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PNCT841-78-01(Rev.)

ACRO-A Computer Program for Calculating Organ Doses from Acute or Chronic Inhalation and Ingestion of Radionuclides

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TOKAI WORKS
POWER REACTOR & NUCLEAR FUEL DEVELOPMENT CORPORATION

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Yoshihisa KITAHARA*
Yoichiro KISHIMOTO*
and Kunihiko SHINOHARA*

Abstract

A Computer Program ACRO (PNCT841-78-01) has been revised for the lung model.

A composite organ of the tracheo-bronchial, the pulmonary parenchyma and the pulmonary lymphatic system is used as the new lung model.

The revised ACRO can be completely run by IBM DOS/VS medium computer system.

* Health and Safety Division, Tokai Works

PROGRAM ABSTRACT

1. NAME OR DESIGNATION OF PROGRAM: ACRO
2. COMPUTER FOR WHICH THE PROGRAM IS DESIGNED AND OTHERS UPON WHICH IT IS OPERABLE: IBM 360 and 370
3. NATURE OF PHYSICAL PROBLEM SOLVED: ACRO calculates organ burdens and doses from acute or chronic inhalation and ingestion of radionuclides. The International Commission on Radiological Protection(ICRP) Task Group Lung Model(TGLM) is used as the inhalation model, and a simple one-compartment model is used as the ingestion model.
4. RESTRICTIONS ON THE COMPLEXITY OF THE PROGRAM:
   - ° memory requirements: 260 kilo bytes
   - ° maximum number of the library records : 3000 records
   - ° maximum number of nuclides inputted : 30
   - ° maximum number of organ codes inputted : 30
5. TYPICAL RUNNING TIME : It is necessary about 10 minutes to calculate with the sample input data by IBM 370/115Ⅱ.
6. RELATED AND AUXILIARY PROGRAMS : Non
7. REFERENCES: PNCT843-80-11 (1980) , ACRO - A Computer Program for Calculating Organ Doses from Acute or Chronic Inhalation and Ingestion of Radionuclides.
8. MACHINE REQUIREMENTS: Following hardware components are required;
   - ° disk for three work files, each file reqiures about 170 tracks.
   - ° tape for the data library
   - ° card reader for input
   - ° line printer for output
9. PROGRAMMING LANGUAGE: IBM FORTRAN IV H compiler
10. OPERATING SYSTEM OR MONITOR UNDER WHICH PROGRAM IS EXECUTED: IBM DOS/POWER/VS or IBM OS/MVS
11. NAME AND ESTABLISHMENT OF AUTHOR:

KUNIHIKO SHINOHARA (Power Reactor and Nuclear Fuel Development Corp.,Tokai Works, Health and Safety Division*)
YOICHIRO KISHIMOTO (Power Reactor and Nuclear Fuel Development Corp.,Tokai Works, Health and Safety Division)
and EIETSU TAMURA (IBM, Japan)

* Power Reactor and Nuclear Fuel Development Corporation, Tokai-works, Post No.319-11, Tokai-mura, Ibaraki-ken, Japan

CONTENTS

1. Introduction

The estimation of internal radiation exposure is of considerable importance in radiological protection for both workers and public, because human organs or tissues may be directly exposed to radioactive materials retained in the body for a substantial period.

There are two main routes through which radioactive materials are taken into human body; one is the respiratory tract and the other is the gastro-intestinal tract. The precise estimation of internal exposure requires detailed knowledge on radiological and physiological behaviour of radionuclide in the body, but such estimation can not be generally applied to radiological protection.

About twenty years ago the ICRP* presented a relatively simple dosimetry model and related metabolic data in the report[1] (ICRP Pub.2) in which the maximum permissible concentration and the maximum permissible body burden for workers were calculated. This model and data have still been widely used for radiation protection and regulation purposes.

Following the progress and increase of the knowledge, more precise and detailed models have been developed. The lung dynamics model developed by the ICRP task group on lung dynamics[2] has been applied to make a more precise estimation of internal exposure following the inhalation of radioactive materials. In this model the respiratory tract is devided into four regions, i.e., NP (Naso-Pharyngeal)-, TB (Tracheo-Bronchial)-, P (Pulmonary parenchyma)- and L (the pulmonary lymphatic system)-regions.[3] The lung is defined as a composite organ of TB, P and L regions.

Inhaled materials are deposited in these regions with varying probabilities depending on the particle size.[2] Deposited materials are excreted from the regions to the body fluids and to the gastrointestinal tract (GI tract) or exhaled with different removal rates determined by the solubility.

