BCDOL
 CLA TEMP1
 TSL DTRANP
 TSX FIL,4
 TRA* DATAIN
 TSX STH,4
 TSL SKP
 AXI 1,1
 CAL FMT52
 TSL BCDOL
 CLA CY+1,1
 TSL DTRANP
 CAL FMT53
 TSL BCDOL
 CLA CZ+1,1
 TSL DTRANP
 TXI ++1,1,1
 ORK3 TXL ++9,1,1
 TSX FIL,4
 TRA* DATAIN
 CURY1 TSX STH,4
 TSL SKP
 WRITE FMT54,3

RSAC9840
 RSAC9850
 RSAC9860
 RSAC9870
 RSAC9880
 RSAC9890
 RSAC9900
 RSAC9910
 RSAC9920
 RSAC9930
 RSAC9940
 RSAC9950
 RSAC9960
 RSAC9970
 RSAC9980
 RSAC9990
 RSAC001-
 RSAC002-
 RSAC003-
 RSAC004-
 RSAC005-
 RSAC006-
 RSAC007-
 RSAC008-
 RSAC009-
 RSAC010-
 RSAC011-
 RSAC012-
 RSAC013-
 RSAC014-
 RSAC015-
 RSAC016-
 RSAC017-
 RSAC018-
 RSAC019-
 RSAC020-
 RSAC021-
 RSAC022-
 RSAC023-
 RSAC024-
 RSAC025-
 RSAC026-
 RSAC027-
 RSAC028-
 RSAC029-
 RSAC030-
 RSAC031-
 RSAC032-
 RSAC033-
 RSAC034-
 RSAC035-
 RSAC036-
 RSAC037-
 RSAC038-
 RSAC039-
 RSAC040-
 RSAC041-
 RSAC042-

AXT 0,1
 AXT 6,4
 CLA TIME,1
 TZE **5
 TSL DTRANP
 TIX **2,4,1
 TXI **2,1,1
 TXI **5,1,1
 IDA1 TSX FIL,4
 TSX STH,4
 AXT 6,4
 CLA TIME,1
 TZE **7
 TSL DTRANP
 TIX **2,4,1
 TXI **2,1,1
 TXI **5,1,1
 TSX FIL,4
 TRA IDA1
 TSX FIL,4
 TRA* DATAIN
 FROUT PZE **
 CLA NCH
 TZE FRC1
 TMI FRCP1
 LXD NCH,2
 CLA CHN,2
 TSX USCL6,4
 SLW FMT61+3
 TSX STH,4
 TSL SKP
 WRITE FMT61,6
 CLA LONGB,2
 TSL DTRANP
 TSX FIL,4
 TIX **13,2,1
 TSX STH,4
 TSL SKP
 WRITE FMT62,11
 LDQ FRACT
 FMP =100.0
 TSL DTRANP
 TSX FIL,4
 TRA* FROUT
 FRC1 TSX STH,4
 TSL SKP
 WRITE FMT55,9
 LDQ FRACT
 FMP =100.0
 TSL DTRANP
 TSX FIL,4
 TRA* FROUT
 FRCP1 AXT 4,2
 TSX STH,4
 TSL SKP
 WRITE FMT56,6
 TSX FIL,4
 TSX STH,4

RSAC043-	TSL	SKP	RSAC101-
RSAC044-	WRITE	FMT42,4	RSAC102-
RSAC045-	LDQ	CHN+1,2	RSAC103-
RSAC046-	FMP	=100.0	RSAC104-
RSAC047-	TSL	DTRANP	RSAC105-
RSAC048-	TSX	FIL,4	RSAC106-
RSAC049-	TIX	**1,2,1	RSAC107-
RSAC050-	TSX	STH,4	RSAC108-
RSAC051-	TSL	SKP	RSAC109-
RSAC052-	WRITE	FMT43,4	RSAC110-
RSAC053-	LDQ	CHN+1,2	RSAC111-
RSAC054-	FMP	=100.0	RSAC112-
RSAC055-	TSL	DTRANP	RSAC113-
RSAC056-	TSX	FIL,4	RSAC114-
RSAC057-	TIX	**1,2,1	RSAC115-
RSAC058-	TSX	STH,4	RSAC116-
RSAC059-	TSL	SKP	RSAC117-
RSAC060-	WRITE	FMT44,4	RSAC118-
RSAC061-	LDQ	CHN+1,2	RSAC119-
RSAC062-	FMP	=100.0	RSAC120-
RSAC063-	TSL	DTRANP	RSAC121-
RSAC064-	TSX	FIL,4	RSAC122-
RSAC065-	TIX	**1,2,1	RSAC123-
RSAC066-	TSX	STH,4	RSAC124-
RSAC067-	TSL	SKP	RSAC125-
RSAC068-	WRITE	FMT45,4	RSAC126-
RSAC069-	LDQ	CHN+1,2	RSAC127-
RSAC070-	FMP	=100.0	RSAC128-
RSAC071-	TSL	DTRANP	RSAC129-
RSAC072-	TSX	FIL,4	RSAC130-
RSAC073-	TRA*	FROUT	RSAC131-
RSAC074-	FMT00 BCI	9,	RSAC132-
RSAC075-	BCI	3, COMPUTER PROGRAM	RSAC133-
RSAC076-	FMT01 BCI	9,	RSAC134-
RSAC077-	BCI	2, FROM A TAPE	RSAC135-
RSAC078-	FMT03 BCI	9,	RSAC136-
RSAC079-	BCI	2, ULATION	RSAC137-
RSAC080-	FMT04 BCI	5, THE REACTOR HAS OPERATED AT (POWER)	RSAC138-
RSAC081-	FMT05 BCI	2, WATTS FOR (TROP)	RSAC139-
RSAC082-	FMT06 BCI	2, SECONDS	RSAC140-
RSAC083-	FMT07 BCI	9, THE CONVERSION FACTOR FROM WATTS TO FISSIONS PER SECON	RSAC141-
RSAC084-	BCI	1, D IS (CONVERSION FACTOR)	RSAC142-
RSAC085-	FMT08 BCI	9, PERCENT OF THE F.P. INVENTORY REMAINS AFTER REFUELING	RSAC143-
RSAC086-	FMT09 BCI	5, TOTAL FISSION PRODUCT RELEASE	RSAC144-
RSAC087-	FMT10 BCI	2, D/SEC OR	RSAC145-
RSAC088-	FMT11 BCI	1, CURIES	RSAC146-
RSAC089-	FMT12 BCI	6, THE REACTOR HAS BEEN SHUTDOWN FOR	RSAC147-
RSAC090-	BCI	2, SECONDS	RSAC148-
RSAC091-	FMT13 BCI	9, FISSION YIELD IN PERCENT FOR ISOTOPE I = DECAY CONSTA	RSAC149-
RSAC092-	BCI	3, NT FOR ISOTOPE I =	RSAC150-
RSAC093-	FMT14 BCI	3, HALF LIFE	RSAC151-
RSAC094-	FMT15 BCI	3, TIME IN SECONDS	RSAC152-
RSAC095-	FMT16 BCI	3, CURIES	RSAC153-
RSAC096-	FMT17 BCI	6, TIME	RSAC154-
RSAC097-	FMT18 BCI	7, TIME	RSAC155-
RSAC098-	FMT19 BCI	3, MEV/SEC	RSAC156-
RSAC099-	FMT20 BCI	1, MEV/	RSAC157-
RSAC100-	FMT21 BCI	9, TIME	RSAC158-

RSAC... RADIOLOGICAL SAFETY ANALYSIS C
 FISSON PRODUCT INVENTORY HAS BEEN READ
 FISSON PRODUCT INVENTORY CALC
 TOTAL F.P.I.
 TOTAL CURIES FOR
 CESIUM NOBLE GASES

	BCI	5, HALOGENS	SOLIDS	RSAC159-	NON.	FDP	GAMEN,2	RSAC217-
FMT30	BCI	2, JBAR =		RSAC160-		CONTRL	//	RSAC218-
FMT31	BCI	4, DOWNWIND DISTANCES =		RSAC161-		USE	//	RSAC219-
FMT32	BCI	1, W1 =		RSAC162-		DEF	MTOT,40	RSAC220-
FMT33	BCI	1, W2 =		RSAC163-		DEF	FRACT,1	RSAC221-
FMT34	BCI	1, W3 =		RSAC164-		DEF	(ADD,AK1,AK2,AMBD,ANSW,BREATH,CHI,CHIY,CNTRL,CONV),1	RSAC222-
FMT35	BCI	3, STACK HEIGHT =		RSAC165-		DEF	(D,BET,DOTOT,EXTRM,EXX,FISS,G,H,IE,K,LB,LONG,LT,M,MUR),1	RSAC223-
FMT36	BCI	4, INVERSION HEIGHT =		RSAC166-		DEF	(NCH,NEG,NK1,NREG,NUI,ORGAN,PART,POWER,R,SAVE4,SH,T),1	RSAC224-
FMT37	BCI	3, WASHOUT FACTOR =		RSAC167-		DEF	(TCY,TCZ,TDEPOS,TEMP,TEMP0,TEMP1,TEMP2,TEMP3,TEMP4),1	RSAC225-
FMT38	BCI	3, EXPOSURE TIME =		RSAC168-		DEF	(TENE,THISD,THISE,TBISX,TIM,TINMA,TMU,TNU,TOTAL,TOTAL1),1	RSAC226-
FMT39	BCI	9, DEPLETION FROM THE CLOUD DUE TO FALLOUT HAS BEEN NEGL		RSAC169-		DEF	(U,UBAR,V,VE,W1,W2,W3,X,XMAX,XMAXP,XMIN,XMINP,XR4,Y,Z),1	RSAC227-
	BCI	1,ECTED,		RSAC170-		DEF	(ZE,TROP,TTROP),3	RSAC228-
FMT40	BCI	9, DEPLETION FROM THE CLOUD DUE TO FALLOUT HAS BEEN INCL		RSAC171-		DEF	(XK1,A1,KX,VG),4	RSAC229-
	BCI	1,UEED,		RSAC172-		DEF	(SUM1,K1,K2,MU,NU),11	RSAC230-
FMT41	BCI	4, DEPOSITION VELOCITIES,		RSAC173-		DEF	(ENE,XK,HXKP,HAKP,DCSE,ELB,CZ,CY,STORE,TIME,DIE),25	RSAC231-
FMT42	BCI	4, FOR CESIUM =		RSAC174-		DEF	(SUM,LOGB,CHN,NNM),100	RSAC232-
FMT43	BCI	4, FOR THE NOBLE GASES =		RSAC175-		DEF	(MM,BODY,BONE,GI,KIDNEY,LIVER,LUNG,MUSCLE,TESTES),450	RSAC233-
FMT44	BCI	4, FOR THE HALOGENS =		RSAC176-		DEF	(THYROID,YIELDM,NPROTM,LOGB,JBASH,MALM,ELEMM,GDMFY),450	RSAC234-
FMT45	BCI	4, FOR THE SOLIDS =		RSAC177-		DEF	(ATOM,GAMEN),450	RSAC235-
FMT46	BCI	2, THERE ARE		RSAC178-		DEF	FPI,10000	RSAC236-
FMT47	BCI	7, SET(S) OF EXPONENTIALS FOR THE LEAK RATE,		RSAC179-		DEF	FPIC,1	RSAC237-
FMT48	BCI	1, K =		RSAC180-		USE		RSAC238-
FMT49	BCI	1, P =		RSAC181-		END		RSAC239-
FMT50	BCI	4, CROSSWIND DISTANCES =		RSAC182-				
FMT51	BCI	7, THERE IS ONE SET OF CY AND CZ VALUES,		RSAC183-				
FMT52	BCI	1, CY =		RSAC184-				
FMT53	BCI	1, CZ =		RSAC185-				
FMT54	BCI	3, TIME IN SECONDS =		RSAC186-				
FMT55	BCI	9, PER CENT OF THE FISSION PRODUCT INVENTORY RELEASED =		RSAC187-				
FMT56	BCI	6, FRACTIONATION BY ELEMENT GROUP,		RSAC188-				
FMT61	BCI	6, FRACTIONATION FOR		RSAC189-				
FMT62	BCI	9, FRACTIONATION FOR THE REST OF THE FISSION PRODUCT INV		RSAC190-				
	BCI	2,ENTORY =		RSAC191-				
FMT63	BCI	9, THE FISSION PRODUCT INVENTORY HAS BEEN WRITTEN ON A 1		RSAC192-				
	BCI	1,APE,		RSAC193-				
BET40	SUMI	NNM,MTOT,4	CALCULATE F.P.I. IN MEV/SEC.	RSAC194-				
	STD	BETAD1		RSAC195-				
	AXT	3,1		RSAC196-				
	AXT	1,2		RSAC197-				
NONE	TSL	DECIM		RSAC198-				
	STO	GAMEN+1,2		RSAC199-				
	CLA	=1.0		RSAC200-				
	FDP	GAMEN+1,2		RSAC201-				
	STO	GAMEN+1,2		RSAC202-				
	TXI	**1,2,1		RSAC203-				
BETAD1	TXL	NONE,2,**		RSAC204-				
BLOOP	CAL	FMT19+3,1		RSAC205-				
	SLW	FMT16+3,1		RSAC206-				
	TIX	BLOOP,1,1		RSAC207-				
	CAL	NON		RSAC208-				
	SLW	SCNLP+15		RSAC209-				
	SLW	THRLP+6		RSAC210-				
	SLW	DSCL0+6		RSAC211-				
	SLW	P1+3		RSAC212-				
	SLW	DSCLP+14		RSAC213-				
	CAL	FMT20		RSAC214-				
	SLW	FMT18+4		RSAC215-				
	TRA	DECAY		RSAC216-				

SIBMAP	IODECK	REF,DECK		IODE0010	ALS	3		IODE0590
	ENTRY	FIXTR		IODE0020	LLS	3		IODE0600
	ENTRY	TBUFF		IODE0030	TIX	**2,4,1		IODE0610
	ENTRY	BCDOU		IODE0040	SLW	DFMT		IODE0620
	ENTRY	FIL		IODE0050	TSX	STM;4		IODE0630
	ENTRY	DTRANP		IODE0060	AXT	0,4		IODE0640
	ENTRY	STM		IODE0070	CAL	DFMT,4		IODE0650
	ENTRY	FIXPL		IODE0080	TSL	BCDOU		IODE0660
	ENTRY	INT		IODE0090	TXI	**1,4,-1		IODE0670
	ENTRY	EXIT		IODE0100	TXH	**3,4,-5		IODE0680
	ENTRY	DECIM		IODE0110	TSX	FIL,4		IODE0690
	ENTRY	SKP		IODE0120	PZE			IODE0700
	ENTRY	BCD		IODE0130	BCI	5, LOCATION, OVERFLOW		IODE0710
	ENTRY	NPG		IODE0140	TRA	**		IODE0720
	ENTRY	FIXIN		IODE0150	SXA	READR,1	SAVE INDEX REGISTERS...	IODE0730
	ENTRY	DTRANS		IODE0160	SXA	READR+1,2		IODE0740
INT	TRA	**	SAVE XR4...	IODE0170	SXA	READR+2,4		IODE0750
	SXA	INTR,4		IODE0180	CLA	#150	SET UP THE PCS COMMAND...	IODE0760
	CLA	FPT		IODE0190	STO	RCOUNT		IODE0770
	TSX	S,SCCR,4		IODE0200	ADD	BUFF1		IODE0780
	STO	8		IODE0210	STA	TBUFF		IODE0790
	AXT	-299,4		IODE0220	AXT	150,1		IODE0800
	STZ	BUFF1,4	INITIALIZE BUFFERS TO ZERO...	IODE0230	HSP	RSW	NEXT CALL DOES NOT INITIATE READ...	IODE0810
	TXL	**2,4,0		IODE0240	TSX	S,100P,4		IODE0820
	TXI	**2,4,1		IODE0250	IODLY			IODE0830
	TSX	S,100P,4		IODE0260	PZE	S,SIN1		IODE0840
	IODR1	BUFF1		IODE0270	CLA	TBUFF	READ COMPLETED...	IODE0850
	PZE	S,SIN1		IODE0280	SUB	=1		IODE0860
	MSH	RSW	NEXT CALL INITIATES NEXT READ...	IODE0290	STA	**1		IODE0870
	STZ	RCOUNT		IODE0300	DSIGN	PCS		IODE0880
INTR	AXT	**4		IODE0310	CCS	**1,0	CHECK FOR \$ CARD...	IODE0890
	TRA*	INT	RETURN...	IODE0320	TRA	**2		IODE0900
FPT	TRA	**1		IODE0330	TRA	ENDFIL	YES, ALL THROUGH...	IODE0910
	STO	FPT		IODE0340	LDQ	ADDR	NO, PROCEED...	IODE0920
	CLA	0		IODE0350	RQL	18		IODE0930
	STA	FPTRN		IODE0360	STQ	ADDR		IODE0940
	ARS	18		IODE0370	CLA	ADDR		IODE0950
	LBT			IODE0380	STA	BUFF1		IODE0960
	TRA	**2		IODE0390	STA	**2		IODE0970
	LDQ	=0		IODE0400	AXT	-149,4	ZERO BUFFER...	IODE0980
	ARS	1		IODE0410	STZ	**4		IODE0990
	LBT			IODE0420	TXL	**2,4,0		IODE1000
	TRA	**2		IODE0430	TXI	**2,4,1		IODE1010
	HSP	**5		IODE0440	TSX	S,100P,4	READ NEXT RECORD...	IODE1020
	ARS	1		IODE0450	IODR1	BUFF1		IODE1030
	LBT			IODE0460	PZE	S,SIN1		IODE1040
	TRA	**2		IODE0470	READR	AXT	RESTORE INDEX REGISTERS...	IODE1050
	TRA	OVFLO		IODE0480	AXT	**2		IODE1060
	TXL	**4,0,0		IODE0490	AXT	**4		IODE1070
	ZAC			IODE0500	TRA*	READ	RETURN...	IODE1080
	MSH	**2		IODE0510	FIXINP	TRA		IODE1090
FPTRN	TRT	**		IODE0520	MSH	DSW		IODE1100
	CLA	FPT		IODE0530	TRA	**2		IODE1110
	TRA	**2		IODE0540	FIXIN	TRA		IODE1120
OVFLO	CLA	0		IODE0550	HSP	CTEST		IODE1130
	LRS	15		IODE0560	PLT	RSW	CHECK TO SEE IF READ IS NECESSARY...	IODE1140
	ZAC			IODE0570	TSL	READP	YES...	IODE1150
	AXT	5,4		IODE0580	SXA	FXRTN,1	SAVE INDEX REGISTERS...	IODE1160