A computer code ACRO has been developed to estimate the burden and dose to the organs or tissues as a result of inhalation or ingestion of radioactive materials. The ICRP lung dynamics model has been used for the estimation of doses due to inhalation and the ICRP Pub.2 model has been adopted for the estimation of ingestion. A simple four compartment model for the GI-tract has also been applied to compute exposure to the tract.[4]

ACRO is written in IBM FORTRAN (H compiler) and can be run on IBM 360/370 computer.

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* International Commission on Radiological Protection.

Notation for equations found in this article is as follows;

P_0 : the rate at which the radioactive material is taken in, in $\mu Ci \cdot day^{-1}$.

λ^r : the physical decay constant of the radionuclide of interest, in day^{-1}.

λ^b : the biological removal constant for the organ or tissue of interest, in day^{-1}.

λ : the effective removal constant for the organ or tissue of interest, in day^{-1}; $\lambda = \lambda^r + \lambda^b$

f_1 : the fraction of material in the GI tract that reaches to the body fluids.

f_2' : the fraction of material in the body fluids that reaches to the organ or tissue of interest.

f_w : the fraction of material taken into the body by ingestion that reaches to the organ or tissue of interest.

D_k : the fraction of the deposition in the k region of the respiratory tract;

k = 3 --- NP region
k = 4 --- TB region
k = 5 --- P region

f_j : the fraction of material removed from the compartment j.

T_1 : the intake period, in days.

t_1 : the time interval following the start of intake; $t_1 \leq T_1$, in days.

t_2 : the time interval following the termination of intake, in days.

$Q_{1n}(t)$: the quantity of radioactive material in the n-th organ or tissue as a function of time during intake period, in μCi.

$D_{1n}(t)$: the dose commitment to the n-th organ or tissue as a function of time during intake period, in rem.

$Q_{2n}(t)$: the quantity of radioactive material in the n-th organ or tissue as a function of time after the termination of intake, in μCi.

$D_{2n}(t)$: the dose commitment to the n-th organ or tissue as a function of time after the termination of intake, in rem.

M_n : the mass of the n-th organ or tissue, in grams.

E_n : the effective absorbed energy per disintegration for the n-th organ or tissue, in MeV/dis.

2. ICRP Task Group Lung Model

ICRP task group on lung dynamics developed a lung dynamic model (Task Group Lung Model : TGLM) in 1966.[2] As shown in Fig.1, the respiratory tract is devided into four distinct regions that are NP, TB, P and L in the model and each regions is devided two or four parts giving ten compartments.[3],[5] Inhaled materials are transfered to the organs or tissues passing through these compartments with different removal half-time and fraction.[2],[5],[6] The half-time is determined by the solubility of the inhaled materials that are categorized into three classes by the ICRP, i.e., class D for well-soluble, class W for soluble and class Y for insoluble material.[2] The class is dependent on the chemical form of the material. The fractions of deposition in the lung regions depend on the particle diameter of inhaled materials (AMAD : Activity Median Aerodynamic Diameter).[2],[5] The half-lives and the fractions removed from the compartments that have been revised in ICRP Pub. 19[6] are shown in Table 1.

In TGLM the following eight transfer routes are considered;

route 1 : a ⟶ body fluids ⟶ organ

route 2 : b ⟶ GI ⟶ body fluids ⟶ organ

route 3 : c ⟶ body fluids ⟶ organ

route 4 : d ⟶ GI ⟶ body fluids ⟶ organ

route 5 : e ⟶ body fluids ⟶ organ

route 6 : f ⟶ GI ⟶ body fluids ⟶ organ

route 7 : g ⟶ GI ⟶ body fluids ⟶ organ

route 8 : h ⟶ i ⟶ body fluids ⟶ organ

The transfer of inhaled materials through these routes are represented by a system of linear differential equations.

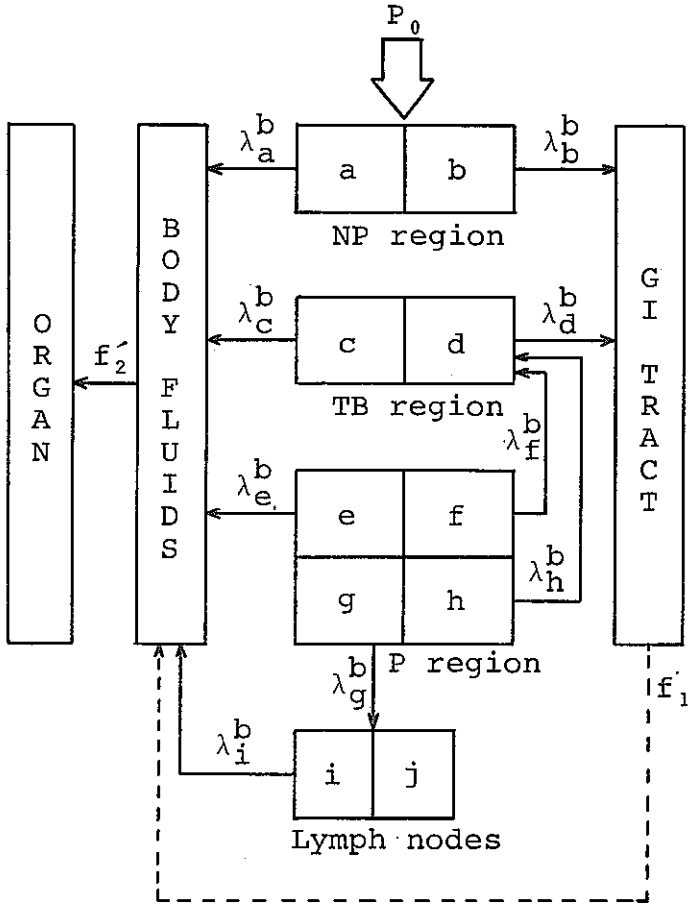


Fig.1. Schematic diagram of ICRP task group lung model[5]

Table 1. Constants for use with ICRP task group lung model[5],[6]

REGION		SOLUBILITY CLASS					
		D		W		Y	
	j[a]	T_j[b]	f_j[c]	T_j	f_j	T_j	f_j
NP	a	0.01	0.5	0.01	0.1	0.01	0.01
	b	0.01	0.5	0.40	0.9	0.4	0.99
TB	c	0.01	0.95	0.01	0.5	0.01	0.01
	d	0.2	0.05	0.2	0.5	0.2	0.99
P	e	0.5	0.8	50	0.15	500	0.05
	f	n.a.[d]	n.a.	1	0.4	1	0.4
	g	n.a.	n.a.	50	0.4	500	0.4
	h	0.5	0.2	50	0.05	500	0.15
L	i	0.5	1	50	1	1,000	0.9
	j	n.a.	n.a.	n.a.	n.a.	∞	0.1

(a). Compartment of respiratory region.
(b). Removal half-time in days.
(c). Fraction removed from region via compartment j.
(d). not applicable.

Intake Period

The dynamic material balance in the compartment j of the region k is expressed in Eq. 1.

$$\frac{dQ_{1jk}(t_1)}{dt_1} = f_j D_k P_0 - \lambda_j Q_{1jk}(t_1) \qquad 1.$$

If $Q_{1jk}(0)=0$, the solution of Eq. 1 is written as follow;

$$Q_{1jk}(t_1) = f_j D_k P_0 \frac{1 - e^{-\lambda_j t_1}}{\lambda_j} \qquad 2.$$

Eq. 2 is the basic equation to calculate the quantity of radioactive material during intake period.

The quantity of radioactive material in the n-th organ or tissue passed through the routes 1, 3 and 5 is computed by Eq. 3.

$$\frac{dQ_{1n}(t_1)}{dt_1} = \lambda_j^b f_2' Q_{1jk}(t_1) - \lambda_n Q_{1n}(t_1) \qquad 3.$$

If $Q_{1n}(0)=0$, then Eq. 4 is derived from Eq. 2 and Eq. 3;

$$Q_{1n}(t_1) = \frac{\lambda_j^b f_2' f_j D_k P_0}{\lambda_j} \left(\frac{1 - e^{-\lambda_n t_1}}{\lambda_n} - \frac{e^{-\lambda_n t_1} - e^{-\lambda_j t_1}}{\lambda_j - \lambda_n} \right) \qquad 4.$$

where j = a for the route 1 (k=3), c for the route 3 (k=4) and e for the route 5 (k=5).

For the routes 2, 4, 6 and 7, the quantity of radioactive material in the n-th organ or tissue is computed by Eq. 5.

$$\frac{dQ_{1n}(t_1)}{dt_1} = \lambda_j^b f_1 f_2' Q_{1jk}(t_1) - \lambda_n Q_{1n}(t_1) \qquad 5.$$

If $Q_{1n}(0)=0$, then Eq. 6 is derived from Eq. 2 and Eq. 5;

$$Q_{1n}(t_1) = \frac{\lambda_j^b f_1 f_2' f_j D_k P_0}{\lambda_j} \left(\frac{1 - e^{-\lambda_n t_1}}{\lambda_n} - \frac{e^{-\lambda_n t_1} - e^{-\lambda_j t_1}}{\lambda_j - \lambda_n} \right) \qquad 6.$$

where j = b for the route 2 (k=3), d for the route 4 (k=4), f for the route 6 (k=5) and g for the route 7 (k=5).