SXA	FXRTN+1,2	10DE1170	STQ	FANSW	PUT IT AWAY...	10DE1750
SXA	FXRTN+2,4	10DE1180	LXA	SIGN,1	GET DIGIT COUNT...	10DE1760
AXT	0,1	10DE1190	MIT	FSW	CHECK SWITCH, WAS THERE AN EXPONENT	10DE1770
STZ	ANSW	10DE1200	TSL	ERROR1		10DE1780
STZ	SIGN	10DE1210	PLT	SIGN	YES, CHECK ITS SIGN...	10DE1790
FLOOP	TSL PCS	10DE1220	MSM	EXPSW		10DE1800
TRA	**2	10DE1230	TSL	FIXINP	GO GET IT...	10DE1810
TRA	FIXRTN	10DE1240	ZAC		SET IT UP FOR USE...	10DE1820
TOV	**1	10DE1250	PLT	EXPSW		10DE1830
CCS	CTEST,,5	10DE1260	CHS			10DE1840
TRA	CANAL	10DE1270	LRS	0		10DE1850
FERTN	TSL ERROR	10DE1280	LLS	35		10DE1860
LDO	CTEST	10DE1290	CHS			10DE1870
VMA	ANSW,,4	10DE1300	ADD	=01000000000000		10DE1880
LLS	4	10DE1310	ALS	16		10DE1890
TOV	FERTN	10DE1320	STD	**1		10DE1900
STO	ANSW	10DE1330	TXI	**1,1,**	ADD IT INTO DIGIT COUNT...	10DE1910
TXI	FLOOP,1,1	10DE1340	LDO	FANSW		10DE1920
CANAL	CCS CTEST,,3	10DE1350	ZAC		FLOAT THE MANTISSA...	10DE1930
TSL	ERROR	10DE1360	TXL	**2,1,38		10DE1940
TRA	MINUS	10DE1370	TXL	ERROR3,1,-39		10DE1950
CCS	CTEST,,4	10DE1380	AXT	155,2		10DE1960
TSL	ERROR	10DE1390	LLS	8		10DE1970
TRA	PLUS	10DE1400	TZE	**3		10DE1980
TSL	ERROR	10DE1410	LRS	1		10DE1990
MINUS	TXH **3,1,0	10DE1420	TXI	**2,2,1		10DE2000
MSM	CTEST	10DE1430	PXA	,2		10DE2010
TRA	FLOOP	10DE1440	LLS	27		10DE2020
DSW	BRN **2	10DE1450	FAD	=02000000000000	NORMALIZE IT...	10DE2030
TSL	ERROR,	10DE1460	LRS	35		10DE2040
MSM	SIGN	10DE1470	FMP	EXPON,1	MULTIPLY BY THE PROPER POWER OF TEN...	10DE2050
MSM	FSW	10DE1480	LRS	35	RETURN...	10DE2060
TRA	FIXRTN	10DE1490	DTRTN	AXT **1		10DE2070
PLUS	TXL FLOOP,1,0	10DE1500	AXT	**2		10DE2080
MIT	DSW	10DE1510	AXT	**4		10DE2090
TSL	ERROR,	10DE1520	TRA*	DECIM		10DE2100
MSM	FSW	10DE1530	PCS	TRA **	ROUTINE TO GET A CHARACTER W/CHECK...	10DE2110
FIXRTN	SXA SIGN,1	10DE1540	MSP	PSW	SET SWITCH FOR CHECK...	10DE2120
LDO	ANSW	10DE1550	TRA	**2		10DE2130
CLA	CTEST	10DE1560	PCSP	TRA **	ENTRY POINT TO DELETE CHECK...	10DE2140
LRS	0	10DE1570	SXA	PCSR,1	SAVE INDEX REGISTERS...	10DE2150
FXRTN	AXT **1	10DE1580	SXA	PCSR+1,2		10DE2160
AXT	**2	10DE1590	SXA	PCSR+2,4		10DE2170
AXT	**4	10DE1600	MSP	ENHRTN		10DE2180
PLT	DSW	10DE1610	CLA	CCOUNT	UPDATE CHARACTER COUNT...	10DE2190
TRA	**2	10DE1620	SUB	=1		10DE2200
TRA*	FIXIN	10DE1630	TZE	BLANK	IF ZERO, SET READ SWITCH AND RETURN...	10DE2210
MSP	DSW	10DE1640	STO	CCOUNT		10DE2220
TRA*	FIXINP	10DE1650	LXD	TBUFF,2	INITIALIZE...	10DE2230
DECIM	TRA **	10DE1660	LXA	RCOUNT,1		10DE2240
SXA	DTRTN,1	10DE1670	TXL	**2,2,20805	RESET CHARACTER COUNT...	10DE2250
SXA	DTRTN+1,2	10DE1680	TSL	NEWWD		10DE2260
SXA	DTRTN+2,4	10DE1690	ZAC			10DE2270
MSP	EXPSW	10DE1700	TBUFF	PCS **1,0	PICK UP CHARACTER...	10DE2280
MSF	FSW	10DE1710	TXI	**1,2,1		10DE2290
PLT	RSW	10DE1720	SXD	TBUFF,2	UPDATE TBUFF...	10DE2300
TSL	READP	10DE1730	PSW	PCSR,,	TO CHECK OR NOT TO CHECK ...	10DE2310
TSL	FIXINP	10DE1740	CCS	CTEST,,1	TO CHECK...	10DE2320

TRA	PCSR	10DE2330	TZE	CHEK-3	IF ZERO, MUST READ AFTER ALL...	10DE2910
TRA	COMMA	10DE2340	TXI	**1,4,-1		10DE2920
CCS	CTEST,,2	10DE2350	CLA	TBUFF	OTHERWISE, CHECK COLUMN ONE FOR BLANK	10DE2930
TRA	PCSR	10DE2360	STA	**1		10DE2940
TRA	BLANK	10DE2370	PCS	**4,0		10DE2950
TRA	PCSR	10DE2380	CCS	CTEST,,2		10DE2960
BLANK	MSM	10DE2390	TRA	PRTN		10DE2970
COMMA	CLA	10DE2400	TRA	**2		10DE2980
ADD	=1	10DE2410	TRA	PRTN		10DE2990
STA	ENHRTN	10DE2420	LXA	**5,2	IF BLANK, WRITE THIS CARD OUT...	10DE3000
MSM	PSW	10DE2430	SXD	**1,4		10DE3010
MSM	ENHRTN	10DE2440	TIX	**1,2,**		10DE3020
PCSR	AXT	10DE2450	SXA	OBUFF,2		10DE3030
AXT	**1	10DE2460	TSX	STH,4		10DE3040
AXT	**2	10DE2470	AXT	0,4		10DE3050
ENHRTN	AXT	10DE2480	OBUFF	CAL		10DE3060
BRA	**	10DE2490	TSL	BCDOU		10DE3070
PLT	PSW	10DE2500	TXI	**1,4,-1		10DE3080
TRA*	PCSP	10DE2510	TXH	OBUFF,4,*13		10DE3090
MSM	PSW	10DE2520	TSX	FIL,4		10DE3100
TRA*	PCS	10DE2530	CLA	RCOUNT		10DE3110
SXA	RCOUNT,1	10DE2540	SUB	=15		10DE3120
NEWWD	TRA	10DE2550	STC	RCOUNT		10DE3130
AXT	2C800,2	10DE2560	TRA	READP*4		10DE3140
SXD	TBUFF,2	10DE2570	PRTN	AXT		10DE3150
TIX	NEWWD-1.1,1	10DE2580	AXT	**2		10DE3160
TRA	BLANK	10DE2590	AXT	**4		10DE3170
READP	TRA	10DE2600	TRA*	READP		10DE3180
SXA	PRTN,1	10DE2610	BCD	TRA		10DE3190
SXA	PRTN*1,2	10DE2620	PLT	RSW	PICK UP BCD WORD...	10DE3200
SXA	PRTN*2,4	10DE2630	TSL	READP	CHECK READ SWITCH...	10DE3210
CLA	=150	10DE2640	SXA	BCRTN,1		10DE3220
STO	CCOUNT	10DE2650	AXT	6,1	SAVE XR1...	10DE3230
LDO	RCOUNT	10DE2660	TSL	PCSP	PICK UP SIX CHARACTERS...	10DE3240
ZAC		10DE2670	LGR	6		10DE3250
DVP	=15	10DE2680	ROL	12		10DE3260
STO	REM	10DE2690	TIX	**3,1,1		10DE3270
ZAC		10DE2700	ROL	30		10DE3280
LLS	35	10DE2710	TSL	PCS	CHECK FOR FOLLOWING COMMA OR BLANK...	10DE3290
TNZ	CHEK	10DE2720	TSL	ERROR2		10DE3300
TSL	READ	10DE2730	BCRTN	AXT		10DE3310
CLA	=10	10DE2740	BCRTN	AXT		10DE3320
STZ	REM	10DE2750	TRA*	BCD		10DE3330
CHEK	MSP	10DE2760	ENDFIL	LXA		10DE3340
LRS	35	10DE2770	PXD	DSIGN,4		10DE3350
MPY	=15	10DE2780	COM			10DE3360
STO	RCOUNT	10DE2790	STD	**1		10DE3370
LXA	RCOUNT,4	10DE2800	TXI	**1,4,**		10DE3380
CLA	TBUFF	10DE2810	TXI	**1,4,1		10DE3390
AXT	20800,2	10DE2820	PXD	,4		10DE3400
SXD	TBUFF,2	10DE2830	ORA	STH=1		10DE3410
STA	**2	10DE2840	TSX	S,SCCR,4		10DE3420
PCS	CTEST,,1	10DE2850	TMT	14		10DE3430
SAC	**4,5	10DE2860	TSX	S,SCCR,4		10DE3440
LXA	FIXIN,2	10DE2870	MSM	S,SCD1		10DE3450
TSL	FIXIN	10DE2880	EXIT	AXT		10DE3460
SXA	FIXIN,2	10DE2890	AXT	1,1		10DE3470
ZAC		10DE2900	TSX	S,SCCR,4		
LLS	35					

SXD	S.SCD1,1	10DE3480 BCORTN AXI	**4	RETURN...	10DE4060
CLA	=+18SYS	10DE3490 TRA	BCDOU		10DE4070
TSX	S.SCCR,4	10DE3500 DTRANS TRA	**	ENTRY FOR TRANSLATED NUMBER RETURN	10DE4080
STO	S.SCUR	10DE3510 MSP	PLACT	IN AC-MQ...	10DE4090
TRA	S.SRET	10DE3520 TRA	**2		10DE4100
PZE	S.SAVE	10DE3530 DTRANP TRA	**	ENTRY FOR TRANSLATED NUMBER PLACED	10DE4110
STH	OUTBU	10DE3540 SXA	DCTRIN,1	IN OUTPUT BUFFER...	10DE4120
STA	**6	10DE3550 SXA	DCTRIN+1,2	SAVE INDEX REGISTERS...	10DE4130
SXA	**8,4	10DE3560 SXA	DCTRIN+2,4		10DE4140
AXT	-2,4	10DE3570 TNZ	**3		10DE4150
SXA	BCDOU+2,4	10DE3580 LDQ	=0	ANSWER IS ZERO...	10DE4160
AXT	-22,4	10DE3590 TRA	DCTRIN	SO QUIT...	10DE4170
CLA	=H	10DE3600 STO	ANSW1		10DE4180
STO	**4	10DE3610 AXT	0,7	INITIALIZE...	10DE4190
TXI	**1,4,1	10DE3620 TPL	**4	CHECK THE SIGN...	10DE4200
TXH	**2,4,0	10DE3630 PCS	CTEST,,3	PLACE MINUS SIGN...	10DE4210
AXT	**4	10DE3640 SAC	ANSW1-1,,0		10DE4220
CLA	**4	10DE3650 SAC	ANSW1-1,,0		10DE4230
STA	OLT	10DE3660 TXI	**1,4,1		10DE4240
TRA	1,4	10DE3670 CLA	ANSW1		10DE4250
SXA	FLRTN,4	10DE3680 SSP		WORK WITH A POSITIVE NUMBER...	10DE4260
TSX	S.100P,4	10DE3690 COMP CAS	=1,0	TOO LARGE...	10DE4270
10DLY		10DE3700 TRA	DIV		10DE4280
NZE	S.SOU1	10DE3710 TRA	DIV		10DE4290
PZE	ERRET	10DE3720 CAS	=,1		10DE4300
TSX	S.100P,4	10DE3730 TRA	**3		10DE4310
10WDI	OUTBU	10DE3740 TRA	**2	TOO SMALL...	10DE4320
PZE	S.SOU1	10DE3750 TRA	MULT		10DE4330
LDQ	ADJRP	10DE3760 STO	ANSW1		10DE4340
RQL	18	10DE3770 CLA	=H00E	SET UP THE EXPONENT PART...	10DE4350
STO	ADJRP	10DE3780 STO	SIGNE	CHECK ITS SIGN...	10DE4360
CLA	ADJRP	10DE3790 TXL	**3,2,0		10DE4370
STA	OUTBU	10DE3800 CLA	=040	MINUS...	10DE4380
FLRTN	AXT	10DE3810 SAC	SIGNE,,3		10DE4390
TRA	1,4	10DE3820 PXA	,2		10DE4400
SKP	TRA	10DE3830 TRA	**2	PLUS...	10DE4410
MSH	SKFR	10DE3840 PXA	,1	GO GET THE VALUE TRANSLATED...	10DE4420
CAL	=H	10DE3850 TSL	FIXTR		10DE4430
TRA	**3	10DE3860 LGL	30	STORE IT IN SIGNE...	10DE4440
NPG	TRA	10DE3870 SAC	SIGNE,,4		10DE4450
CAL	=H	10DE3880 LGL	6	PICK UP THE FRACTION PART...	10DE4460
SXA	**3,4	10DE3890 SAC	SIGNE,,5		10DE4470
AXT	-1,4	10DE3900 CLA	ANSW1		10DE4480
XEC	OUT	10DE3910 UFA	=02000000000000		10DE4490
AXT	**4	10DE3920 LRS	27		10DE4500
SKPR	TXH	10DE3930 CLA	=033	SET UP THE SAC COMMAND	10DE4510
TRA	NPG	10DE3940 TXI	**1,4,25792		10DE4520
MSP	SKFR	10DE3950 AXT	2,2		10DE4530
TRA	SKP	10DE3960 SXD	**1,4		10DE4540
BCDOU	TRA	10DE3970 SAC	ANSW1+1,2,**	CHECK FOR THE UPPER LIMIT...	10DE4550
SXA	BCORTN,4	10DE3980 TXH	**3,4,25796		10DE4560
AXT	**4	10DE3990 HPY	=10		10DE4570
OUT	SLW	10DE4000 TXI	**4,4,1	CHECK FOR THE LAST WORD	10DE4580
TXI	**1,4,-1	10DE4010 TNX	**4,2,1		10DE4590
SXA	BCDOU+2,4	10DE4020 AXT	25793,4	CHANGE THE UPPER LIMIT	10DE4600
TXH	BCORTN,4,-22	10DE4030 SXD	**5,4	GO BACK	10DE4610
TSX	FIL,4	10DE4040 TXI	**5,4,-2		10DE4620
TSX	STH,4	10DE4050 AXT	25796,4		

CARD	SLW	LOC		10DE5800	TXH	**3,4,-12		10DE6380
	TRA	1,4		10DE5810	TSX	FIL,4		10DE6390
	PZE	**	PRINT CARD WHICH HAD THE ERROR,	10DE5820	TSL	CARD		10DE6400
	SXA	ERR1,1		10DE5830	TRA	EXIT+1		10DE6410
	LXA	RCOUNT,1		10DE5840	FT2 BCI	9, LOCATION. AN ILLEGAL INTEGER NUMBER ENCOUNTERED. EXEC		10DE6420
	PXA	,1		10DE5850	BCI	3,UTION TERMINATED		10DE6430
	LRS	35		10DE5860	ERROR1 PZE	**	AN ILLEGAL DECIMAL NUMBER,	10DE6440
	DVP	=15		10DE5870	CLA	DECIM		10DE6450
	MPY	=15		10DE5880	STA	LDC		10DE6460
	ZAC			10DE5890	TSX	ADRES,4		10DE6470
	LLS	35		10DE5900	TSX	STH,4		10DE6480
	ADD	=14		10DE5910	CAL	LDC		10DE6490
	PAX	,5		10DE5920	TSL	BCDOU		10DE6500
	TSX	STH,4		10DE5930	AXT	0,4		10DE6510
	CLA	TBUFF		10DE5940	CAL	FT3,4		10DE6520
	STA	**2		10DE5950	TSL	BCDOU		10DE6530
	AXT	14,4		10DE5960	TXI	**1,4,-1		10DE6540
	CAL	**1		10DE5970	TXH	**3,4,-12		10DE6550
	TSL	BCDOU		10DE5980	TSX	FIL,4		10DE6560
	TXI	**1,1,-1		10DE5990	TSL	CARD		10DE6570
	TIX	**3,4,1		10DE6000	TRA	EXIT+1		10DE6580
ERR1	TSX	FIL,4		10DE6010	FT3 BCI	9, LOCATION. AN ILLEGAL DECIMAL NUMBER ENCOUNTERED. EXEC		10DE6590
	AXT	**1		10DE6020	BCI	3,UTION TERMINATED		10DE6600
ERROR	TRA*	CARD	AN ILLEGAL CHARACTER IS IN A NUMERIC DATA FIELD.	10DE6030	ERROR2 PZE	**	AN ILLEGAL BCD WORD,	10DE6610
	PZE	**		10DE6040	CLA	BCD		10DE6620
	MIT	DSW		10DE6050	STA	LDC		10DE6630
	TRA	**4		10DE6060	TSX	ADRES,4		10DE6640
	CLA	DECIM		10DE6070	TSX	STH,4		10DE6650
	STA	LOC		10DE6080	CAL	LOC		10DE6660
	TRA	**3		10DE6090	TSL	BCDOU		10DE6670
	CLA	FIXIN		10DE6100	AXT	0,4		10DE6680
	STA	LOC		10DE6110	CAL	F14,4		10DE6690
	TSX	ADRES,4		10DE6120	TSL	BCDOU		10DE6700
	TSX	STH,4		10DE6130	TXI	**1,4,-1		10DE6710
	AXT	0,4		10DE6140	TXH	**3,4,-11		10DE6720
	CAL	LOC		10DE6150	TSX	FIL,4		10DE6730
	TSL	BCDOU		10DE6160	TSL	CARD		10DE6740
	CAL	FT1,4		10DE6170	TRA	EXIT+1		10DE6750
	TSL	BCDOU		10DE6180	FT4 BCI	9, LOCATION. AN ILLEGAL BCD WORD ENCOUNTERED. EXECUTION		10DE6760
	TXI	**1,4,-1		10DE6190	BCI	2,TERMINATED		10DE6770
	TXH	**3,4,-14		10DE6200	ERROR3 CLA	DECIM	AN EXPONENT NOT IN THE LEGAL RANGE,	10DE6780
	TSX	FIL,4		10DE6210	STA	LOC		10DE6790
	TSL	CARD		10DE6220	TSX	ADRES,4		10DE6800
	TRA	EXIT+1		10DE6230	TSX	STH,4		10DE6810
LOC	BSS	1		10DE6240	CAL	LOC		10DE6820
FT1	BCI	9, LOCATION. AN ILLEGAL CHARACTER IS IN A NUMERIC DATA FIELD. EXECUTION TERMINATED		10DE6250	TSL	BCDOU		10DE6830
ERROR,	PZE	**	AN ILLEGAL INTEGER NUMBER,	10DE6260	AXT	0,4		10DE6840
	CLA	FIXIN		10DE6270	CAL	FT5,4		10DE6850
	STA	LOC		10DE6280	TSL	BCDOU		10DE6860
	TSX	ADRES,4		10DE6290	TXI	**1,4,-1		10DE6870
	TSX	STH,4		10DE6300	TXH	**3,4,-12		10DE6880
	CAL	LOC		10DE6310	TSX	FIL,4		10DE6890
	TSL	BCDOU		10DE6320	TSL	CARD		10DE6900
	AXT	0,4		10DE6330	TRA	EXIT+1		10DE6910
	CAL	FT2,4		10DE6340	FT5 BCI	9, LOCATION. AN EXPONENT NOT IN THE LEGAL RANGE. EXECUT		10DE6920
	TSL	BCDOU		10DE6350	BCI	3,ON TERMINATED		10DE6930
	TXI	**1,4,-1		10DE6360	BUFP1 BSS	150		10DE6940
				10DE6370	BUFP2 BSS	150		10DE6950

MSSG	BSS	1	10DE6960	MZE	S,SOU1	10DE7540
FAPSW	BSS	1	10DE6970	PZE	**1	10DE7550
	BSS	1	10DE6980	TSX	S,100P,4	10DE7560
ANSW1	BSS	2	10DE6990	IOSKP	**4	10DE7570
ANSW	BSS	1	10DE7000	MZE	S,SOU1	10DE7580
BUFF1	PZE	8UFF1,,150	10DE7010	PZE	**1	10DE7590
CCOUNT	BSS	1	10DE7020	TRA	**2	10DE7600
CTEST	OCT	007360402012	10DE7030	MZE	,-1	10DE7610
DIV	FDP	=10.0	10DE7040	TSX	S,XPRT,4	10DE7620
	ZAC		10DE7050	PZE	MSSG,,	10DE7630
	LLS	35	10DE7060	LDQ	ADDRP	10DE7640
	TXI	COMP,1,1	10DE7070	RQL	18	10DE7650
	DEC	1.0E-38,1.0E-37,1.0E-36,1.0E-35,1.0E-34,1.0E-33,1.0E-32	10DE7080	STQ	ADDRP	10DE7660
	DEC	1.0E-31,1.0E-30,1.0E-29,1.0E-28,1.0E-27,1.0E-26,1.0E-25	10DE7090	CLA	ADDRP	10DE7670
	DEC	1.0E-24,1.0E-23,1.0E-22,1.0E-21,1.0E-20,1.0E-19,1.0E-18	10DE7100	STA	OUTBU	10DE7680
	DEC	1.0E-17,1.0E-16,1.0E-15,1.0E-14,1.0E-13,1.0E-12,1.0E-11	10DE7110	TSX	S,100P,4	10DE7690
	DEC	1.0E-10	10DE7120	IOWDI	OUTBU	10DE7700
	DEC	1.0E-09,1.0E-08,1.0E-07,1.0E-06,1.0E-05,1.0E-04,1.0E-03	10DE7130	PZE	S,SOU1	10DE7710
	DEC	1.0E-02,1.0E-01	10DE7140	LDQ	ADDRP	10DE7720
EXPJN	DEC	1.0	10DE7150	RQL	18	10DE7730
	DEC	1.0E+01,1.0E+02,1.0E+03,1.0E+04,1.0E+05,1.0E+06,1.0E+07	10DE7160	STQ	ADDRP	10DE7740
	DEC	1.0E+08,1.0E+09,1.0E+10,1.0E+11,1.0E+12,1.0E+13,1.0E+14	10DE7170	CLA	ADDRP	10DE7750
	DEC	1.0E+15,1.0E+16,1.0E+17,1.0E+18,1.0E+19,1.0E+20,1.0E+21	10DE7180	STA	OUTBU	10DE7760
	DEC	1.0E+22,1.0E+23,1.0E+24,1.0E+25,1.0E+26,1.0E+27,1.0E+28	10DE7190	TRA	FIL+5	10DE7770
	DEC	1.0E+29,1.0E+30,1.0E+31,1.0E+32,1.0E+33,1.0E+34,1.0E+35	10DE7200	END		10DE7780
	DEC	1.0E+36,1.0E+37,1.0E+38	10DE7210			
MULT	LRS	35	10DE7220			
	FMP	=10.0	10DE7230			
	TXI	COMP,2,1	10DE7240			
OUTBU	PZE	OUTBU1,,23	10DE7250			
ADDRP	PZE	OUTBU1,,OUTBU2	10DE7260			
RCOUNT	BSS	1	10DE7270			
REST	TRA	**	10DE7280			
	AXT	20801,4	10DE7290			
	SXD	TESTR,4	10DE7300			
	TXI	**1,4,4992	10DE7310			
	SXD	SAC1,4	10DE7320			
	SXD	SAC2,4	10DE7330			
	TRA	REST	10DE7340			
SIGN	BSS	1	10DE7350			
SIGNE	BSS	1	10DE7360			
SIG	BSS	1	10DE7370			
ERRET	CLA	S,SSCH	10DE7380			
	ARS	19	10DE7390			
	LBT		10DE7400			
	TRA	**2	10DE7410			
	TRA	EOM	10DE7420			
	ARS	9	10DE7430			
	LBT		10DE7440			
	STO	1	10DE7450			
EOM	TSX	S,100P,4	10DE7460			
	IOSKP	**4	10DE7470			
	MZE	S,SOU1	10DE7480			
	PZE	**1	10DE7490			
	TRA	**2	10DE7500			
	MZE	1	10DE7510			
	TSX	S,100P,4	10DE7520			
	IOWEF		10DE7530			