For the route 8, as the pulmonaly lymph nodes (compartment j) lies in the route, two equations are necessary to compute the quantity of radioactive material in the n-th organ or tissue. Eq. 7 is given to compute the quantity;

$$\frac{dQ_{1n}(t_1)}{dt_1} = \lambda_i^b f_2' Q_{1LMi}(t_1) - \lambda_n Q_{1n}(t_1) \qquad 7.$$

where $Q_{1LMi}(t_1)$ represents the quantity of radioactive material in the compartment i. $Q_{1LMi}(t_1)$ is expressed in Eq. 8 and Eq. 9;
For $\lambda_h \neq \lambda_i$, i.e., class Y solubility,

$$Q_{1LMi}(t_1) = \frac{\lambda_h^b f_i f_h D_5 P_0}{\lambda_h}\left(\frac{1-e^{-\lambda_i t_1}}{\lambda_i} - \frac{e^{-\lambda_i t_1}-e^{-\lambda_h t_1}}{\lambda_h-\lambda_i}\right) \qquad 8.$$

For $\lambda_h = \lambda_i$, i.e., class D and W solubilities,

$$Q_{1LMi}(t_1) = \frac{\lambda_h^b f_i f_h D_5 P_0}{\lambda_h}\left(\frac{1-e^{-\lambda_i t_1}}{\lambda_i} - t_1 e^{-\lambda_i t_1}\right) \qquad 9.$$

If $Q_{1n}(0) = 0$ for Eq. 7, then Eq. 10 and Eq. 11 are derived for the route 8 to compute the quantity of radioactive material;
For $\lambda_h \neq \lambda_i$, i.e., class Y solubility,

$$Q_{1n}(t_1) = \frac{\lambda_i^b \lambda_h^b f_i f_h f_2' D_5 P_0}{\lambda_h}\left\{\frac{1}{\lambda_i}\left(\frac{1-e^{-\lambda_n t_1}}{\lambda_n} - \frac{e^{-\lambda_n t_1}-e^{-\lambda_i t_1}}{\lambda_i-\lambda_n}\right)\right.$$
$$\left. - \frac{1}{\lambda_h-\lambda_i}\left(\frac{e^{-\lambda_n t_1}-e^{-\lambda_i t_1}}{\lambda_i-\lambda_n} - \frac{e^{-\lambda_n t_1}-e^{-\lambda_h t_1}}{\lambda_h-\lambda_n}\right)\right\} \qquad 10.$$

For $\lambda_h = \lambda_i$, i.e., class D and W solubilities,

$$Q_{1n}(t_1) = \frac{\lambda_i^b \lambda_h^b f_i f_h f_2' D_5 P_0}{\lambda_h}\left\{\frac{1}{\lambda_i}\left(\frac{1-e^{-\lambda_n t_1}}{\lambda_n} - \frac{e^{-\lambda_n t_1}-e^{-\lambda_i t_1}}{\lambda_i-\lambda_n}\right)\right.$$
$$\left. - \frac{e^{-\lambda_n t_1} - (\lambda_i-\lambda_n)t_1 + 1)e^{-\lambda_i t_1}}{(\lambda_i-\lambda_n)^2}\right\} \qquad 11.$$

Using the preceding equations, the equation to compute the quantity of radioactive material in the n-th organ or tissue as a function of time during inhalation period can be expressed in Eq. 12;

$$Q_{1n}(t_1) = P_0 \sum_{j=a}^{g} f_2' C_j \left(\frac{1-e^{-\lambda_n t_1}}{\lambda_n} - \frac{e^{-\lambda_n t_1}-e^{-\lambda_j t_1}}{\lambda_j-\lambda_n}\right) + L_{1n} \qquad 12.$$

where L_{1n} : the quantity of radioactive material in the n-th organ or tissue passed through the compartment i;
for $\lambda_h \neq \lambda_i$, i.e. class Y solubility,

$$L_{1n} = \text{Eq. 10}$$

for $\lambda_h = \lambda_i$, i.e. class D and W solubilities,

$$L_{1n} = \text{Eq. 11}$$

and

$$C_a = \lambda_a^b f_a D_3/\lambda_a$$
$$C_b = \lambda_b^b f_b f_1 D_3/\lambda_b$$
$$C_c = \lambda_c^b f_c D_4/\lambda_c$$
$$C_d = \lambda_d^b f_d f_1 D_4/\lambda_d$$
$$C_e = \lambda_e^b f_e D_5/\lambda_e$$
$$C_f = \lambda_f^b f_f f_1 D_5/\lambda_f$$
$$C_g = \lambda_g^b f_g f_1 D_5/\lambda_g$$