SIBMAP	DEPOS	DECK	DEP00010	TSX	ROUTE,4	DEP00560
	ENTRY	DEPOS	DEP00020	IRP	PPZ	DEP00570
	ENTRY	PK	DEP00023	PZE	PPZ	DEP00580
	ENTRY	P	DEP00026	IRP		DEP00590
* THE	FOLLOWING IS THE ENTRY BACK TO THE MAIN ROUTINE, RSAC.		DEP00030	ENDM	CALLP	DEP00600
	EXTERN	DETIN	DEP00040			DEP00610
*.	THE FOLLOWING ARE ENTRY POINTS TO IODECK.		DEP00050	DEF	MACRO	DEP00620
	EXTERN	STH,BCDOU,FIXTR,DTRANP,NPC,SKP,DTRANS,FXPL,FXIN,BCB	DEP00060	IRP	LIST,SIZE	DEP00630
	EXTERN	INT,DFCIN,FIL	DEP00070	LIST	BSS	DEP00640
			DEP00080	IRP	SIZE	DEP00650
			DEP00090	ENDM	DEF	DEP00660
*.	THE FOLLOWING ARE SYSTEM ROUTINES USED IN RSAC.		DEP00100			DEP00670
	EXTERN	EXP,,EXP3,,SORT,EXIT,FEXE,	DEP00110	ZERO	MACRO	DEP00680
			DEP00120	AXT	ELOCK,SIZE,T	DEP00690
*.	THE FOLLOWING ARE ENTRY POINTS TO THE SUBROUTINE PACKAGE.		DEP00130	STZ	SIZE,T	DEP00700
	EXTERN	DEC,EFE,EFEE,KCAL,GCAL,DSCL6,GOFX,LAK,LXK	DEP00140	TIX	BLOCK+1,T	DEP00710
	EXTERN	EXXP,EXPP,OMEXP,EXPM,GEYP,EPX	DEP00150	ENDM	++1,T,1	DEP00720
	EXTERN	X3RA,XBR1,EPX1,HEXPT	DEP00153		ZERO	DEP00730
	EXTERN	ETXU,ETXU1	DEP00156	WRITE	MACRO	DEP00740
	EXTERN	HAK,HXK	DEP00160	AXT	FMT,COUNT	DEP00750
			DEP00170	CAL	0,4	DEP00760
*.	FOLLOWING IS A SMALL SET OF MACRO INSTRUCTIONS DEFINED FOR RSAC		DEP00180	TSL	BCDOU	DEP00770
SPACE	MACRO	SPACE ONE LINE ON OUTPUT TAPE	DEP00190	TXI	++1,4,-1	DEP00780
	TSX	STH,4	DEP00200	TXM	++3,4,-COUNT	DEP00790
	TSX	FIL,4	DEP00210	ENDM	WRITE	DEP00800
	ENDM	SPACE	DEP00220	SCRIBE	MACRO	DEP00810
SUM	MACRO	BLOCK,SIZE,T	DEP00230	SKA	FMT,COUNT,OP	DEP00820
	AXT	SIZE,T	DEP00240	TSX	++9,4	DEP00830
	ZAC		DEP00250	TSL	OP	DEP00840
	FAD	BLOCK,T	DEP00260	WRITE	FMT,COUNT	DEP00850
	TIX	++1,T,1	DEP00270	TSX	FIL,4	DEP00860
	ENDM	SUM	DEP00280	AXT	++4	DEP00870
			DEP00290	ENDM	SCRIBE	DEP00880
*.	SUM MUST BE STORED BY A STO INSTRUCTION		DEP00300			DEP00890
			DEP00310	END OF	MACRO PACKAGE, BEGINNING OF CODING	DEP00900
SUMI	MACRO	BLOCK,SIZE,T	DEP00320	DEPOS	AXT	DEP00910
	LXD	SIZE,T	DEP00330	SCRIBE	0,1	DEP00920
	ZAC		DEP00340	READ	FMT13,6,NPG	DEP00930
	ADD	BLOCK+1,T	DEP00350	READ	DECIM,(TDEPOS,T),3	DEP00940
	TIX	++1,T,1	DEP00360	LXA	NREG,4	DEP00950
	ENDM	SUMI	DEP00370	NONE	READ	DEP00960
			DEP00380	TIX	DECIM,(HAKP+1,HXKP+1),4	DEP00970
READ	MACRO	IN,STORE,T	DEP00390	TSX	NONE,4,1	DEP00980
	IRP	STORE	DEP00400	TSL	STH,4	DEP00990
	TSL	IN	DEP00410	WRITE	SKP	DEP01000
	STO	STORE,T	DEP00420	CLA	FMT18,4	DEP01010
	IRP		DEP00430	TSL	T	DEP01020
	ENDM	READ	DEP00440	WRITE	DTRANP	DEP01030
			DEP00450	CLA	FMT17,4	DEP01040
READI	MACRO	DATA,T	DEP00460	TSL	TDEPOS	DEP01050
	IRP	DATA	DEP00470	TSX	DTRANP	DEP01060
	TSL	FIXIN	DEP00480	TSX	FIL,4	DEP01070
	LLS	12	DEP00490	SUMI	NNM,MTOT,4	DEP01080
	STO	DATA,T	DEP00500	LRS	18	DEP01090
	IRP		DEP00510	STO	CHLY	DEP01100
	ENDM	READI	DEP00520	DIELP	CLA	DEP01110
*CALLP	IS TO SIMULATE THE FORTRAN II CALLING SEQUENCE		DEP00530	STO	DI1.1	DEP01120
			DEP00540	TSL	TWISD	DEP01130
CALLP	MACRO	ROUTE,PPZ	DEP00550	SLW	FMT14+6	DEP01140
				STQ	FMT14+7	

PPZ IS THE ARGUMENT LIST

DEFINE A GROUP OF VARIABLES WHICH HAVE THE SAME BLOCK SIZE WITH ONE COMMAND

ZERO A BLOCK OF CORE

WRITE SOME OUTPUT,

READ HERMITE VALUES.

DOWNWIND DISTANCE

CLA	CY,1		DEPO1150	CLA	XK*1,1		DEPO1810
STO	TCY		DEPO1160	STO	THISX		DEPO1820
CLA	CZ,1		DEPO1170	CLA	NUI		DEPO1830
STO	TCZ		DEPO1180	TMI	**2		DEPO1840
PXA	,1		DEPO1190	TSL	H20	USE 20 POINT HERMITE AT X=D	DEPO1850
ADD	=1		DEPO1200	LOOP5 CLA	ELB*1,2		DEPO1860
TSL	FIXTR		DEPO1210	STO	THISE		DEPO1870
STO	FMT14,4		DEPO1220	CLA	THISX		DEPO1880
SCRIBE	FMT14,8,SKP		DEPO1230	TSX	DCAL,4	CALCULATE INTEGRAL OVER Y	DEPO1890
ZERO	DOSE,20,4		DEPO1240	STO	TEMP		DEPO1900
SXA	DIERT,1		DEPO1250	LDO	TEMP		DEPO1910
LDO	W2		DEPO1260	FMP	LAK*1,1		DEPO1920
CLA	THISD		DEPO1270	STO	TEMP		DEPO1930
TSL	,EXP3.		DEPO1280	LDO	TEMP		DEPO1940
LRS	35		DEPO1290	FMP	XMAX		DEPO1950
FMP	TCY		DEPO1300	FAD	DOSE*1,2		DEPO1960
LRS	35		DEPO1310	STO	DOSE*1,2		DEPO1970
FMP	TCY		DEPO1320	TMI	**1,2,1		DEPO1980
STO	Y		DEPO1330	RLOOP5 TXL	LOOP5,2,**	USE HERMITE NUMBERS READ IN	DEPO1990
CAS	=7.0E+5	USE HERMITE CHECK Y	DEPO1340	CLA	TOTAL1		DEPO2000
TRA	XDEPOS	NO	DEPO1350	TMI	RECOV		DEPO2010
TRA	XDEPOS	NO	DEPO1360	TIX	LOOP4,1,1		DEPO2020
CLA	=22.273313	YES (4*(PIE**(1.5)))	DEPO1370	KLOOP1 AXT	**2		DEPO2030
STO	XMIN		DEPO1380	TIX	KLOOP,2,1		DEPO2040
CLA	LR		DEPO1390	CLA	CHI		DEPO2050
STO	RLOOP5		DEPO1400	TPL	**12		DEPO2060
MSP	CHI		DEPO1410	CLA	=1000.0		DEPO2070
CLA	=1000.0		DEPO1420	FSB	THISD		DEPO2080
CAS	THISD	CHECK SIZE OF DIF, IF LESS THAN 1000	DEPO1430	FDP	=2.0		DEPO2090
TRA	MAIN	LIMITS ARE 0.0 TO 2*0, IF GREATER	DEPO1440	STO	XMAX		DEPO2100
TRA	**1	OR EQUAL LIMITS ARE 0-1000 TO 0-1000	DEPO1450	ZAC			DEPO2110
STO	XMAX		DEPO1460	LLS	35		DEPO2120
CLA	THISD		DEPO1470	FAD	THISD		DEPO2130
STO	XMAXP		DEPO1480	FAD	THISD		DEPO2140
TRA	**5		DEPO1490	STO	XMAXP		DEPO2150
MAIN	CLA	THISD	DEPO1500	MSP	CHI		DEPO2160
STO	XMAX		DEPO1510	TRA	XLOOP-1		DEPO2170
STO	XMAXP	SET SWITCH TO ADD INTEGRAL FROM	DEPO1520	DIERT AXT	**1		DEPO2180
MSH	CHI	2*0 TO 0-1000,	DEPO1530	SCRIBE	FMT16,5,SKP		DEPO2190
AXT	15,4	START INTEGRATION OVER X	DEPO1540	LXD	LR,2		DEPO2200
XLOOP	LDO		DEPO1550	TSX	STH,4		DEPO2210
FMP	XMAX		DEPO1560	CLA	ELB*1,2		DEPO2220
FAD	XMAXP		DEPO1570	TSL	DTRANP		DEPO2230
STO	XK*1,4		DEPO1580	CLA	DOSE*1,2		DEPO2240
FDP	URAR		DEPO1590	TSL	DTRANP		DEPO2250
STO	TIME*1,4		DEPO1600	TSX	FIL,4		DEPO2260
TIX	XLOOP,4,1		DEPO1610	TIX	**6,2,1		DEPO2270
STZ	TIME-15		DEPO1620	TMI	**1,1,1		DEPO2280
KLOOP	LXD		DEPO1630	PXA	,1		DEPO2290
CLA	K1,2		DEPO1640	ADD	=01		DEPO2300
STO	AK1		DEPO1650	CAS	IE	IS THIS THE LAST DOWNWIND DISTANCE	DEPO2310
CLA	K2,2		DEPO1660	TRA	DETIN		DEPO2320
STO	AK2		DEPO1670	TRA	DETIN		DEPO2330
MSP	VUI		DEPO1680	TRA	DIELP	NO, GET ANOTHER ONE	DEPO2340
SXA	XLOOP1,2		DEPO1690				DEPO2350
ZERO	FPIC,10000,4		DEPO1700				DEPO2360
CALLP	EXPX,FPIC	CALCULATE DISINTEGRATIONS,	DEPO1750				DEPO2370
QUIT1	AXT		DEPO1790	DCAL	STO	X	DEPO2560
LOCP4	AXT		DEPO1800	SXA	PART,1		DEPO2570

SXA	DCXR,1	DEP02580	TRA*	H20	DEP03190
SXA	DCXR+1,2	DEP02590	PZE	HXX+1	DEP03200
SXA	DCXR+2,4	DEP02600	PZE	HAK+1	DEP03210
CLA	W3	DEP02610	RECOV MSP	TOTAL1	DEP03220
FDP	=2,0	DEP02620	MSH	NUI	DEP03230
CLA	X	DEP02630	CLA	Z	DEP03240
TSL	,EXP3,	DEP02640	STO	NREG	DEP03250
STO	MTOT+13	DEP02650	CLA	++5	DEP03260
LDO	TCZ	DEP02660	STA	UMES+1	DEP03270
FMP	MTOT+13	DEP02670	CLA	++4	DEP03280
STO	MTOT+13	DEP02680	STA	UMES+8	DEP03290
CLS	SH	DEP02690	TRA	KLOOP1-1	DEP03300
FDP	MTOT+13	DEP02700	PZE	HXXP+1	DEP03310
STO	VE	DEP02710	PZE	HAKP+1	DEP03320
STZ	SUM-6	DEP02720	*		DEP03322
LXD	NEG,1	DEP02730	*		DEP03324
CLA	ENE,1	DEP02740	*		DEP03326
STO	TENE	DEP02750	*		DEP03328
CLA	NU,1	DEP02760	XDEPOS CLA	LB	DEP03330
STO	TNU	DEP02770	STD	HGAMM	DEP03340
CLA	MU,1	DEP02780	LDO	=22.273313	DEP03350
STO	TNU	DEP02790	FMP	TCY	DEP03360
ZERO	SUM,4,4	DEP02800	STO	XMIN	DEP03370
STZ	FRACT	DEP02810	CLA	=1000,0	DEP03380
CLA	TENE	DEP02820	STO	XMAX	DEP03390
TZE	ENDF	DEP02830	CLA	TIME,1	DEP03400
UMES	NREG,2	DEP02840	STO	XMAXP	DEP03410
CLA	HXXP+1,2	DEP02850	AXT	15,4	DEP03420
STO	U	DEP02860	XXLOP LDO	LXX+1,4	DEP03430
CALLP	GCAL(X,U,=0,0)	DEP02870	FMP	XMAX	DEP03440
LDO	G	DEP02880	FAD	XMAXP	DEP03450
FMP	HAKP+1,2	DEP02890	STO	XX+1,4	DEP03460
FAD	FRACT	DEP02900	FDP	LRAR	DEP03470
STO	FRACT	DEP02910	STO	TIME+1,4	DEP03480
TIX	UMES+1,2,1	DEP02920	TIX	XXLOP,4,1	DEP03490
STZ	TEMP3	DEP02930	STZ	TIME-15	DEP03500
TSX	GOFX,4	DEP02945	LXD	NK1,2	DEP03510
AXT	4,4	DEP02950	KXLOP CLA	K1,2	DEP03520
LDO	SUM1+1,4	DEP02960	STO	AK1	DEP03530
FMP	FRACT	DEP02970	CLA	K2,2	DEP03540
FAD	SUM-6	DEP02980	STO	AK2	DEP03550
STO	SUM-6	DEP03000	SXA	KXLOP1,2	DEP03560
TIX	++4,4,1	DEP03010	ZERO	FPIC,10000,4	DEP03570
ENDC	TIX	DEP03020	CALLP	EXPX,FPIC	DEP03580
CLA	SUM-6	DEP03030	AXT	15,1	DEP03590
DCXR	AXT	DEP03040	XXLOP4 AXT	1,2	DEP03600
AXT	++1	DEP03050	CLA	XX+1,1	DEP03610
AXT	++2	DEP03060	STO	THISX	DEP03620
AXT	++4	DEP03070	STO	ELB+1,2	DEP03630
TRA	1,4	DEP03080	RGAMX CLA	THISE	DEP03640
H20	PZE	DEP03090	STO	THISE	DEP03650
CLA	NREG	DEP03100	CLA	THISX	DEP03660
STO	Z	DEP03110	TSX	DCALX,4	DEP03670
CLA	=024	DEP03120	STO	TEMP	DEP03680
STA	NREG	DEP03130	LDO	TEMP	DEP03690
MSH	TOTAL1	DEP03140	FMP	LAK+1,1	DEP03700
CLA	++5	DEP03150	STO	TEMP	DEP03710
STA	UMES+1	DEP03160	LDO	TEMP	DEP03720
CLA	++4	DEP03170	FMP	KMAX	DEP03730
STA	UMES+8	DEP03180	FAD	DOSE+1,2	DEP03740
					DEP03750
					DEP03760
					DEP03770
					DEP03780
					DEP03790
					DEP03800

PICK UP WHICH ENERGY GROUP

START INTEGRATION OVER Y.

PICK UP NUMBER OF DISINTEGRATIONS.

THE ALTERNATE METHOD FOR INTEGRATION OVER Y IS USED IF THIS ROUTE IS TAKEN

START INTEGRATION OVER X

CALCULATE DISINTEGRATIONS

CALCULATE INTEGRAL OVER Y

```

      STO      DOSE+1,1
      TXI      **1,2,1
      RGA4M TXL      RGAMX,2,**
      TIX      XLOP4,1,1
      KXLOP1 AXT      **,2
      TIX      KXLOP,2,1
      TRA      DIERT

```

```

*
* THE FOLLOWING SUBROUTINE CALCULATES THE INTEGRAL OVER Y
*

```

```

DCALX STO      X
      SXA      PART,1
      SXA      DINX,1
      SXA      DINX+1,2
      SXA      DINX+2,-
      CLA      W3
      FDP      =2.0
      CLA      X
      TSL      ,EXP3,
      STO      MTOT+13
      LDO      TCZ
      FMP      MTOT+13
      STO      MTOT+13
      CLS      SW
      FDP      MTOT+13
      STO      VE
      STZ      SUM-6
      LXD      NEG,1
      FLOP CLA      ENE,1
      STO      TENE
      CLA      NU,1
      STO      TNU
      CLA      NU,1
      STO      TNU
      ZERO     SUM,4,4
      STZ      FRACT
      CLA      TENF
      TZE      EXND
      VLG15 AXT      15,4
      LDO      LXX+1,4
      FMP      =1000.0
      STO      V
      CLA      W2
      FDP      =2.0
      CLA      X
      TSL      ,EXP3,
      STO      TEMP2
      SXA      **4,4
      CALLP    GCAL1(X,V)
      AXT      **,4
      LDO      G
      FMP      LAK+1,4
      FDP      TEMP2
      FMP      =1000.0
      FAD      FRACT
      STO      FRACT
      TIX      VLG15+1,4,1
      STZ      TEMP3
      TSX      GDFX,4

```

CALCULATE INTEGRAL OVER Y

```

DEPO3810 AXT      4,4
DEPO3820 LDO      SUM1+1,4
DEPO3830 FMP      FRACT
DEPO3840 FAD      SUM-6
DEPO3850 STO      SUM-6
DEPO3860 TIX      **4,4,1
DEPO3870 EXND TIX      FLOP,1,1
DEPO3873 CLA      SUM-6
DEPO3876 DINX AXT      **,1
DEPO3879 AXT      **,2
DEPO3880 AXT      **,4
DEPO3890 STZ      TEMP4
DEPO3900 CLS      THISE
DEPO3910 TZE      **4
DEPO3920 Y
DEPO3930 FMP      THISE
DEPO3940 STO      TEMP4
DEPO3950 CALL      EXP(TEMP4)
DEPO3960 LRS      35
DEPO3970 FMP      SUM-6
DEPO3980 TRA      1,4
DEPO3990 GCAL1 LDO+ 2,4
DEPO4000 FMP+ 2,4
DEPO4010 STO      MTOT+21
DEPO4020 CLA+ 1,4
DEPO4030 FSB      THISO
DEPO4040 STO      MTOT+22
DEPO4050 LDO      MTOT+22
DEPO4060 FMP      MTOT+22
DEPO4070 FAD      MTOT+21
DEPO4080 STO      MTOT+22
DEPO4090 CALL      SORT(MTOT+22)*GCAL1#
DEPO4100 STO      R
DEPO4110 CAS      =1.0
DEPO4120 TRA      GR
DEPO4130 CLA      TNU
DEPO4140 STO      G
DEPO4150 TRA      3,4
DEPO4160 GR      LDO      R
DEPO4170 FMP      TNU
DEPO4180 STO      MUR
DEPO4190 FAD      =1.0
DEPO4200 STO      MTOT+25
DEPO4210 CLA      TENE
DEPO4220 LDO      =2.4
DEPO4230 TSL      ,EXP3,
DEPO4240 STO      MTOT+26
DEPO4250 CLA      MUR
DEPO4260 FDP      =7.0
DEPO4270 FMP      MUR
DEPO4280 FDP      MTOT+26
DEPO4290 STO      MTOT+26
DEPO4300 CLA      MTOT+25
DEPO4310 FAD      MTOT+26
DEPO4320 FDP      R
DEPO4330 FMP      TNU
DEPO4340 FDP      R
DEPO4350 STO      MTOT+25
DEPO4370 MSM      MUR

```

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DEPO4380
DEPO4390
DEPO4420
DEPO4430
DEPO4440
DEPO4450
DEPO4460
DEPO4470
DEPO4480
DEPO4490
DEPO4500
DEPO4510
DEPO4520
DEPO4530
DEPO4540
DEPO4550
DEPO4560
DEPO4570
DEPO4580
DEPO4590
DEPO4600
DEPO4610
DEPO4620
DEPO4630
DEPO4640
DEPO4650
DEPO4660
DEPO4670
DEPO4680
DEPO4690
DEPO4700
DEPO4710
DEPO4720
DEPO4730
DEPO4740
DEPO4750
DEPO4760
DEPO4770
DEPO4780
DEPO4790
DEPO4800
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DEPO4830
DEPO4840
DEPO4850
DEPO4860
DEPO4870
DEPO4880
DEPO4890
DEPO4900
DEPO4910
DEPO4920
DEPO4930
DEPO4940
DEPO4950
DEPO4960
DEPO4970
DEPO4980

```

CALL EXP(MUR)
STO MTOT+26
LDQ MTOT+26
FMP MTOT+25
STO G
TRA 3,4

THIS SUBROUTINE CALCULATES THE TOTAL NUMBER OF DISINTEGRATIONS
THAT HAS TAKEN PLACE FOR EACH ISOTOPE UNDER CONSIDERATION.

EXPK CLA 1,4
ORA *0200000
STO STORE1
SXA TSP,4
AXT 0,4
CLA TIME,4
TZE **5
CLA STORE1,4
SUB CHIV
STO STORE1-1,4
TXI **5,4,1
AXT 0,3
START CLA NNM,1
STD RES1
STO KAY
SXA XRE1,1
SXA XRE2,2
SXA XRA2,2
CLA *01000000
STO PK
MSP XBRA
ALLINT CALLP DEC(FPI,TIME,EP,FPIC-5000)
AXT 0,4
XRE2 AXT **,2
PXD ,2
ADD PK
STO PK1
SPC CLA* STORE,4
STZ* STORE,4
STO MTOT+39
TXI **1,2,1
PXD ,2
CAS PK1
TRA **7
TRA **6
CLA* STORE,4
FAD MTOT+39
STZ* STORE,4
STO MTOT+39
TRA SPC+3
LXD PK1,2
TXI **1,2,-1
CLA MTOT+39
FAD* STORE1,4
STO* STORE1,4
CLA TIME,4
TZE XPX
XRA2 AXT **,2
TXI SPC,4,1

DEP04990 XPX CLA PK
DEP05000 MSP XBRA
DEP05010 CAS KAY
DEP05020 TRA XRE1+2
DEP05030 TRA XRE1+2
DEP05040 ADD *01000000
DEP05050 STO PK
DEP05060 LXA XRE2,2
DEP05070 XRE1 AXT **,1
DEP05080 TRA ALLINT
DEP05090 LXA XRE1,1
DEP05100 LXA XRE2,2
DEP05110 RES1 TXI **1,2,**
DEP05120 TXI **1,1,1
DEP05130 PXD ,1
DEP05140 CAS MTOT
DEP05150 TRA **3
DEP05160 TRA **2
DEP05170 TRA START
DEP05180 CLA AK2
DEP05190 TNZ QUIT10
DEP05200 AXT 0,3
DEP05210 AXL CLA NNM,1
DEP05220 CALLP DEC.(FPI,TIME,E"XU,FPIC)
DEP05230 PXD ,1
DEP05240 CAS MTOT
DEP05250 TRA QUIT10
DEP05260 TRA QUIT10
DEP05270 TRA AXL
DEP05280 QUIT10 STZ XK1-3
DEP05290 AXT 0,4
DEP05300 CLA TIME,4
DEP05310 TZE ENDY
DEP05320 STO XK1-2
DEP05330 XPX2 LXA CHIV,2
DEP05340 TXI **1,2,-1
DEP05350 CLA* STORE1,4
DEP05360 STZ* STORE1,4
DEP05370 STO ATOM,2
DEP05380 TIX **3,2,1
DEP05390 TXI **1,2,-1
DEP05400 CLA* STORE1,4
DEP05410 STZ* STORE1,4
DEP05420 STO ATOM,2
DEP05430 SXA XRE4,4
DEP05440 AXT 0,3
DEP05450 ALL1 CLA VNM,1
DEP05460 CALLP DEC.(ATOM,XK1-2,MEXPT,FPIC)
DEP05470 ALL2 PXD ,1
DEP05480 CAS MTOT
DEP05490 TRA **3
DEP05500 TRA **2
DEP05510 TRA ALL1
DEP05520 CLA ALL2-1
DEP05530 SUB CHIV
DEP05540 STO ALL2-1
DEP05550 XRE4 AXT **,4
DEP05560 TXI XPX2-3,4,1
DEP05570 ENDY AXT 0,3

DEP05580
DEP05590
DEP05600
DEP05610
DEP05620
DEP05630
DEP05640
DEP05650
DEP05660
DEP05670
DEP05680
DEP05690
DEP05700
DEP05710
DEP05720
DEP05730
DEP05740
DEP05750
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DEP05990
DEP06000
DEP06010
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DEP06100
DEP06110
DEP06120
DEP06130
DEP06140
DEP06150
DEP06160

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SSTART CLA      NNH,1
STD      RES10
STO      KAY
SXA      XRE10,1
SXA      XRE20,2
SXA      XRA20,2
CLA      *01000000
STO      PK
MSP      XRR1
ALL0 CALLP DEC.(FPI,TIME,EPX1,FPIC=5000)
AXT      0,4
XRE20 AXT      **,2
PKD      ,2
ADD      PK
STO      PK1
SPC1 CLA*      STORE,4
STZ*      STORE,4
STO      MTOT+39
TXI      **1,2,1
PKD      ,2
CAS      PK1
TRA      **7
TRA      **6
CLA*      STORE,4
FAD      MTOT+39
STZ*      STORE,4
STO      MTOT+39
TRA      SPC1+3
LXD      PK1,2
TXI      **1,2,-1
CLA      MTOT+39
FAD*      STORE1,4
STO*      STORE1,4
CLA      TIME,4
TZE      XPX10
XRA20 AXT      **,2
TXI      SPC1,4,1
CPX10 CLA      PK
MSP      XBR1
CAS      KAY
TRA      XRE10+2
TRA      XRE10+2
ADD      *01000000
STO      PK
LXA      XRE20,2
XRE10 AXT      **,1
TRA      ALL0
LXA      XRE10,1
LXA      XRE20,2
RES10 TXI      **1,2,**
TXI      **1,1,1
PKD      ,1
CAS      MTOT
TRA      **3
TRA      **2
TRA      SSTART
CLA      AK2
TNZ      AXX1+1
AXT      0,3

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DEP06170 AXX CLA      NNH,1
DEP06180 CALLP DEC.(FPI,TIME,ETXU1,FPIC)
DEP06190 PKD      ,1
DEP06200 CAS      MTOT
DEP06210 TRA      TSXP
DEP06220 TRA      TSXP
DEP06230 AXX1 TRA      AXX
DEP06240 LXA      TSXP,4
DEP06250 CLA      1,4
DEP06260 STA      ALL2-1
DEP06270 ORA      *0200000
DEP06280 STO      STORE
DEP06290 AXT      0,4
DEP06300 CLA      TIME,4
DEP06310 TZE      **5
DEP06320 CLA      STORE,4
DEP06330 SUB      CHY
DEP06340 STO      STORE-1,4
DEP06350 TXI      *-5,4,1
DEP06360 TSXP AXT      **,4
DEP06370 TRA      2,4
DEP06380 FMT13 BCI 6,DEPOSITION GAMMA DOSE CALCULATION
DEP06390 FMT14 BCI 8,DOWNWIND DISTANCE NO,
DEP06400 FMT16 BCI 5,CROSSWIND DISTANCE DOSE
DEP06410 FMT17 BCI 4, THE DEPOSITION TIME =
DEP06420 FMT18 BCI 4, THE EXPOSURE TIME =
DEP06430 P      BSS
DEP06440 DEF      (KAY,PK),1
DEP06450 PK1 BSS 20
DEP06460 STORE1 BSS 1
DEP06470 CONTRL //
DEP06480 USE      //
DEP06490 DEF      MTOT,40
DEP06500 DEF      FRACT,1
DEP06510 DEF      (ADD,AK1,AK2,AMBDA,ANSW,BREATH,CHI,CHIY,CNTRL,CONV),1
DEP06520 DEF      (D,NET,DOTOT,EXTRM,EXX,FISS,G,H,IE,K,LB,LONG,LT,M,MUR),1
DEP06530 DEF      (NCH,NEG,NK1,NREG,NUI,ORGAN,PART,POWER,R,SAVE4,SH,T),1
DEP06540 DEF      (TCY,TCZ,TDEPOS,TEMP,TEMP0,TEMP1,TEMP2,TEMP3,TEMP4),1
DEP06550 DEF      (TENE,THISD,THISE,THISX,TIM,TINMA,TMU,TNU,TOTAL,TOTAL1),1
DEP06560 DEF      (U,UBAR,V,VE,W1,W2,W3,X,XMAX,XMAXP,XMIN,XMINP,XR4,Y,Z),1
DEP06570 DEF      (ZE,TROP,TTROP),3
DEP06580 DEF      (XK1,A1,KX,VG),4
DEP06590 DEF      (SUM1,K1,K2,MU,NU),11
DEP06600 DEF      (ENF,XK,HXKP,MAKP,DOSE,ELR,CZ,CY,STORE,TIME,DIE),25
DEP06610 DEF      (SUM,LONGR,CHN,NNH),100
DEP06620 DEF      (MM,BODY,BONE,G1,KIDNEY,LIVER,LUNG,MUSCLE,TESTES),450
DEP06630 DEF      (THYROID,YIELD,NPROTH,LONGH,JGASH,MALM,ELEMM,GOMPY),450
DEP06640 DEF      (ATOM,GAMEN),450
DEP06650 DEF      FPI,10000
DEP06660 DEF      FPIC,1
DEP06670 USE
DEP06680 END
DEP06690
DEP06700
DEP06710
DEP06730
DEP06740
DEP06750
DEP06760

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DEP06770
DEP06780
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DEP06800
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DEP05300
DEP05310

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SIBMAP	SUBR	DECK		SUBR0020	IRP		SUBR0470
	EXTERN	EXP,EXP3,,SORT,EXIT,FEXEM,		SUBR0030	ENDM	READI	SUBR0480
	EXTERN	PK		SUBR0034			SUBR0483
	EXTERN	P		SUBR0038		CALLP IS TO SIMULATE THE FORTRAN II CALLING SEQUENCE	SUBR0486
				SUBR0040			SUBR0489
		THE FOLLOWING ARE ENTRY POINTS TO IODECK,		SUBR0050	CALLP	MACRO ROUTE,PPZ	SUBR0490
	EXTERN	STM,BCDOU,FIXT3,DTRANP,NPG,SKP,DTRANS,FIPL,FIIM,BCD		SUBR0060	TSX	ROUTE,4	SUBR0500
	EXTERN	INT,DECIM,FIL		SUBR0070	IRP	PPZ	SUBR0510
				SUBR0080	PZE	PPZ	SUBR0520
	ENTRY	DEC		SUBR0090	IRP		SUBR0530
	ENTRY	EFE		SUBR0100	ENDM	CALLP	SUBR0540
	ENTRY	EFE		SUBR0110			SUBR0545
	ENTRY	KCAL		SUBR0120	SUM	MACRO BLOCK,SIZE,T	SUBR0550
	ENTRY	GCAL		SUBR0130	AXT	SIZE,T	SUBR0560
	ENTRY	DSCL6		SUBR0140	ZAC		SUBR0570
	ENTRY	GOFX		SUBR0150	FAD	BLOCK,T	SUBR0580
	ENTRY	LAK		SUBR0160	TIX	**1,T,1	SUBR0590
	ENTRY	LXK		SUBR0170	ENDM	SUM	SUBR0600
	ENTRY	EXXP		SUBR0180			SUBR0603
	ENTRY	EXPP		SUBR0190		SUM MUST BE STORED BY A STO INSTRUCTION	SUBR0606
	ENTRY	OMEXP		SUBR0200			SUBR0609
	ENTRY	EXPM		SUBR0210	ZERO	MACRO BLOCK,SIZE,T	SUBR0610
	ENTRY	GEXP		SUBR0220	AXT	SIZE,T	SUBR0620
	ENTRY	EPX		SUBR0230	STZ	BLOCK*1,T	SUBR0630
	ENTRY	EPX1		SUBR0231	TIX	**1,T,1	SUBR0640
	ENTRY	MEPT		SUBR0232	ENDM	ZERO	SUBR0650
	ENTRY	XBRA		SUBR0233			SUBR0655
	ENTRY	XBRA1		SUBR0234	SUM1	MACRO BLOCK,SIZE,T	SUBR0660
	ENTRY	ETXU		SUBR0235	LXD	SIZE,T	SUBR0670
	ENTRY	ETXU1		SUBR0236	ZAC		SUBR0680
				SUBR0237	ADD	BLOCK*1,T	SUBR0690
		FOLLOWING IS A SMALL SET OF MACRO INSTRUCTIONS DEFINED FOR FSAC.		SUBR0238	TIX	**1,T,1	SUBR0700
				SUBR0239	ENDM	SUM1	SUBR0710
	WRITE	MACRO FHT,COUNT		SUBR0240			SUBR0711
		AXT 0,4		SUBR0250		THE FOLLOWING SUBROUTINE CALCULATES THE VALUES OF THE E LINEAR	SUBR0712
		CAL FHT,4		SUBR0260		OPERATOR FOR AN ENTIRE CHAIN. IT HAS THE FOLLOWING CALLING	SUBR0713
		TSL BCDOU		SUBR0270		SEQUENCE. SET ACCUMULATOR EQUAL TO NUMBER ISOTOPES IN CHAIN,	SUBR0714
		TXI **1,4,-1		SUBR0280	TSX	DEC,4	SUBR0715
		TXM **3,4,-COUNT		SUBR0290	PZE	FPI	SUBR0716
		ENDM WRITE		SUBR0300	PZE	TIME	SUBR0717
				SUBR0305	PZE	EXP	SUBR0718
	DEF	MACRO LIST,SIZE	DEFINE A GROUP OF VARIABLES WHICH	SUBR0310	PZE	FPIC	SUBR0719
	IRP	LIST	HAVE THE SAME BLOCK SIZE WITH ONE	SUBR0320	DEC	STD	SUBR0720
	LIST	BSS SIZE	COMMAND	SUBR0330		STZ	SUBR0730
	IRP			SUBR0340		STD	SUBR0740
	ENDM	DEF		SUBR0350		SXA	SUBR0750
				SUBR0355		SXA	SUBR0760
	READ	MACRO IN,STORE,T	STORE MAY BE A LIST ENCLOSED IN	SUBR0360		SXA	SUBR0770
	IRP	STORE	PARENTHESES. READ WILL READ THE	SUBR0370		CLA	SUBR0780
	TSL	IN	ENTIRE LIST THROUGH *IN*	SUBR0380		STA	SUBR0790
	STO	STORE,T		SUBR0390		CLA	SUBR0800
	IRP			SUBR0400		STA	SUBR0810
	ENDM	READ		SUBR0410		STA	SUBR0820
				SUBR0415		STA	SUBR0830
	READI	MACRO DATA,T	SPECIAL TREATMENT FOR INTEGERS	SUBR0420		CLA	SUBR0840
	IRP	DATA	DATA MAY BE A LIST IN PARENTHESES	SUBR0430		STA	SUBR0850
	TSL	FIXIN		SUBR0440		CLA	SUBR0860
	LLS	18	PUT INTEGER IN DECREMENT PORTION	SUBR0450		STA	SUBR0870
	STO	DATA,T		SUBR0460		CLA	SUBR0880

ORA	#0200000		SUBR0890	STO	M	A(M)=N(FIRST ISOTOPE OF CHAIN)	SUBR1430
STO	STORE		SURR0900	PXA	,2		SURR1440
SUMI	NNM,MTOT,4		SURR0910	STO	TEMP1	(K-1 ISOTOPE OF CHAIN)	SURR1450
LGR	18		SURR0920	LOOP1 LXA	M,2		SURR1460
STO	T:M		SURR0930	SOURCE CLA	*,2	N(K)	SURR1470
AXT	0,4		SURR0940	STO	MTOT+1		SURR1480
TIME	CLA	*,4	SURR0950	CLA	=1.0		SURR1490
	TZE	*,5	SURR0960	STO	MTOT+2		SURR1500
	CLA	STORE,4	SURR0970	PXA	,2		SURR1510
	SUB	T:M	SURR0980	CAS	TEMP1		SURR1520
	STO	STORE-1,4	SURR0990	TRA	*,6		SURR1530
	TXI	TIME,4,1	SURR1000	TRA	*,5		SURR1540
	AXT	0,1	SURR1010	LDO	LONGM,2		SURR1550
	TIME	CLA	SURR1020	FMP	MTOT+1		SURR1560
		ANSW	SURR1030	STO	MTOT+1		SURR1570
	STZ	P	SURR1035	TXI	*,7,2,1		SURR1580
TLOOP	LXD	LT,4	SURR1040	STZ	MTOT+19		SURR1590
	LXA	ODEC+1,2	SURR1050	LXA	M,2	I=M (XR2=)	SURR1600
ILOOP	PXA	,2	SURR1060	LDO	LONGM,2		SURR1610
	STO	K	SURR1070	FMP	ANSW	ACC=LONGM(I)*(X/U)	SURR1620
	PXD	,4	SURR1080	CMS			SURR1630
	SUB	LT	SURR1090	LDO	ANSW		SURR1640
	SSP		SURR1100	TSX	*,4		SURR1650
	ADD	K	SURR1110	STO	EXTRM		SURR1660
	STO	K	SURR1120	CLA	=1.0		SURR1670
	SXA	DE,1	SURR1130	STO	D		SURR1680
	SXA	DE+1,2	SURR1140	LXA	M,1	J	SURR1690
	SXA	DE+2,4	SURR1150	CLA	LONGM,2	.I	SURR1700
	CLA	P	SURR1153	STO	TEMP	= LONGM(I)	SURR1710
	ADD	#01000000	SURR1156	LXA	K,4		SURR1720
	STO	P	SURR1159	PXA	,4		SURR1730
	TSL	EEE	SURR1160	STO	TEMP2	= K	SURR1740
DE	AXT	*,1	SURR1170	LOOP3 CLA	LONGM,1	LONGM(J)	SURR1750
	AXT	*,2	SURR1180	FSB	TEMP		SURR1760
	AXT	*,4	SURR1190	TZE	*,4		SURR1770
	FAD*	STORE,1	SURR1200	LRS	35		SURR1780
	STO*	STORE,1	SURR1210	FMP	D		SURR1790
	TXI	*,1,2,1	SURR1220	STO	D		SURR1800
	TXI	ILOOP,4,1	SURR1230	PXA	,1	= J	SURR1810
	TXI	*,1,1,1	SURR1240	CAS	TEMP2		SURR1820
TTT	CLA	*,1	SURR1250	TRA	*,3		SURR1830
	STO	ANSW	SURR1260	TRA	*,2		SURR1840
	STZ	P	SURR1265	TXI	LOOP3,1,1		SURR1850
	TZE	*,2	SURR1270	CLA	MTOT+2		SURR1860
	TRA	TLOOP	SURR1280	FDP	D	PIE(M TO K)OF (LONGM(J)-LONGM(I))	SURR1870
ODEC	AXT	*,1	SURR1290	FMP	EXTRM		SURR1880
	AXT	*,2	SURR1300	FAD	MTOT+19		SURR1890
	AXT	*,4	SURR1310	STO	MTOT+19	INNERSUM	SURR1900
	TXI	*,1,1,1	SURR1320	PXA	,2	=1	SURR1910
LTT	TXI	*,1,2,*,*	SURR1330	CAS	TEMP2		SURR1920
	TRA	5,4	SURR1340	TRA	*,3		SURR1930
EEE	PZE	*,*	SURR1350	TRA	*,2		SURR1940
	STZ	MTOT+4	SURR1360	TXI	EEXX-4,2,1		SURR1950
	LXA	K,2	SURR1370	LDO	MTOT+19		SURR1960
	LXD	K,4	SURR1380	FMP	MTOT+1		SURR1970
	PXA	,4	SURR1390	FAD	MTOT+4		SURR1980
	STO	TEMP	SURR1400	STO	MTOT+4	OUTERSUM	SURR1990
	PXA	,2	SURR1410	LXA	M,2		SURR2000
	SUB	TEMP	SURR1420	PXA	,2		SURR2010

SET ADDRESS OF K = LOCATION OF
 CURRENT ISOTOPE OF CHAIN
 SET DECREMENT OF K = WHICH ISOTOPE
 OF THE CHAIN

CALCULATE ONE ISOTOPE

$A(K) = N + K - 1$
 $D(K) = K$
 $= K - 1$

CAS	TEMP2		SUBR2020	LLS	35		SUBR2610
TRA	**5		SUBR2030	TRA	KK+3		SUBR2620
TRA	**4		SUBR2040	LGX	TSL	FEXEM.	SUBR2630
TXI	**1,2,1		SUBR2050	PZE	**1,,10		SUBR2640
SXA	M,2	SET A(M)= NEXT ISOTOPE	SUBR2060	PZE			SUBR2650
TRA	LOOP1		SUBR2070	KVG	CLA	X	SUBR2660
CLA	MTOT+4		SUBR2080	FDP	=2.0		SUBR2670
TRAE	EEE		SUBR2090	STQ	XMINP	X/2.	SUBR2680
EEEE	1.4		SUBR2100	SXA	KOUT+1,1	SAVE XR1	SUBR2690
STA	EEXX		SUBR2110	STZ	MTOT+4		SUBR2700
CLA	2.4		SUBR2120	CLA	W3		SUBR2710
STA	SOURCE		SUBR2130	FDP	=2.0		SUBR2720
SXA	OUTEEF.4		SUBR2140	STQ	TEMP0	W3/2.	SUBR2730
CLA	TIMF		SUBR2150	CLA	SH		SUBR2740
STO	ANSW		SUBR2160	CAS	=0	IS SH=0	SUBR2750
TSL	EEE		SUBR2170	TRA	**2	NO, CALCULATE SH**2/(CZ**2)	SUBR2760
LDQ	LONGH,4		SUBR2180	TRA	EXACT	YES, CALCULATE EXACT INTEGRAL	SUBR2770
FMP	MTOT+4		SUBR2190	FDP	TCZ		SUBR2780
STO	MTOT+25		SUBR2200	FMP	SH		SUBR2790
LDQ	MTOT+25		SUBR2210	FDP	TCZ		SUBR2800
FMP	NUI		SUBR2220	STQ	TEMP4	SH**2/(CZ**2)	SUBR2810
OUTEEE	AXT		SUBR2230	AXT	15,1	SET XR1 FOR INTEGRATION OVER X	SUBR2820
TRA	3.4	WASH-OUT FACTOR	SUBR2240	LOPK	XMINP		SUBR2830
KCAL	LDQ		SUBR2250	FMP	LXK+1,1		SUBR2840
FMP	X		SUBR2260	FAD	XMINP		SUBR2850
FDP	URAR		SUBR2270	LDQ	TEMP0		SUBR2860
STO	TEMP		SUBR2280	TSL	EXP3.		SUBR2870
SXA	KOUT,4	AMBDA*(X/UBAR)	SUBR2290	STO	MTOT+5	X(1)**(W3/2.)	SUBR2880
SXA	KZ,4	SAVE XR4 FOR NORMAL RETURN	SUBR2300	CLA	TEMP4		SUBR2890
CLA	MTOT+8	SAVE XR4 FOR ALL ZERO VG RETURN	SUBR2310	FDP	MTOT+5		SUBR2900
TNZ	**5		SUBR2320	FMP	=-1.0		SUBR2910
AXT	4.4		SUBR2330	FDP	MTOT+5		SUBR2920
CLA	VG+1.4		SUBR2340	STQ	MTOT+6	-(SH**2)/((CZ**2)*(X**W3))	SUBR2930
TNZ	KVG	FOUND A NONZERO VG, GO CALCULATE IT	SUBR2350	CALL	EXP(MTOT+6)		SUBR2940
TIX	**2,4,1		SUBR2360	FDP	MTOT+5	EXP(MTOT+6)/(X**W3/2.)	SUBR2950
CLA	TEMP		SUBR2370	FMP	LXK+1,1		SUBR2960
CALL	EXPM	EXP(-AC) ALL VG ARE ZERO	SUBR2380	FAD	MTOT+4		SUBR2970
STO	KX		SUBR2390	STO	MTOT+4		SUBR2980
STO	KX-1		SUBR2400	TIX	LOPK,1,1		SUBR2990
STO	KX-2		SUBR2410	KK	CLA	X	SUBR3000
STO	KX-3		SUBR2420	FDP	URAR	X= 2.0*(X/2.0)	SUBR3010
KZ	AXT		SUBR2430	FMP	MTOT+4		SUBR3020
TRA	**4		SUBR2440	FDP	=1.7724539		SUBR3030
EXPM	1.4	RETURN FOR ALL ZERO VG	SUBR2450	STQ	MTOT+6		SUBR3040
PZE	**		SUBR2460	CLA	MTOT+6		SUBR3050
CHS	TEMP0		SUBR2470	FDP	TCZ		SUBR3060
STO	EXP(TEMP0)		SUBR2480	STQ	MTOT+6		SUBR3070
CALL	EXPM		SUBR2490	AXT	4.4		SUBR3080
TRA	=1.0		SUBR2500	LOPK	VG+1,4		SUBR3090
FSB	TEMP0		SUBR2510	FMP	MTOT+6		SUBR3100
TZE	LGX	W3=2.0 AND CANNOT FIND LOG(0)	SUBR2520	FAD	TEMP		SUBR3110
STO	TEMP4		SUBR2530	CALL	EXPM		SUBR3120
CLA	X		SUBR2540	STO	KX+1,4		SUBR3130
LDQ	TEMP4		SUBR2550	TIX	LOPK,4,1		SUBR3140
TSL	EXP3.		SUBR2560	KOUT	AXT	RESTORE XR4	SUBR3150
FDP	TEMP4		SUBR2570	AXT	**4	RESTORE XR1	SUBR3160
FMP	=2.0		SUBR2580	TRA	**1	RETURN	SUBR3163
FDP	URAR		SUBR2590		1.4		SUBR3166
ZAC			SUBR2600			TWIS SUBROUTINE CALCULATES THE DOSE ATTENUATION KERNAL G(R)	

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GCAL CLA* 1.4
FSB TH1SD
STO MTOT+21
LDQ MTOT+21
FMP MTOT+21
STO MTOT+21
LDQ* 2.4
FMP TCY
STO MTOT+22
CLA W2
FDP #2.0
CLA X
TSL ,EXP3.
STO MTOT+23
LDQ MTOT+23
FMP MTOT+22
FSB TH1SE
STO MTOT+22
LDQ MTOT+22
FMP MTOT+22
FAD MTOT+21
STO MTOT+21
LDQ* 3.4
FMP TCZ
STO MTOT+22
CLA W3
FDP #2.0
CLA X
TSL ,EXP3.
STO MTOT+23
LDQ MTOT+23
FMP MTOT+22
STO MTOT+22
LDQ MTOT+22
FMP MTOT+22
FAD MTOT+21
STO MTOT+21
CALL SQRT(MTOT+21)*GCAL*
STO R
CAS #0.1
TRA GR
TRA **1
LDQ TNU
FMP #100.0
STO G
TRA 4.4
GR LDQ R
FMP THU
STO MUR
CLA #1.0
FAD MUR
STO MTOT+25
CLA TENE
LDQ #2.4
TSL ,EXP3.
STO MTOT+26
CLA MUR
FDP #7.0

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SUBR3169 FMP MUR
SUBR3170 FDP MTOT+26
SUBR3180 STQ MTOT+26
SUBR3190 CLA MTOT+25
SUBR3200 FAD MTOT+26
SUBR3210 FDP R
SUBR3220 FMP TNU
SUBR3230 FDP R
SUBR3240 STQ MTOT+25
SUBR3250 MSM MUR
SUBR3260 CALL EXP(MUR)
SUBR3270 STO MTOT+26
SUBR3280 LDQ MTOT+26
SUBR3290 FMP MTOT+25
SUBR3300 STO G
SUBR3310 TRA 4.4
SUBR3320 *
SUBR3330 *
SUBR3340 *
SUBR3350 *
SUBR3360 DSCL6 SXA ELMH4.4
SUBR3370 SUB #036000000
SUBR3380 PDX .4
SUBR3390 CAL ELEM.4
SUBR3400 ELMH4 AXI **4
SUBR3410 TRA 1.4
SUBR3420 BCI 1. GD
SUBR3430 BCI 1. EU
SUBR3440 BCI 1. SM
SUBR3450 BCI 1. PH
SUBR3460 BCI 1. ND
SUBR3470 BCI 1. PR
SUBR3480 BCI 1. CE
SUBR3490 BCI 1. LA
SUBR3500 BCI 1. BA
SUBR3510 BCI 1. CS
SUBR3520 BCI 1. XE
SUBR3530 BCI 1. I
SUBR3540 BCI 1. TE
SUBR3550 BCI 1. SB
SUBR3560 BCI 1. SN
SUBR3570 BCI 1. IN
SUBR3580 BCI 1. CD
SUBR3590 BCI 1. AG
SUBR3600 BCI 1. PD
SUBR3610 BCI 1. RH
SUBR3620 BCI 1. RU
SUBR3630 BCI 1. TC
SUBR3640 BCI 1. MO
SUBR3650 BCI 1. NB
SUBR3660 BCI 1. ZR
SUBR3670 BCI 1. Y
SUBR3680 BCI 1. SR
SUBR3690 BCI 1. RB
SUBR3700 BCI 1. KR
SUBR3710 BCI 1. BR
SUBR3720 BCI 1. SE
SUBR3730 BCI 1. AS
SUBR3740 BCI 1. GE
SUBR3750 SUBR3750
SUBR3760 SUBR3760
SUBR3770 SUBR3770
SUBR3780 SUBR3780
SUBR3790 SUBR3790
SUBR3800 SUBR3800
SUBR3810 SUBR3810
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SUBR3950 SUBR3950
SUBR3960 SUBR3960
SUBR3970 SUBR3970
SUBR3980 SUBR3980
SUBR3990 SUBR3990
SUBR4000 SUBR4000
SUBR4010 SUBR4010
SUBR4020 SUBR4020
SUBR4030 SUBR4030
SUBR4040 SUBR4040
SUBR4050 SUBR4050
SUBR4060 SUBR4060
SUBR4070 SUBR4070
SUBR4080 SUBR4080
SUBR4090 SUBR4090
SUBR4100 SUBR4100
SUBR4110 SUBR4110
SUBR4120 SUBR4120
SUBR4130 SUBR4130
SUBR4140 SUBR4140
SUBR4150 SUBR4150
SUBR4160 SUBR4160
SUBR4170 SUBR4170
SUBR4180 SUBR4180
SUBR4190 SUBR4190
SUBR4200 SUBR4200
SUBR4210 SUBR4210
SUBR4220 SUBR4220
SUBR4230 SUBR4230
SUBR4240 SUBR4240
SUBR4250 SUBR4250
SUBR4260 SUBR4260
SUBR4270 SUBR4270
SUBR4280 SUBR4280
SUBR4290 SUBR4290
SUBR4300 SUBR4300
SUBR4310 SUBR4310
SUBR4320 SUBR4320

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THIS SUBROUTINE WILL GIVE THE SYMBOL OF AN ELEMENT IF THE ATOMIC
NUMBER OF THE ELEMENT IS ENTERED IN THE DECIMENT OF THE AC

```

ELEM BCI 1, GA
      BCI 1, ZN
*
* THIS SUBROUTINE CALCULATES THE NUMBER PHOTONS FOR EXTERNAL
* EXPOSURES(I.E. CLOUD AND DEPOSITION DOSES)
*
GOFX SXA ENDG,4
      ZERO SUM1,4,4
      SUM1 MNM,MTOT,4
      SUB #01000000
      STD GGG
      SXA ENDG-1,2
      LXA PART,4
      PXA .1
      STO TEMP
      AXT C,2
GLOOP CLA JGASH,2
      STA TEMP3
      STD XR4
      CLA TEMP3
      CAS TEMP
      TRA **2
      TRA FOUND
      TXI **1,2,1
GGG TXL GLOOP,2,***
      AXT **2
      AXT **4
      TRA 1,4
FOUND LDO+ STORE+1,4
      FMP LONGH,2
      FDP XMIN
      FMP GMPY,2
      SXA **4,1
      LXD XR4,1
      FAD SUM1,1
      STO SUM1,1
      AXT **1
      TRA GGG-1
*
* THE FOLLOWING IS A TABLE OF LEGENDRE POINTS AND WEIGHTING VALUES
*
DEC 0.0
DEC 0.20119409
DEC -.20119409
DEC 0.39415135
DEC -.39415135
DEC 0.57097217
DEC -.57097217
DEC 0.72441773
DEC -.72441773
DEC 0.84820658
DEC -.84820658
DEC 0.93727339
DEC -.93727339
DEC 0.98799252
DEC -.98799252
LXK DEC 0.20257824
      DEC 0.19843149
      DEC 0.19843149

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SUBR4330 DEC 0.186161
SUBR4340 DEC 0.186161
SUBR4342 DEC 0.16626921
SUBR4344 DFC 0.16626921
SUBR4346 DEC 0.13957068
SUBR4348 DEC 0.13957068
SUBR4350 DEC 0.10715922
SUBR4360 DEC 0.10715922
SUBR4370 DEC 0.070366047
SUBR4380 DEC 0.070366047
SUBR4390 DEC 0.030753242
SUBR4400 DEC 0.030753242
SUBR4410 LAK DEC 0.030753242
*
* THE FOLLOWING SUBROUTINE CALCULATES 1-EXP(AC)
*
EXXP PZE **
      TZE LLL-1
      STO EXX
      SSP
      CAS #.1
      TRA **3
      TRA LLL
      TRA LLL
      CALL EXP(EXX)
      FSB #1.
      CMS 1-EXP(MTOT*11)
      TRA+ EXXP
      CLA #1.0
      STO MTOT+32
      CLA EXX
      STO MTOT+31
      STO MTOT+33
      STO MTOT+34
      CLA MTOT+32
      EXLOP FAD #1.0
      STO MTOT+32
      CLA MTOT+33
      FDP MTOT+32
      FMP MTOT+31
      STO MTOT+33
      FAD MTOT+34
      CLA MTOT+33
      FDP MTOT+34
      STO MTOT+7
      CLA MTOT+7
      SSP
      FSB #.00000001
      TPL EXLOP
      CLA MTOT+34
      CMS
      TRA+ EXXP
*
* THE FOLLOWING SUBROUTINES ARE FUNCTIONS OPERATED UPON BY THE
* E LINEAR OPERATOR, AND THE CALLING SEQUENCE ASSUMES THAT
* AC = -LAMBDA*(X/UBAR) AND XR2 = CURRENT ISOTOPE AND
* MO = (X/UBAR)
SUBR4850
SUBR4860
SUBR4870
SUBR4880
SUBR4890
SUBR4900
SUBR4910
SUBR4920
SUBR4930
SUBR4940
SUBR4950
SUBR4960
SUBR4963
SUBR4966
SUBR4969
SUBR4970
SUBR4980
SUBR4990
SUBR5000
SUBR5010
SUBR5020
SUBR5030
SUBR5040
SUBR5050
SUBR5060
SUBR5070
SUBR5080
SUBR5090
SUBR5100
SUBR5110
SUBR5120
SUBR5130
SUBR5140
SUBR5150
SUBR5160
SUBR5170
SUBR5180
SUBR5190
SUBR5200
SUBR5210
SUBR5220
SUBR5230
SUBR5240
SUBR5250
SUBR5260
SUBR5270
SUBR5280
SUBR5290
SUBR5300
SUBR5310
SUBR5320
SUBR5330
SUBR5331
SUBR5332
SUBR5333
SUBR5334
SUBR5335
SUBR5336
SUBR5337

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* DECAY EQUATION

*
*
EXPP STO **3
TSL EXP
TRA **3
BSS 1
PZE **1
TRA 1.4

RETURN

* BUILDUP EQUATION

*
*
OMEXP STO TEMP
STQ TEMP2
CLS TEMP
FDP TEMP2
STQ TEMP2
CLA TEMP
TSL EXXP
FDP TEMP2
STQ TEMP
CLA TEMP
TRA 1.4

MINUS LAMBDA*T
T

LAMBDA

RETURN ANSWER IN AC

* INHALATION EQUATION

*
*
EXPH STO LT
STQ TIM
FDP TIM
STQ LONG
SXA ENDD,4
SXA ENDD+1,1
CLA LONG
FSB AK2
STO TEMP
CALL EXP(LT)
STQ MTOT+20
LDQ TEMP
FHP TINHA
TSL EXXP
STQ MTOT+3
CHS
FDP TEMP
STQ MTOT+9
LXA K,4
LXA SAVE4,1
CLS LONGM,4
FSB LONGB,1
STO LONGE
CHS
FAD TEMP
TZE EDUAL
STQ TEMP4
LDQ TINHA
FHP LONGE
TSL EXXP
STQ MTOT+10
FDP LONGE
ZAC
LLS 35

-(LAMBDA*AK2)

-(EFFECTIVE HALF LIFE)

SUBR5338 FAD MTOT+9
SUBR5339 STO MTOT+9
SUBR5340 CLS MTOT+10
SUBR5350 FAD MTOT+3
SUBR5360 FDP LONGE
SUBR5370 STQ MTOT+10
SUBR5380 LDQ T
SUBR5390 FHP LONGE
SUBR5393 TSL EXXP
SUBR5396 LRS 35
SUBR5399 FHP MTOT+10
SUBR5400 FAD MTOT+9
SUBR5410 FDP TEMP4
SUBR5420 FHP MTOT+20
SUBR5430 LRS 35
SUBR5440 FHP AK1
SUBR5450 ENDD AXT **,4
SUBR5460 AXT **,1
SUBR5470 TRA 1.4
SUBR5480 EDUAL CLS MTOT+9
SUBR5490 FDP TEMP
SUBR5500 TRA ENDD-1
SUBR5503 LONGE BSS 1
SUBR5506
SUBR5509

* CLOUD GAMMA EQUATION

*
*
GEXP STO TEMP
STQ TEMP4
FDP TEMP
STQ MTOT+20
CALL EXP(TEMP4)
STQ TEMP4
CLA MTOT+20
FSB AK2
STQ MTOT+20
LDQ MTOT+20
FHP T
TSL EXXP
CHS
LRS 35
FHP AK1
FDP MTOT+20
FHP TEMP4
TRA 1.4

* DEPOSITION GAMMA EQUATIONS

*
*
EPX1 STO TEMP
STQ TEMP4
MSM TRRA1
CLS LONGM,2
STQ MTOT+20
CALL EXP(TEMP4)
STQ TEMP4
CLA =1.0
STQ PIE
SXA X11,1
SXA X21,2
SXA X41,4

X/U
-LAMBDA*X/U
-LAMBDA
EXP(-LAMBDA*(X/U))
-(LAMBDA*AK2)
RETURN

SUBR5850
SUBR5860
SUBR5870
SUBR5880
SUBR5890
SUBR5900
SUBR5910
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SUBR6340
SUBR6350
SUBR6360
SUBR6370

XBR11 BRN XRT21
 LXA K,2
 TXI **1.2,-1
 PXD ,2
 ADD PK
 PDX ,2
 MSN XBR11
 SXA XRT21,2
 SXA XXR21,2
 XRT21 AXT
 PXD **2
 SUB ,2
 ADD PK
 STD P
 STD XP10
 STD XP20
 STD XP30
 CLA AK2
 TNZ PROD2-1
 MSP TBRA1
 CLA XRT21
 CAS X21
 TRA **5
 TRA **2
 TRA **3
 ZAC
 TRA X21
 LXA X21,4
 PROD2 CLA LONGM,2
 FSB LONGM,4
 FSB AK2
 STO PART1
 LDO PIE
 FMP PART1
 STO PIE
 KP10 TXL **2.2,**
 TXI PROD2,2,-1
 CLA AK2
 FSB MTOT+20
 STO TEMP
 CHS
 LRS 35
 FMP TDEPOS
 TSL EXXP
 FDP TEMP
 FMP **1.0
 FDP PIE
 STO TEMP
 XXR21 AXT **2
 CLA LONGM,2
 FAD MTOT+20
 FSB AK2
 STO PART1
 LXA XRT21,4
 PROD3 CLA LONGM,4
 FSB LONGM,2
 STO TEST
 TZE **4
 LDO TEST
 FMP PART1

SUBR6380 STO
 SUBR6390 XP20 TXC
 SUBR6400 TXI
 SUBR6410 LDO
 SUBR6420 FMP
 SUBR6430 CHS
 SUBR6440 TSL
 SUBR6450 FDP
 SUBR6460 FMP
 SUBR6470 FDP
 SUBR6480 FMP
 SUBR6490 FAD
 SUBR6500 STO
 SUBR6510 XP30 TXL
 SUBR6520 TXI
 SUBR6530 LDO
 SUBR6540 FMP
 SUBR6550 STO
 SUBR6560 LXA
 SUBR6570 LXD
 SUBR6580 XTU1 CLA
 SUBR6590 FSB
 SUBR6600 TZE
 SUBR6610 LDO
 SUBR6620 FMP
 SUBR6630 STO
 SUBR6640 TXI
 SUBR6650 LXD
 SUBR6660 TSL
 SUBR6670 TBRA1 BRA
 SUBR6680 SXA
 SUBR6690 LXA
 SUBR6700 TSL
 SUBR6710 AXT
 SUBR6720 CLA
 SUBR6730 FSB
 SUBR6740 STO
 SUBR6750 TZE
 SUBR6760 LDO
 SUBR6770 FMP
 SUBR6780 TRA
 SUBR6790 LDO
 SUBR6800 FMP
 SUBR6810 LRS
 SUBR6820 FMP
 SUBR6830 X21 AXT
 SUBR6840 X41 AXT
 SUBR6850 X11 AXT
 SUBR6860 TRA
 SUBR6870 EPX STO
 SUBR6880 STO
 SUBR6890 MSN
 SUBR6900 CLS
 SUBR6910 STO
 SUBR6920 CALL
 SUBR6930 STO
 SUBR6940 CLA
 SUBR6950 STO
 SUBR6960 SXA

PART1
 2.4,
 PROD3,4,-1
 LONGM,2
 TDEPOS
 EXXP
 LONGM,2
 **1.0
 PART1
 **1.0
 TEMP
 TEMP
 2.2,
 XXR21+1.2,-1
 TEMP
 TEMP4
 TEMP4
 XRT21,4
 XP30,2
 LONGM,4
 LONGM,2
 **5
 TEMP4
 LONGM,2
 TEMP4
 XTU1,2,1
 XP10,2
 TEST1
 X21-4
 **3,4
 X21,2
 TEST1
 **1
 A1,1
 A1,4
 TEMP
 X21
 TEMP4
 TEMP
 X21-2
 TEMP4
 A1,4
 35
 AK1
 **2
 **4
 **1
 1,4
 TEMP
 TEMP4
 TBRA
 LONGM,2
 MTOT+20
 EXP(TEMP4)
 TEMP4
 **1.0
 PIE
 X1,1

SUBR6970
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 SUBR6990
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 SUBR7530
 SUBR7540
 SUBR7550

ADDRESS	OPERATION	OPERAND	OPERATION	OPERAND
SUBR7560	STO	PART1		
SUBR7570	XP2	TXL	**2,4,**	
SUBR7580		TXI	PROD1,4,-1	
SUBR7590		LDO	LONGM,2	
SUBR7600		FMP	TDEPOS	
SUBR7610		GHS		
SUBR7620		STO	TEST	
SUBR7630		CALL	EXP(TEST)	
SUBR7640		FDP	PART1	
SUBR7650		FMP	=-1.0	
SUBR7660		FAD	TEMP	
SUBR7670		STO	TEMP	
SUBR7680	XP3	TXL	**2,2,**	
SUBR7690		TXI	XXR2+1,2,-1	
SUBR7700		LDO	TEMP	
SUBR7710		FMP	TEMP4	
SUBR7720		STO	TEMP4	
SUBR7730		LXA	XRT2,4	
SUBR7740		LXD	XP3,2	
SUBR7750	XTU	CLA	LONGM,4	
SUBR7760		FSB	LONGM,2	
SUBR7770		TZE	**5	
SUBR7780		LDO	TEMP4	
SUBR7790		FMP	LONGM,2	
SUBR7800		STO	TEMP4	
SUBR7810		TXI	XTU,2,1	
SUBR7820		LXD	XP1,2	
SUBR7830		TSL	TEST1	
SUBR7840	TBRA	BRA	X2-4	
SUBR7850		SXA	**3,4	
SUBR7860		LXA	X2,2	
SUBR7870		TSL	TEST1	
SUBR7880		AXT	**1	
SUBR7890		CLA	A1,1	
SUBR7900		FSB	A1,4	
SUBR7910		STO	TEMP	
SUBR7920		TZE	X2	
SUBR7930		LDO	TEMP4	
SUBR7940		FMP	TEMP	
SUBR7950		TRA	X2-2	
SUBR7960		LDO	TEMP4	
SUBR7970		FMP	A1,4	
SUBR7980		LRS	35	
SUBR7990		FMP	AK1	
SUBR8000	X2	AXT	**1,2	
SUBR8010	X4	AXT	**1,4	
SUBR8020	X1	AXT	**1	
SUBR8030		TRA	1,4	
SUBR8040	HEXPT	STQ	TEMP	
SUBR8050		STO	TEMP4	
SUBR8060		FDP	TEMP	
SUBR8070		STQ	MYOT+20	
SUBR8080		FMP	T	
SUBR8090		TSL	EXXP	
SUBR8100		FDP	MYOT+20	
SUBR8110		FMP	=-1.0	
SUBR8120		TRA	1,4	
SUBR8130	TEST1	PZE	**	
SUBR8140		LDO	ANSW	

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	FMP	UBAR		SUBR8740	LRS	35	SUBR9330
	STO	X		SUBR8750	FMP	AK1	SUBR9340
EXPT	BRA	GB		SUBR8760	DET	AXT	SUBR9350
	CAS	XK1		SUBR8770		TRA	SUBR9360
	TRA	GB		SUBR8780	ETXU1	STO	SUBR9370
	TRA	**2		SUBR8790		SXA	SUBR9380
	TRA	GB		SUBR8800		CALL	SUBR9390
RET	CLA	JGASM,2		SUBR8810		STO	SUBR9400
	PDX	,4		SUBR8820		LDQ	SUBR9410
	TRA*	TEST1		SUBR8830		FMP	SUBR9420
GE	CLA	X		SUBR8840		CWS	SUBR9430
	STO	XK1		SUBR8850		STO	SUBR9440
	MSP	EXPT		SUBR8860		TSL	SUBR9450
	CLA	W3		SUBR8870		FDP	SUBR9460
	FDP	*2.0		SUBR8880		STQ	SUBR9470
	CLA	X		SUBR8890		CALL	SUBR9480
	TSL	,EXP3.		SUBR8900		LRS	SUBR9490
	STO	MTOT+13.		SUBR8910		FMP	SUBR9500
	LDQ	TCZ		SUBR8920		CWS	SUBR9510
	FMP	MTOT+13		SUBR8930		FAD	SUBR9520
	STO	MTOT+13		SUBR8940		FCP	SUBR9530
	CLS	SH		SUBR8950		FMP	SUBR9540
	FDP	MTOT+13		SUBR8960		STO	SUBR9550
	STQ	VE		SUBR8970		TSL	SUBR9560
	FMP	VE	(-SM)/CZ*(X**W3)	SUBR8980		LDQ	SUBR9570
	CWS			SUBR8990		FMP	SUBR9580
	STO	MTOT+9		SUBR9000		LRS	SUBR9590
	CALL	EXP(MTOT+9)		SUBR9010		FMP	SUBR9600
	FDP	MTOT+13		SUBR9020	DET1	AXT	SUBR9610
	FMP	*2.0		SUBR9030		TRA	SUBR9620
	FDP	*1.7724539	PIE**0.5	SUBR9040		DEF	SUBR9630
	STQ	MTOT+9		SUBR9050		CONTRL	SUBR9640
	SXA	GG,4		SUBR9060		USE	SUBR9650
	TSX	KCAL,4		SUBR9070		DEF	SUBR9660
	AXT	4,4		SUBR9080		DEF	SUBR9670
VLOP	LDQ	VG+1,4		SUBR9090		DEF	SUBR9680
	FMP	MTOT+9		SUBR9100		DEF	SUBR9690
	FAD	AMBDA		SUBR9110		DEF	SUBR9700
	FDP	UBAR		SUBR9120		DEF	SUBR9710
	FMP	KX+1,4		SUBR9130		DEF	SUBR9720
	STO	A1+1,4		SUBR9140		DEF	SUBR9730
	TIX	VLOP,4,1		SUBR9150		DEF	SUBR9740
GG	AXT	**4		SUBR9160		DEF	SUBR9750
	TRA	RET	RETURN	SUBR9170		DEF	SUBR9760
ETXU	STQ	TEMP		SUBR9180		DEF	SUBR9770
	SXA	DET,4		SUBR9190		DEF	SUBR9780
	CLA	TEMP		SUBR9200		DEF	SUBR9790
	FAD	TDEPOS		SUBR9210		DEF	SUBR9800
	LRS	35		SUBR9220		DEF	SUBR9810
	FMP	LONGM,2		SUBR9230		DEF	SUBR9820
	CWS			SUBR9240		DEF	SUBR9830
	STO	TEMP4		SUBR9250		DEF	SUBR9840
	CALL	EXP(TEMP4)		SUBR9260		DEF	SUBR9850
	STO	TEMP4		SUBR9270		DEF	SUBR9860
	TSL	TEST1		SUBR9280		DEF	SUBR9870
	LDQ	TEMP4		SUBR9290		DEF	SUBR9880
	FMP	A1,4		SUBR9300		DEF	SUBR9890
	LRS	35		SUBR9310		DEF	SUBR9900
	FMP	TDEPOS		SUBR9320		DEF	SUBR9910
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						DEF	SUBR2360
						DEF	SUBR2370
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SIBMAP INHAL DECK	INHA0010	* DEF MACRO	LIST,SIZE	DEFINE A GROUP OF VARIABLES WHICH	INHA0600
* THE FOLLOWING IS THE ENTRY BACK TO THE MAIN ROUTINE, RSAC.	INHA0020	IRP	.LIST	HAVE THE SAME BLOCK SIZE WITH ONE	INHA0610
EXTERN DETIN	INHA0030	LIST BSS	SIZE	COMMAND	INHA0620
* THE FOLLOWING ARE ENTRY POINTS TO IODECK.	INHA0040	IRP	ENDM		INHA0630
EXTERN STM,BCDOU,FIXTR,DTRANP,NPG,SKP,DTRANS,FXPL,FXIN,BCD	INHA0050				INHA0640
EXTERN INT,DECIM,FIL	INHA0060				INHA0650
* THE FOLLOWING ARE SYSTEM ROUTINES USED IN RSAC.	INHA0070	* ZERO MACRO	BLOCK,SIZE,T	ZERO A BLOCK OF CORE	INHA0660
EXTERN EXP,EXP3, SORT,EXIT,PEXEM.	INHA0080	AXT	SIZE,T		INHA0670
* THE FOLLOWING ARE ENTRY POINTS TO THE SUBROUTINE PACKAGE.	INHA0090	STZ	BLOCK+1,T		INHA0680
EXTERN DEC,EEE,EEEE,KCAL,GCAL,DSCL6,GOFX,LAK,LXK	INHA0100	TIX	**1,T,1		INHA0690
EXTERN EXXP,EXPP,OMEXP,EXPM,GEXP,EPX	INHA0110	ENDM	ZERO		INHA0700
* ENTRY INHAL	INHA0120	* WRITE MACRO	FMT,COUNT		INHA0710
FOLLOWING IS A SMALL SET OF MACRO INSTRUCTIONS DEFINED FOR RSAC	INHA0130	AXT	0,4		INHA0720
SPACE MACRO SPACE ONE LINE ON OUTPUT TAPE	INHA0140	CAL	FMT,4		INHA0730
TSX STM,4	INHA0150	TSL	BCDOU		INHA0740
TSX FIL,4	INHA0160	TXI	**1,4,**1		INHA0750
ENDM SPACE	INHA0170	TXH	**3,4,-COUNT		INHA0760
* SUM MACRO BLOCK,SIZE,T SUM A BLOCK OF FLOATING POINT NUMBERS	INHA0180	ENDM WRITE		WRITE SOME OUTPUT,	INHA0770
AXT SIZE,T	INHA0190	SCRIBE MACRO	FMT,COUNT,OP		INHA0780
ZAC	INHA0200	SXA	**9,4		INHA0790
FAD BLOCK,T	INHA0210	TSX	STM,4		INHA0800
TIX **1,T,1	INHA0220	TSL	OP		INHA0810
ENDM SUM	INHA0230	WRITE	FMT,COUNT		INHA0820
* SUM MUST BE STORED BY A STO INSTRUCTION	INHA0240	TSX	FIL,4		INHA0830
* SUM1 MACRO BLOCK,SIZE,T SUM A BLOCK OF FIXED OR INTEGERS	INHA0250	AXT	**4		INHA0840
LXD SIZE,T	INHA0260	ENDM	SCRIBE		INHA0850
ZAC	INHA0270	* INHAL	END OF MACRO PACKAGE, BEGINNING OF CODING		INHA0860
ADD BLOCK+1,T	INHA0280	READ	BCD,ORGAN,0		INHA0870
TIX **1,T,1	INHA0290	READ	FIXIN,CNTRL,0		INHA0880
ENDM SUM1	INHA0300	READ	DECIM,(TINHA,BREATM),0		INHA0890
* READ MACRO IN,STORE,T STORE MAY BE A LIST ENCLOSED IN	INHA0310	CLA	MTOT		INHA0900
IRP STORE	INHA0320	SUB	=01000000		INHA0910
TSL IN	INHA0330	STD	DDD+3		INHA0920
STO STORE,T	INHA0340	STD	OK		INHA0930
IRP	INHA0350	READI	CNTRL1,0	CHECK IF AN INGESTION CALCULATION	INHA0940
ENDM READ	INHA0360	CLA	CNTRL1	IS REQUESTED.	INHA0950
* READI MACRO DATA,T SPECIAL TREATMENT FOR INTEGERS	INHA0370	TNZ	INGEST	DETERMINE WHICH ORGAN IS TO BE	INHA0960
IRP DATA	INHA0380	TSL	SCH	CONSIDERED, READ NUMBER OF ELEMENTS,	INHA0970
TSL FIXIN	INHA0390	READI	NCH,0		INHA0980
LLS IR	INHA0400	LXD	NCH,2		INHA0990
STO DATA,T	INHA0410	READI	CNN+1,2		INHA1000
IRP	INHA0420	READ	DECIM,LON08,2		INHA1010
ENDM READI	INHA0430	TIX	BBB,2,1		INHA1020
* CALLP IS TO SIMULATE THE FORTRAN 11 CALLING SEQUENCE	INHA0440	SCRIBE	FMT10,10,NPG		INHA1030
* CALLP MACRO ROUTE,PPZ	INHA0450	AXT	0,4		INHA1040
TSX ROUTE,4	INHA0460	LOOPH CLA	DIE,4		INHA1050
IRP PPZ	INHA0470	STO	X		INHA1060
PZE PPZ	INHA0480	YZE	LOOPH1+2		INHA1070
IRP	INHA0490	FDP	U3AR		INHA1080
ENDM CALLP	INHA0500	STO	TIME		INHA1090
	INHA0510	CLA	CV,4		INHA1100
	INHA0520	STO	TCY		INHA1110
	INHA0530	CLA	CZ,4		INHA1120
	INHA0540	STO	TCZ		INHA1130
	INHA0550	CLA	CZ,4		INHA1140
	INHA0560	STO	TCZ		INHA1150
	INHA0570	SXA	LOOPH1,4		INHA1160
	INHA0580	TSX	KCAL,4	CALCULATE FALLOUT	INHA1170
	INHA0590				INHA1180

CALA1	TSX	CALCH1,4	CALCULATE CH1(X,Y)	INHA1190	TIX	K1LOOP,4,1	INHA1780
	STZ	TOTAL		INHA1200	LYD	XR4,4	INHA1790
	LXD	NCH,4		INHA1210	LDO	MTOT*36	INHA1800
FFF	CLA	CHN+1,4		INHA1220	FHP	KX,4	INHA1810
	STO	TEMP3		INHA1230	STO	MTOT*36	INHA1820
	MSP	BRI		INHA1240	CLA	CNTRL	INHA1830
	SXA	SAVE4,4		INHA1250	CAS	=01	INHA1840
	LXD	NK1,4		INHA1260	TRA	ELAB	INHA1850
	STZ	MTOT*36		INHA1270	TRA	SIMP	INHA1860
K1LOOP	CLA	K1,4		INHA1280	TOT	CLA	INHA1870
	STO	AK1		INHA1290	FAD	MTOT*36	INHA1880
	CLA	K2,4		INHA1300	STO	TOTAL	INHA1890
	STO	AK2		INHA1310	LXA	SAVE4,4	INHA1900
	SXA	K14,4		INHA1320	TIX	FFF,4,1	INHA1910
	AXT	0,3		INHA1330	TRA	OUTPUT	INHA1920
	STZ	DOTOT		INHA1340	LOOPM1	AXT	INHA1930
A#4	CLA	NNM,1		INHA1350	TXI	LOOPM,4,1	INHA1940
	PDX	,4		INHA1360	TRA	DETIN	INHA1950
CCC	CLA	NPROTH,2	LOOK FOR ELEMENT UNDER CONSIDERATION	INHA1370	CALCH1	CLA	INHA1960
	CAS	TEMP3		INHA1380	LDO	W1	INHA1970
	TRA	DDD		INHA1390	TSL	,EXP3.	INHA1980
	TRA	++2		INHA1400	FDP	=2.0	INHA1990
	TRA	DDD		INHA1410	FMP	UBAR	INHA2000
BRI	BRA	++4		INHA1420	STO	TEMP1	INHA2010
	CLA	JGASH,2	PICK UP WHICH ELEMENT GROUP TO WHICH IT BELONGS.	INHA1435	LDO	TCZ	INHA2020
	STD	XR4		INHA1440	FMP	TCY	INHA2030
	MSM	BRI		INHA1450	STO	TEMP	INHA2040
	PXA	,2		INHA1460	LDO	TEMP	INHA2050
	STO	K		INHA1470	FMP	TEMP1	INHA2060
	PXD	,4		INHA1480	STO	TEMP1	INHA2070
	SUB	NNM,1		INHA1490	LDO	TEMP1	INHA2080
	SSP			INHA1500	FMP	=3.1415927	INHA2090
	ADD	K		INHA1510	STO	CHI	INHA2100
	STO	K		INHA1520	CLA	X	INHA2110
	SXA	DDD-1,4		INHA1530	LDO	W3	INHA2120
	SXA	DDD-2,2		INHA1540	TSL	,EXP3.	INHA2130
	SXA	DDD-3,1		INHA1550	STO	TEMP	INHA2140
	PXA	,2		INHA1560	CLS	SH	INHA2150
	PAX	,4		INHA1570	FDP	TCZ	INHA2160
	CLA	NUI		INHA1580	FMP	SH	INHA2170
	TZE	DDD-1		INHA1590	FDP	TCZ	INHA2180
	CALLP	EEEE,(EXP,FPI)		INHA1600	STO	TEMP1	INHA2190
	FAD	DOTOT	ACCUMULATE DOSE FOR THAT ELEMENT	INHA1610	CLA	TEMP1	INHA2200
	STO	DOTOT		INHA1620	FDP	TEMP	INHA2210
	AXT	++1		INHA1630	STO	TEMP1	INHA2220
	AXT	++2		INHA1640	CALL	EXP(TEMP1)	INHA2230
	AXT	++4		INHA1650	STO	TEMP1	INHA2240
DDD	TXI	++1,2,1		INHA1660	CLA	W	INHA2250
	TIX	CCC,4,1		INHA1670	CAS	=0.0	INHA2260
	TXI	++1,1,1		INHA1680	TRA	INVER	INHA2270
	TXL	AAA,1,++		INHA1690	TRA	++3	INHA2280
	LDO	CHI		INHA1700	CAL	FLAG	INHA2290
	FMP	BREATH		INHA1710	SLW	FMT18	INHA2300
	STO	A1		INHA1720	CLA	TEMP1	INHA2310
	LDO	DOTOT		INHA1730	FDP	CHI	INHA2320
	FMP	A1		INHA1740	STO	CHI	INHA2330
	FAD	MTOT*36		INHA1750	TRA	ZYC	INHA2340
	STO	MTOT*36		INHA1760	INVER	SXA	INHA2350
K14	AXT	++4		INHA1770	AXT	0,1	INHA2360

CHECK FOR TYPE OF OUTPUT REQUESTED.

WRITE TOTAL DOSE FOR ALL ELEMENTS

$$X \leftarrow (W1)$$

$$X \leftarrow (W1)/2.0$$

$$UBAR \leftarrow X \leftarrow (W1)/2.0$$

CZ ← CY

$$(CZ \leftarrow CY + UBAR \leftarrow X \leftarrow (W1))/2.0$$

X ← W3

$$-(SH \leftarrow 2)/(CZ \leftarrow 2)$$

$$-(SH \leftarrow 2)/(CZ \leftarrow 2) \times X \leftarrow W3$$

L30PN LDO TEMP1
 FMP #2.0
 STO SUM
 LDO M
 FMP NO,1
 STO SUM-1
 FAD SM
 STO SUM-2
 FDP TCZ
 FMP SUM-2
 FDP TCZ
 FMP #-1.0
 FDP TEMP
 STO SUM-2
 CALL EXP(SUM-2)
 FAD SUM
 STO SUM
 CLA SUM-1
 FSB SM
 STO SUM-2
 FDP TCZ
 FMP SUM-2
 FDP TCZ
 FMP #-1.0
 FDP TEMP
 STO SUM-2
 CALL EXP(SUM-2)
 STO PART
 FAD SUM
 STO SUM
 TXI **1.1,-1
 TXL ZYC1,1,-49
 CLA PART
 FDP SUM
 ZAC
 LLS 35
 CAS #0.00000061
 TRA LOOPN
 AXT 0.0
 ZYC1 AXT **1
 CLA #0.5
 FDP CHI
 FMP SUM
 STO CHI
 ZYC TRA 1.4
 CALXY STO Y
 CLA X
 LDO W3
 TSL ,EXP3.
 STO TEMP
 CLA Y
 FDP TEMP
 FMP Y
 FDP TCY
 STO TEMP
 CLA TEMP
 FDP TCY
 STO TEMP
 MSM TEMP

INHA2370 CALL EXP(TEMP)
 INHA2380 STO CHIY
 INHA2390 TRA 1.4
 INHA2400 E-AB CLA X
 INHA2410 TSL DTRANS
 INHA2420 SLW FMT14*6
 INHA2430 STO FMT14*7
 INHA2440 CAL ORGAN
 INHA2450 SLW FMT14*11
 INHA2460 SCRIBE FMT14,12,SKP
 INHA2470 CLA TEMP3
 INHA2480 TSX DSCL6,4
 INHA2490 SLW FMT20*4
 INHA2500 SCRIBE FMT20,6,SKP
 INHA2510 SCRIBE FMT16,9,SKP
 INHA2520 LXD LB,4
 INHA2530 LOPLB1 CLA ELB*1.4
 INHA2540 SXA **2.4
 INHA2550 TSX CALXY,4
 INHA2560 AXT **,4
 INHA2570 LDQ MTOT*36
 INHA2580 FMP CHIY
 INHA2590 STO TOTAL1
 INHA2600 CLA Y
 INHA2610 TSL DTRANS
 INHA2620 SLW FMT18*2
 INHA2630 STO FMT18*3
 INHA2640 CLA TOTAL1
 INHA2650 TSL DTRANS
 INHA2660 SLW FMT18*7
 INHA2670 STO FMT18*8
 INHA2680 SCRIBE FMT18,9,SKP
 INHA2690 TIX LOPLB1,4,1
 INHA2700 TRA TOT
 INHA2710 SIMP CLA X
 INHA2720 TSL DTRANS
 INHA2730 SLW FMT14*6
 INHA2740 STO FMT14*7
 INHA2750 CAL ORGAN
 INHA2760 SLW FMT14*11
 INHA2770 SCRIBE FMT14,12,SKP
 INHA2780 CLA TEMP3
 INHA2790 TSX DSCL6,4
 INHA2800 SLW FMT20*4
 INHA2810 CLA MTOT*36
 INHA2820 TSL DTRANS
 INHA2830 SLW FMT20*10
 INHA2840 STO FMT20*11
 INHA2850 SCRIBE FMT20,13,SKP
 INHA2860 TRA TOT
 INHA2870 OUTPUT CLA TINHA
 INHA2880 TSL DTRANS
 INHA2890 SLW FMT12*5
 INHA2900 STO FMT12*6
 INHA2910 CLA Y
 INHA2920 TSL DTRANS
 INHA2930 SLW FMT12*11
 INHA2940 STO FMT12*12
 INHA2945 SCRIBE FMT12,14,SKP

INHA2950
 INHA2960
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 INHA2990
 INHA3000
 INHA3010
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 INHA3530

CLA X
 TSL DTRANS
 SLW FMT14+6
 STO FMT14+7
 CAL ORGAN
 SLW FMT14+11
 SCRIBE FMT14,12,SKP
 SCRIBE FMT16,9,SKP
 LOPLB LXO LB,4
 CLA ELB+1,4
 SXA **2,4
 TSX CALXY,4
 AXT **,4
 LDO TOTAL
 FMP CH1Y
 STO TOTAL1
 CLA Y
 TSL DTRANS
 SLW FMT18+2
 STO FMT18+3
 CLA TOTAL1
 TSL DTRANS
 SLW FMT18+7
 STO FMT18+8
 SCRIBE FMT18,9,SKP
 TIX LOPLB,4,1
 TRA LOOPH1
 INGEST ZERO G1,450,1
 CLA #01000000
 STO NCH
 READI CHN,C
 READ FIXIN,ATOM,0
 READ DECIP,(LONGR-1,FRAC),0
 CLA ATOM
 TSL FIXTR
 STO FMT1+11
 SCRIBE FMT1,12,NPG
 TSL SCH
 TSL FIND
 CLA SW2
 TPL ERR
 CLA SW1
 THI **3
 MSP BE
 TRA **2
 MSM BE
 LXA PLACE,4
 LDO+ NUI
 FMP FRAC
 STO G1,4
 BE BRA **5
 LXO PLACE,4
 LDO+ NUI
 FMP FRAC
 STO G1,4
 CLA **1
 STO NUI
 TRA LOOPH-1
 FIND PZE **

COULD NOT FIND ELEMENT, EXIT

INHA3540	MSP	SW1	INHA4130
INHA3550	MSP	SW2	INHA4140
INHA3560	STZ	PLACE	INHA4150
INHA3570	AXT	0,1	INHA4160
INHA3580	CLA	MMH,1	INHA4170
INHA3590	CAS	ATOM	INHA4180
INHA3600	TRA*	FIND	INHA4190
INHA3610	TRA	FIND1	INHA4200
INHA3620	CLA	NNH,1	INHA4210
INHA3630	ADD	PLACE	INHA4220
INHA3640	STO	PLACE	INHA4230
INHA3650	TXI	**1,1,1	INHA4240
INHA3660	OK TXL	**8,1,**	INHA4250
INHA3670	TRA*	FIND	INHA4260
INHA3680	FIND1 SXA	ENDF,1	INHA4270
INHA3690	MSH	SW2	INHA4280
INHA3700	CLA	NNH,1	INHA4290
INHA3710	PDX	,2	INHA4300
INHA3720	LXD	PLACE,4	INHA4310
INHA3730	TXI	**1,4,1	INHA4320
INHA3740	CLA	NPROTH,4	INHA4330
INHA3750	CAS	CHN	INHA4340
INHA3760	TRA	**2	INHA4350
INHA3770	TRA	FIND2	INHA4360
INHA3780	TIX	**5,2,1	INHA4370
INHA3790	CLA	SW1	INHA4380
INHA3800	THI	ENDF	INHA4390
INHA3810	TRA*	FIND	INHA4400
INHA3820	FIND2 CLA	SW1	INHA4410
INHA3830	THI	**5	INHA4420
INHA3840	PXA	,4	INHA4430
INHA3850	STA	PLACE	INHA4440
INHA3860	MSH	SW1	INHA4450
INHA3870	TRA	FIND1+10	INHA4460
INHA3880	PXD	,4	INHA4470
INHA3890	STD	PLACE	INHA4480
INHA3900	MSP	SW1	INHA4490
INHA3910	TRA*	FIND	INHA4500
INHA3920	ENDF AXT	**1	INHA4510
INHA3930	TRA	OK+4	INHA4520
INHA3940	SCH PZE	**	INHA4530
INHA3950	CAL	ORGAN	INHA4540
INHA3960	LAS	#0224645256060	BONE
INHA3970	TRA	**2	INHA4550
INHA3980	TRA	ORGAN1	INHA4560
INHA3990	LAS	#0273160606060	GI
INHA4000	TRA	**2	INHA4570
INHA4010	TRA	ORGAN2	INHA4580
INHA4020	LAS	#0423124452570	KIDNEY
INHA4030	TRA	**2	INHA4590
INHA4040	TRA	ORGAN3	INHA4600
INHA4050	LAS	#0433165255160	LIVER
INHA4060	TRA	**2	INHA4610
INHA4070	TRA	ORGAN4	INHA4620
INHA4080	LAS	#0436445276060	LUNG
INHA4090	TRA	**2	INHA4630
INHA4100	TRA	ORGAN5	INHA4640
INHA4110	LAS	#0446462234325	MUSCLE
INHA4120	TRA	**2	INHA4650
			INHA4660
			INHA4670
			INHA4680
			INHA4690
			INHA4700
			INHA4710

TRA	ORGAN6		INHA4720	OCT	206400000000	INHA5280
LAS	#0632562632562	TESTES	INHA4730	OCT	207400000000	INHA5290
TRA	**2		INHA4740	OCT	210400000000	INHA5300
TRA	ORGAN7		INHA4750	OCT	211400000000	INHA5310
LAS	#0633070514624	THYROID (THYROID)	INHA4760	OCT	212400000000	INHA5320
TRA	**4		INHA4770	OCT	213400000000	INHA5330
TRA	ORGAN8		INHA4780	OCT	214400000000	INHA5340
TRA	**2		INHA4790	OCT	215400000000	INHA5350
PZE	BODY	OTHERWISE BODY	INHA4800	OCT	216400000000	INHA5360
CLA	**1		INHA4810	OCT	217400000000	INHA5370
TRA	ABC		INHA4820	OCT	220400000000	INHA5380
PZE	THYROID		INHA4830	OCT	221400000000	INHA5390
ORGAN8 CLA	**1		INHA4840	OCT	222400000000	INHA5400
TRA	ABC		INHA4850	OCT	223400000000	INHA5410
PZE	TESTES		INHA4860	OCT	224400000000	INHA5420
ORGAN7 CLA	**1		INHA4870	OCT	225400000000	INHA5430
TRA	ABC		INHA4880	OCT	226400000000	INHA5440
PZE	MUSCLE		INHA4890	OCT	227400000000	INHA5450
ORGAN6 CLA	**1		INHA4900	OCT	230400000000	INHA5460
TRA	ABC		INHA4910	OCT	231400000000	INHA5470
PZE	LUNG		INHA4920	OCT	232400000000	INHA5480
ORGAN5 CLA	**1		INHA4930	OCT	233400000000	INHA5490
TRA	ABC		INHA4940	OCT	234400000000	INHA5500
PZE	LIVER		INHA4950	OCT	235400000000	INHA5510
ORGAN4 CLA	**1		INHA4960	OCT	236400000000	INHA5520
TRA	ABC		INHA4970	OCT	237400000000	INHA5530
PZE	KIDNEY		INHA4980	OCT	240400000000	INHA5540
ORGAN3 CLA	**1		INHA4990	OCT	241400000000	INHA5550
TRA	ABC		INHA5000	OCT	242400000000	INHA5560
PZE	GI		INHA5010	OCT	243400000000	INHA5570
ORGAN2 CLA	**1		INHA5020	OCT	244400000000	INHA5580
TRA	ABC		INHA5030	OCT	245400000000	INHA5590
PZE	BONE		INHA5040	OCT	246400000000	INHA5600
ORGAN1 CLA	**1		INHA5050	OCT	247400000000	INHA5610
ABC	ADD	#0000000400000	INHA5060	OCT	250400000000	INHA5620
STO	MU		INHA5070	OCT	251400000000	INHA5630
TRA	SCM		INHA5080	OCT	252400000000	INHA5640
ERR	PZE	**	INHA5090	OCT	253400000000	INHA5650
DEF	(SW1,SW2,CNTRL,PLACE),1		INHA5100	OCT	254400000000	INHA5660
FMT1	BCI	9,	INHA5110	OCT	255400000000	INHA5670
BCI	3,N CHAIN NO.	CALCULATED DOSE FOR INGESTID	INHA5120	OCT	256400000000	INHA5680
FMT10	BCI	9,	INHA5130	OCT	257400000000	INHA5690
BCI	1,ON	CALCULATED DOSE FOR INHALATI	INHA5140	OCT	260400000000	INHA5700
FMT12	BCI	9,	INHA5150	OCT	261400000000	INHA5710
BCI	5,TOTAL TIME =	SEC	INHA5160	OCT	262400000000	INHA5720
FMT14	BCI	9,	INHA5170	OCT	263400000000	INHA5730
BCI	THIS DOWNWIND DISTANCE =	DOSE	INHA5180	CONTRL	//	INHA5740
BCI	3, IS TO THE		INHA5190	USE	//	INHA5750
FMT16	BCI	9,	INHA5200	DEF	MTOT,40	INHA5760
FMT18	BCI	9,	INHA5210	DEF	FRACT,1	INHA5770
FMT20	BCI	9,	INHA5220	DEF	(ADD,AK1,AK2,AMEEA,ANSW,BREATH,CMI,CMY,CNTRL,CONV),1	INHA5780
BCI	4, =		INHA5230	DEF	(D,DET,DOTOT,EXTRM,EXX,FISS,G,H,IE,K,LB,LONG,LT,M,MUR),1	INHA5790
FLAG	OCT	543066452527	INHA5232	DEF	(NCW,NEG,NK1,NREG,MU1,ORGAN,PART,POWER,R,SAVE4,SM,T),1	INHA5800
			INHA5234	DEF	(TCY,TCZ,TDEPOS,TEMP,TEMP1,TEMP2,TEMP3,TEMP4),1	INHA5810
			INHA5236	DEF	(TENE,THISD,THISE,THISX,TIM,TINHA,THU,TNU,TOTAL,TOTAL1),1	INHA5820
			INHA5240	DEF	(U,UBAR,V,VE,W1,W2,W3,X,XMAX,XMAXP,XMIN,XMINP,XR4,Y,Z),1	INHA5830
			INHA5250	DEF	(ZE,TRUP,TTROP),3	INHA5840
			INHA5260	DEF	(XK1,A1,KK,VG),4	INHA5850
			INHA5270	DEF	(SUM1,K1,K2,MU,NU),11	INHA5860

THE FOLLOWING IS A TABLE OF POWERS OF TWO, STARTING WITH TWO.

NO	OCT	202400000000
	OCT	203400000000
	OCT	204400000000
	OCT	205400000000

SIBMAP	GAMMA	DECK		GAMM0010	DEF	(ENE,XK,HXKP,HAKP,DOSE,ELB,CZ,CY,STORE,TIME,DIE),25	INHA5870
	ENTRY	GAMMA		GAMM0020	DEF	(SUM,LONGR,CMN,NNM),100	INHA5880
	ENTRY	HXX		GAMM0030	DEF	(MM,BDDY,BONE,GI,KIDNEY,LIVER,LUNG,MUSCLE,TESTES),450	INHA5890
	ENTRY	HAK		GAMM0040	DEF	(THYROID,YIELDN,NPROTH,LONGM,JGASH,HALH,ELEMM,GDHPY),450	INHA5900
* THE FOLLOWING IS THE ENTRY BACK TO THE MAIN ROUTINE, RSAC.				GAMM0050	DEF	(ATOM,GAMEN),450	INHA5910
	EXTERN	DETIN		GAMM0060	DEF	FPI,10000	INHA5920
				GAMM0070	DEF	FPIC,1	INHA5930
				GAMM0080	USE		INHA5940
				GAMM0090	END		INHA5950
				GAMM0100			
				GAMM0110			
				GAMM0120			
				GAMM0130			
				GAMM0140			
				GAMM0150			
				GAMM0160			
				GAMM0170			
				GAMM0180			
				GAMM0190			
				GAMM0200			
				GAMM0210			
				GAMM0220			
				GAMM0230			
				GAMM0240			
				GAMM0250			
				GAMM0260			
				GAMM0270			
				GAMM0280			
				GAMM0290			
				GAMM0300			
				GAMM0310			
				GAMM0320			
				GAMM0330			
				GAMM0340			
				GAMM0350			
				GAMM0360			
				GAMM0370			
				GAMM0380			
				GAMM0390			
				GAMM0400			
				GAMM0410			
				GAMM0420			
				GAMM0430			
				GAMM0440			
				GAMM0450			
				GAMM0460			
				GAMM0470			
				GAMM0480			
				GAMM0490			
				GAMM0500			
				GAMM0510			
				GAMM0520			
				GAMM0530			
				GAMM0540			
				GAMM0550			
				GAMM0560			
				GAMM0570			
				GAMM0580			
				GAMM0590			

IRP	CALLP		GAMM0600	ZERO	DOSE,20.4		GAMM1190
ENDM			GAMM0610	SXA	DIERT,1		GAMM1200
DEF	MACRO	LIST,SIZE	GAMM0620	LDO	W3		GAMM1210
IRP	LIST	LIST	GAMM0630	CLA	THISD		GAMM1220
LIST	BSS	SIZE	GAMM0640	TSL	,EXP3.		GAMM1230
IRP			GAMM0650	LRS	35		GAMM1240
ENDM	DEF		GAMM0660	FMP	TCZ		GAMM1250
			GAMM0670	LRS	35		GAMM1260
ZERO	MACRO	BLOCK,SIZE,T	GAMM0680	FMP	TCZ		GAMM1270
AXT	SIZE,T		GAMM0690	STO	Z		GAMM1280
STZ	BLOCK+1,T		GAMM0700	CAS	=7.0E+5	USE HERMITE CHECK Z.	GAMM1290
TIX	**1,T,1		GAMM0710	TRA	**3	MAYBE	GAMM1300
ENDM	ZERO		GAMM0720	TRA	**2	MAYBE	GAMM1310
			GAMM0730	TRA	**12	YES	GAMM1320
WRITE	MACRO	FMT,COUNT	GAMM0740	LDO	W2		GAMM1330
AXT	0,4		GAMM0750	CLA	THISD		GAMM1340
CAL	FMT,4		GAMM0760	TSL	,EXP3.		GAMM1350
TSL	BCDOU		GAMM0770	LRS	35		GAMM1360
TXI	**1,4,-1		GAMM0780	FMP	TCY		GAMM1370
TXH	**3,4,-COUNT		GAMM0790	LRS	35		GAMM1380
ENDM	WRITE		GAMM0800	FMP	TCY		GAMM1390
SCRIBE	MACRC	FMT,COUNT,OP	GAMM0810	STO	Y		GAMM1400
SXA	**9,4		GAMM0820	CAS	=7.0E+5	USE HERMITE CHECK Y	GAMM1410
TSX	STH,4		GAMM0830	TRA	XGAMMA	NO	GAMM1420
TSL	OP		GAMM0840	TRA	XGAMMA	NO	GAMM1430
WRITE	FMT,COUNT		GAMM0850	LDO	UBAR	YES	GAMM1440
TSX	FIL,4		GAMM0860	FMP	=39.478418	4*(PIE**2)	GAMM1450
AXT	**4		GAMM0870	STO	XMIN		GAMM1460
ENDM	SCRIBE		GAMM0880	CLA	LB		GAMM1470
			GAMM0890	STD	RLOOP5		GAMM1480
END OF	MACRO PACKAGE, BEGINNING OF CODING		GAMM0900	MSP	A1		GAMM1490
GAMMA	AXT	0,1	GAMM0910	CLA	=1000.0		GAMM1500
SCRIBE	FMT13,6,NPG		GAMM0920	CAS	THISD	CHECK SIZE OF DIE, IF LESS THAN 1000	GAMM1510
READ	DECIM,T,0		GAMM0930	TRA	MAIN	LIMITS ARE 0.0 TO 2*D. IF GREATER	GAMM1520
READ	FIXIN,NREG,0		GAMM0940	TRA	**1	OR EQUAL LIMITS ARE D=1000 TO D=10000	GAMM1530
LXA	NREG,4		GAMM0950	STO	XMAX		GAMM1540
NONE	READ	DECIM,(HAKP+1,HXKP+1),4	GAMM0960	CLA	THISD		GAMM1550
TIX	NONE,4,1		GAMM0970	STO	XMAXP		GAMM1560
TSX	STH,4		GAMM0980	TRA	**5		GAMM1570
TSL	SKP		GAMM0990	CLA	THISD		GAMM1580
WRITE	FMT18,4		GAMM1000	STO	XMAX	SET SWITCH TO ADD INTEGRAL FROM	GAMM1590
CLA	T		GAMM1010	MSH	A1	2*D TO D=1000.	GAMM1600
TSL	DTRANP		GAMM1020	AXT	15,4		GAMM1610
TSX	FIL,4		GAMM1030	LDO	LXK+1,4	START INTEGRATION OVER X	GAMM1620
DIEIP	CLA	DIE,1	GAMM1040	FMP	XMAX		GAMM1630
STO	THISD		GAMM1050	FAD	XMAXP		GAMM1640
TSL	DTRANS		GAMM1060	STO	XK+1,4		GAMM1650
SLW	FMT14+6		GAMM1070	FDP	UBAR		GAMM1660
STO	FMT14+7		GAMM1080	STO	TIME+1,4		GAMM1670
CLA	CY,1		GAMM1090	TIX	XLOOP,4,1		GAMM1680
STO	TCY		GAMM1100	STZ	TIMF-15		GAMM1690
CLA	CZ,1		GAMM1110	LXD	NK1,2		GAMM1700
STO	TCZ		GAMM1120	CLA	K1,2		GAMM1710
PXA	,1		GAMM1130	STO	AK1		GAMM1720
ADD	=1		GAMM1140	CLA	K2,2		GAMM1730
TSL	FIXTR		GAMM1150	STO	AK2		GAMM1740
STO	FMT14+4		GAMM1160	MSP	NUI		GAMM1750
SCRIBE	FMT14,8,SKP		GAMM1170	SXA	KLOOP1,2		GAMM1760
			GAMM1180				GAMM1770

USE HERMITE NUMBERS READ IN

GAMM1780		PXA	,1
GAMM1790		ADD	#01
GAMM1800		CAS	IE
GAMM1810		TRA	DETIN
GAMM1820		TRA	DETIN
GAMM1830		TRA	DIELP
GAMM1840	H20	PZE	..
GAMM1850		CLA	NREG
GAMM1860		STO	XR4
GAMM1870		CLA	#024
GAMM1880		STA	NREG
GAMM1890		MSM	TOTAL
GAMM1900		CLA	##7
GAMM1910		STA	UMES20+1
GAMM1920		STA	VMES20+1
GAMM1930		CLA	##5
GAMM1940		STA	NEWV+9
GAMM1950		STA	NEWV+14
GAMM1960		TRA*	H20
GAMM1970		PZE	HXX+1
GAMM1980		PZE	HXX+1
GAMM1990	RECOV	HSP	TOTAL
GAMM2000		MSM	NUI
GAMM2010		CLA	XR4
GAMM2020		STO	NREG
GAMM2030		CLA	##7
GAMM2040		STA	UMES20+1
GAMM2050		STA	VMES20+1
GAMM2060		CLA	##5
GAMM2070		STA	NEWV+9
GAMM2080		STA	NEWV+14
GAMM2090		TRA	KLOOP1-1
GAMM2100		PZE	HXXP+1
GAMM2110		PZE	HAKP+1
GAMM2120	*		
GAMM2130	*	THE FOLLOWING SU	
GAMM2140	*		
GAMM2150	DINCG	STO	X
GAMM2160		SXA	PART,1
GAMM2170		SXA	DINCR,1
GAMM2180		SXA	DINCR+1
GAMM2190		SXA	DINCR+2
GAMM2200		STZ	SUM-2
GAMM2210		LXD	NEG,1
GAMM2220	ELOOP	CLA	ENE,1
GAMM2230		STO	TENE
GAMM2240		CLA	NU,1
GAMM2250		STO	THU
GAMM2260		CLA	MU,1
GAMM2270		STO	THU
GAMM2280		STZ	SUM-1
GAMM2290		CLA	TENE
GAMM2300		TZE	ENDE-2
GAMM2310	UMES20	LXA	NREG,2
GAMM2320		CLA	HXX+1,2
GAMM2330		STO	U
GAMM2340		STZ	SUM
GAMM2350	VMES20	LXA	NREG,4
GAMM2360		CLA	HXX+1,4

NO. GET ANOTHER ONE

THE FOLLOWING SUBROUTINE CALCULATES THE INTEGRAL OVER Y AND Z.

PICK UP WHICH ENERGY GROUP

START INTEGRATION OVER Y.

START INTEGRATION OVER Z.

GAMM2370
GAMM2380
GAMM2390
GAMM2400
GAMM2410
GAMM2420
GAMM2430
GAMM2440
GAMM2450
GAMM2460
GAMM2470
GAMM2480
GAMM2490
GAMM2500
GAMM2510
GAMM2520
GAMM2530
GAMM2540
GAMM2550
GAMM2560
GAMM2570
GAMM2580
GAMM2590
GAMM2600
GAMM2610
GAMM2620
GAMM2630
GAMM2640
GAMM2650
GAMM2660
GAMM2670
GAMM2680
GAMM2690
GAMM2700
GAMM2710
GAMM2720
GAMM2730
GAMM2740
GAMM2750
GAMM2760
GAMM2770
GAMM2780
GAMM2790
GAMM2800
GAMM2810
GAMM2820
GAMM2830
GAMM2840
GAMM2850
GAMM2860
GAMM2870
GAMM2880
GAMM2890
GAMM2900
GAMM2910
GAMM2920

STO	V		GAMM2930	STO	SUM	GAMM3520
CLA	W3		GAMM2940	TIX	VNES20*1,4,1	GAMM3530
FDP	#2,0		GAMM2950	LDQ	SUM	GAMM3540
CLA	X		GAMM2960	FMP	HAK*1,2	GAMM3550
TSL	,EXP3.		GAMM2970	FAD	SUM-1	GAMM3560
STO	TEMP2		GAMM2980	STO	SUM-1	GAMM3570
LDQ	TEMP2		GAMM2990	TIX	UMES20*1,2,1	GAMM3580
FMP	TCZ		GAMM3000	STZ	TEMP3	GAMM3590
STO	TEMP2	CD*(X**1W3/2)	GAMM3010	TSX	KCAL,4	GAMM3600
LDQ	TEMP2		GAMM3020	TSX	GOFX,4	GAMM3610
FMP	V		GAMM3030	STZ	TEMP4	GAMM3620
STO	Z		GAMM3040	AXT	4,4	GAMM3630
HSP	H		GAMM3050	LDQ	SUM1*1,4	GAMM3640
CLA	H		GAMM3060	FMP	KX*1,4	GAMM3650
TNZ	INVER	TEST FOR AN INVERSION LAYER	GAMM3070	FAD	TEMP4	GAMM3660
CLA	Z		GAMM3080	STO	TEMP4	GAMM3670
FAD	SH		GAMM3090	TIX	**4,4,1	GAMM3680
SSP			GAMM3100	LDQ	TEMP4	GAMM3690
STO	ZE		GAMM3110	FMP	SUM-1	GAMM3700
TRA	NEWV		GAMM3120	FAD	SUM-2	GAMM3710
INVER	CLA		GAMM3130	STO	SUM-2	GAMM3720
FAD	SH		GAMM3140	ENDE TIX	ELOOP,1,1	GAMM3730
SSP			GAMM3150	DINCR	AXT	GAMM3740
STO	MTOT*30		GAMM3160	AXT	**1	GAMM3750
INVER0	CAS		GAMM3170	AXT	**2	GAMM3760
TRA	INVER1		GAMM3180	AXT	**4	GAMM3770
TRA	INVER1		GAMM3190	TRA	1,4	GAMM3772
LDQ	#2,0		GAMM3200			GAMM3774
FMP	H		GAMM3210			GAMM3776
STO	MTOT*29		GAMM3220			GAMM3778
CLA	MTOT*30		GAMM3230	XGAMMA	CLA	GAMM3780
CAS	MTOT*29		GAMM3240	STD	RGAMM	GAMM3790
TRA	INVER2		GAMM3250	LDQ	UBAR	GAMM3800
TRA	**1		GAMM3260	FMP	#6,2831853	GAMM3810
FDP	MTOT*29		GAMM3270	LRS	35	GAMM3820
STQ	MTOT*28		GAMM3280	FMP	TCZ	GAMM3830
CLA	MTOT*28		GAMM3290	LRS	35	GAMM3840
UFA	#02330000000000		GAMM3300	FMP	TCY	GAMM3850
FAD	#02000000000000		GAMM3310	STO	XMIN	GAMM3860
FSE	MTOT*28		GAMM3320	CLA	#1000,0	GAMM3870
SSP			GAMM3330	STO	XMAX	GAMM3880
LRS	35		GAMM3340	CLA	TWISD	GAMM3890
FMP	MTOT*29		GAMM3350	STO	XMAXP	GAMM3900
STO	MTOT*30		GAMM3360	AXT	15,4	GAMM3910
TRA	INVER0		GAMM3370	XXLOP	LDQ	GAMM3920
INVER1	CLA		GAMM3380	FMP	LXK*1,4	GAMM3930
STO	MTOT*30		GAMM3390	FAD	XMAXP	GAMM3940
TRA	NEWV		GAMM3400	STO	XK*1,4	GAMM3950
INVER2	CLA		GAMM3410	FDP	UBAR	GAMM3960
FSB	MTOT*29		GAMM3420	STO	TIME*1,4	GAMM3970
STO	ZE		GAMM3430	TIX	XXLOP,4,1	GAMM3980
NEWV	FDP		GAMM3440	STZ	TIME-15	GAMM3990
STO	VE		GAMM3450	LXD	NK1,2	GAMM4000
SXA	**5,4		GAMM3460	XXLOP	CLA	GAMM4010
CALLF	GCAL(X,U,VE)	CALCULATE G(R)	GAMM3470	STO	AK1	GAMM4020
AXT	**4		GAMM3480	CLA	K2,2	GAMM4030
LDQ	G		GAMM3490	STO	AK2	GAMM4040
FMP	HAK*1,4		GAMM3500	SXA	KXLOP1,2	GAMM4050
FAD	SUM		GAMM3510	ZERO	FPIC,10000,4	GAMM4060

CALCULATE FALLOUT
PICK UP THE NUMBER OF DISINTEGRATION

THE ALTERNATE METHOD FOR INTEGRATION OVER Y AND Z IS USED IF THIS ROUTE IS TAKEN.

START INTEGRATION OVER X

```

AXL  AXT  0.3
CLA  NNM,1
CALLP DEC,(FPI,TIME,GEXP,FPIC)
PXD  .1
CAS  MTOT
TRA  **3
TRA  **2
TRA  AXL*1
AXT  15.1
KLOP4 AXT  1.2
CLA  XK*1.1
STO  THISX
RGAMX CLA  ELB*1.2
STO  THISE
CLA  THISX
TSX  DINGX.4
STO  TEMP
LDQ  TEMP
FMP  LAK*1.1
STO  TEMP
LDQ  TEMP
FMP  XMAX
FAD  DOSE*1.2
STO  DOSE*1.2
TXI  **1.2.1
RGAMX TXL  RGAMX.2,**
TIX  XLOP4.1.1
K*LOP1 AXT  **2
TIX  KXLOP.2.1
TRA  DIERT

*
* THE FOLLOWING SUBROUTINE CALCULATES THE INTEGRAL OVER Y AND Z.
* USING POLAR COORDINATES, THE INTEGRAL OVER THETA IS SOLVED
* ANALYTICALLY. THE INTEGRAL OVER RHO IS DONE NUMERICALLY.
*
GINGX STO  X
SXA  PART,1
SXA  DINRX,1
SXA  DINRX*1.2
SXA  DINRX*2.4
STZ  SUM*2
LXD  NEG,1
ELOP CLA  ENE,1
STO  TENE
CLA  NU,1
STO  TNU
CLA  MU,1
STO  TMU
STZ  SUM
CLA  TENE
TZE  EXND*2
VL615 AXT  15.4
LDQ  LKX*1.4
FMP  *500.0
FAD  *500.0
STO  V
LDQ  W1
CLA  X
TSL  ,EXP3.

CALCULATE INTEGRAL OVER Y AND Z.

CALCULATE INTEGRAL OVER RHO.

PICK UP WHICH ENERGY GROUP

THIS SUBROUTINE CALCULATES VALUES OF RHO*G(R)

GAMM4070 STO  TEMP2
GAMM4080 SXA  **4.4
GAMM4090 CALLP GCAL1(X,V)
GAMM4100 AXT  **4
GAMM4110 LDQ  G
GAMM4120 FMP  LAK*1.4
GAMM4130 FDP  TEMP2
GAMM4140 FMP  *500.0
GAMM4150 FAD  SUM
GAMM4160 STO  SUM
GAMM4170 TIX  VLG15*1.4.1
GAMM4180 STZ  TEMP3
GAMM4190 TSX  KCAL,4
GAMM4200 TSX  GOFX,4
GAMM4210 STZ  TEMP4
GAMM4220 AXT  4.4
GAMM4230 LDQ  SUM1*1.4
GAMM4240 FMP  KX*1.4
GAMM4250 FAD  TEMP4
GAMM4260 STO  TEMP4
GAMM4270 TIX  **4.4.1
GAMM4280 LDQ  TEMP4
GAMM4290 FMP  SUM
GAMM4300 FAD  SUM*2
GAMM4310 STO  SUM*2
GAMM4320 EXND TIX  ELOP,1.1
GAMM4330 DINRX AXT  **1
GAMM4340 AXT  **2
GAMM4350 AXT  **4
GAMM4360 STZ  TEMP4
GAMM4362 CLS  SH
GAMM4364 TZE  ZSH
GAMM4366 FDP  Z
GAMM4368 FMP  SH
GAMM4369 STO  TEMP4
GAMM4370 ZSH CLS  THISE
GAMM4380 TZE  **5
GAMM4390 FDP  Y
GAMM4400 FMP  THISE
GAMM4410 FAD  TEMP4
GAMM4420 STO  TEMP4
GAMM4430 CALL  EXP(TEMP4)
GAMM4440 LRS  35
GAMM4450 FMP  SUM*2
GAMM4460 TRA  1.4
GAMM4470 *
GAMM4480 * THIS SUBROUTINE CALCULATES VALUES OF RHO*G(R)
GAMM4490 *
GAMM4500 GCAL1 CLA* 2.4
GAMM4510 STO  MTOT*21
GAMM4520 TNZ  **3
GAMM4530 STZ  G
GAMM4540 TRA  3.4
GAMM4550 CLA* 1.4
GAMM4560 FSB  THISD
GAMM4570 STO  MTOT*22
GAMM4580 LDQ  MTOT*22
GAMM4590 FMP  MTOT*22
GAMM4600 STO  MTOT*22

GAMM4610
GAMM4620
GAMM4630
GAMM4640
GAMM4650
GAMM4660
GAMM4670
GAMM4680
GAMM4690
GAMM4700
GAMM4710
GAMM4720
GAMM4730
GAMM4740
GAMM4750
GAMM4760
GAMM4770
GAMM4780
GAMM4790
GAMM4800
GAMM4810
GAMM4820
GAMM4830
GAMM4840
GAMM4850
GAMM4860
GAMM4870
GAMM4880
GAMM4890
GAMM4900
GAMM4910
GAMM4920
GAMM4930
GAMM4940
GAMM4950
GAMM4960
GAMM4970
GAMM4980
GAMM4990
GAMM5000
GAMM5010
GAMM5020
GAMM5030
GAMM5040
GAMM5050
GAMM5052
GAMM5054
GAMM5056
GAMM5060
GAMM5070
GAMM5080
GAMM5090
GAMM5100
GAMM5110
GAMM5120
GAMM5130
GAMM5140
GAMM5150
GAMM5160

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LDO MTOT*21
FMP MTOT*21
FAD MTOT*22
STO MTOT*22
CALL SORT(MTOT*22)#GCAL1#
STO R
CAS #1.0
TRA GR
LDO TNU
FMP MTOT*21
STO G
TRA 3.4
GR LDO R
FMP THU
STO MUR
FAD #1.0
STO MTOT*25
CLA TENE
LDO #2.4
TSL ,EXP3.
STO MTOT*26
CLA MUR
FDP #7.0
FMP MUR
FDP MTOT*26
STO MTOT*26
CLA MTOT*25
FAD MTOT*26
FDP R
FMP TNU
FDP R
STO MTOT*25
MSH MUR
CALL EXP(MUR)
STO MTOT*26
LDO MTOT*26
FMP MTOT*25
STO G
LDO G
FMP MTOT*21
STO G
TRA 3.4
FMT13 BCI 6,EXTERNAL GAMMA DOSE CALCULATION
FMT14 BCI 8,DOWNWIND DISTANCE NO.
FMT16 BCI 5,CROSSWIND DISTANCE DOSE
FMT18 BCI 4, THE EXPOSURE TIME

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THE FOLLOWING BLOCK OF NUMBERS ARE THE HERMITE POINTS AND
WEIGHTING FACTORS FOR THE 20 POINT INTEGRATION

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DEC 0.46224367
DEC 0.46224367
DEC 0.28667551
DEC 0.28667551
DEC 0.10901721
DEC 0.10901721
DEC 0.24810521E-01
DEC 0.24810521E-01
DEC 0.32437733E-02

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GAMM5170 DEC 0.32437733E-02 GAMM5750
GAMM5180 DEC 0.22833863E-03 GAMM5760
GAMM5190 DEC 0.22833863E-03 GAMM5770
GAMM5200 DEC 0.78025569E-05 GAMM5780
GAMM5210 DEC 0.78025569E-05 GAMM5790
GAMM5220 DEC 0.10860694E-06 GAMM5800
GAMM5230 DEC 0.10860694E-06 GAMM5810
GAMM5240 DEC 0.43993410E-09 GAMM5820
GAMM5250 DEC 0.43993410E-09 GAMM5830
GAMM5260 DEC 0.22293936E-12 GAMM5840
GAMM5270 HAX DEC 0.22293936E-12 GAMM5850
GAMM5280 DEC 0.24534071 GAMM5860
GAMM5290 DEC -.24534071 GAMM5870
GAMM5300 DEC 0.73747373 GAMM5880
GAMM5310 DEC -.73747373 GAMM5890
GAMM5320 DEC 01.2340762 GAMM5900
GAMM5330 DEC -.1.2340762 GAMM5910
GAMM5340 DEC 01.7385377 GAMM5920
GAMM5350 DEC -.1.7385377 GAMM5930
GAMM5360 DEC 02.2549740 GAMM5940
GAMM5370 DEC -.2.2549740 GAMM5950
GAMM5380 DEC 02.7888061 GAMM5960
GAMM5390 DEC -.2.7888061 GAMM5970
GAMM5400 DEC 03.3478546 GAMM5980
GAMM5410 DEC -.3.3478546 GAMM5990
GAMM5420 DEC 03.9447640 GAMM6000
GAMM5430 DEC -.3.9447640 GAMM6010
GAMM5440 DEC 04.6036824 GAMM6020
GAMM5450 DEC -.4.6036824 GAMM6030
GAMM5460 DEC 05.3874809 GAMM6040
GAMM5470 HXX DEC -.5.3874809 GAMM6050
GAMM5480 CONTRL // GAMM6060
GAMM5490 USE // GAMM6070
GAMM5500 DEF MTOT,40 GAMM6080
GAMM5510 DEF FRACT,1 GAMM6090
GAMM5520 DEF (ADD,AK1,AK2,AMBD,ANSH,BREATH,CHI,CHIY,CNTRL,CONV),1 GAMM6100
GAMM5530 DEF (D,DET,DOTOT,EXTRM,EXX,FISS,G,H,IE,K,LB,LONG,LT,M,MUR),1 GAMM6110
GAMM5540 DEF (NCH,NEG,NK1,NREG,NUI,ORGAN,PART,POWER,R,SAVE4,SH,T),1 GAMM6120
GAMM5550 DEF (TCY,TCZ,TDEPOS,TEMP,TEMPO,TEMP1,TEMP2,TEMP3,TEMP4),1 GAMM6130
GAMM5560 DEF (TENE,THISD,THISE,THISX,TIM,TINMA,TMU,TNU,TOTAL,TOTAL1),1 GAMM6140
GAMM5570 DEF (U,UBAR,V,VE,W1,W2,W3,X,XMAX,XMAXP,XMIN,XMINP,XR4,Y,Z),1 GAMM6150
GAMM5580 DEF (ZE,TROP,TTROP),3 GAMM6160
GAMM5590 DEF (XK1,A1,KX,VG),4 GAMM6170
GAMM5600 DEF (SUM1,K1,K2,MU,NU),11 GAMM6180
GAMM5610 DEF (ENE,XK,HXKP,HAKP,DOSE,ELB,CZ,CY,STORE,TIME,DIE),25 GAMM6190
GAMM5620 DEF (SUM,LONGB,CHN,NNW),100 GAMM6200
GAMM5630 DEF (MMH,BODY,BONE,G1,KIDNEY,LIVER,LUNG,MUSCLE,TESTES),450 GAMM6210
GAMM5640 DEF (THYROID,YIELDH,NPROTH,LONGH,JGASH,MALM,ELEMM,GDMFY),450 GAMM6220
GAMM5645 DEF (ATOM,GAMEN),450 GAMM6230
GAMM5650 DEF FPI,10000 GAMM6240
GAMM5660 DEF FPIC,1 GAMM6250
GAMM5670 USE GAMM6260
GAMM5680 END GAMM6270
GAMM5690
GAMM5700
GAMM5710
GAMM5720
GAMM5730
GAMM5740

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**PHILLIPS
PETROLEUM
COMPANY**

ATOMIC ENERGY DIVISION