The quantity of radioactive material in the lung is computed by Eq. 13. The lung is defined as a composite organ of TB, P and L regions in ICRP Pub. 26.[3]

$$Q_{1LUNG}(t_1) = P_0 D_4 \sum_{j=c}^{d} f_j \frac{1-e^{-\lambda_j t_1}}{\lambda_j} + P_0 D_5 \sum_{j=e}^{h} f_j \frac{1-e^{-\lambda_j t_1}}{\lambda_j} + Q_{1LM}(t_1) \quad 13.$$

where $Q_{1LM}(t_1)$: the quantity of radioactive material in the pulmonary lymph nodes (L region);

for $\lambda_h \neq \lambda_i$, i.e., class Y solubility,

$$Q_{1LM}(t_1) = \frac{\lambda_h^b f_i f_h D_5 P_0}{\lambda_h}\left(\frac{1-e^{-\lambda_i t_1}}{\lambda_i} - \frac{e^{-\lambda_i t_1}-e^{-\lambda_h t_1}}{\lambda_h-\lambda_i}\right)$$
$$+\frac{\lambda_h^b (1-f_i) f_h D_5 P_0}{\lambda_h}\left(\frac{1-e^{-\lambda^r t_1}}{\lambda^r} - \frac{e^{-\lambda^r t_1}-e^{-\lambda_h t_1}}{\lambda_h-\lambda^r}\right)$$

for $\lambda_h = \lambda_i$, i.e., class D and W solubilities,

$$Q_{1LM}(t) = \text{Eq. 9}$$

The equation for the calculation of dose to the n-th organ or tissue is expressed in Eq. 14;

$$D_{1n}(t_1) = -\frac{51.15\ E_n}{M_n}\int_0^{t_1} Q_{1n}(t)dt \quad 14.$$

where the constant is a conversion factor;

$$3.7\times10^{4}\left(\frac{\text{dis/sec}}{\mu\text{Ci}}\right)\cdot 1.6\times10^{-6}\left(\frac{\text{erg}}{\text{MeV}}\right)\cdot 10^{-2}\left(\frac{\text{rad}}{\text{erg/g}}\right)\cdot 86400\left(\frac{\text{sec}}{\text{day}}\right)=51.15$$

For $\lambda_h \neq \lambda_i$, i.e., class Y solubility, the dose to the n-th organ or tissue is computed by Eq. 15;

$$D_{1n}(t_1) = 51.15\,\frac{E_n P_0 f_2'}{M_n}\left[\sum_{j=a}^{g} C_j\left\{\frac{t_1 - A_n}{\lambda_n} - \frac{A_n - A_j}{\lambda_j - \lambda_n}\right\} + \frac{C_h}{\lambda_i}\cdot\left\{\frac{t_1 - A_n}{\lambda_n} - \frac{A_n - A_i}{\lambda_i - \lambda_n}\right\} - \frac{C_h}{\lambda_h - \lambda_i}\left\{\frac{A_n - A_i}{\lambda_i - \lambda_n} - \frac{A_n - A_h}{\lambda_h - \lambda_n}\right\}\right] \qquad 15.$$

For $\lambda_h = \lambda_i$, i.e., class D and W solubilities, the dose is computed by Eq. 16;

$$D_{1n}(t_1) = 51.15\,\frac{E_n P_0 f_2'}{M_n}\left[\sum_{j=a}^{g} C_j\left\{\frac{t_1 - A_n}{\lambda_n} - \frac{A_n - A_j}{\lambda_j - \lambda_n}\right\} + \frac{C_h}{\lambda_i}\cdot\left\{\frac{t_1 - A_n}{\lambda_n} - \frac{A_n - A_i}{\lambda_i - \lambda_n}\right\} + \frac{C_h}{(\lambda_i - \lambda_n)^2}\left\{A_i - A_n + \frac{\lambda_i - \lambda_n}{\lambda_i^2}\cdot\left(1 - (\lambda_i t_1 + 1)\cdot e^{-\lambda_i t_1}\right)\right\}\right] \qquad 16.$$

where

$$A_n = (1 - e^{-\lambda_n t_1}) / \lambda_n$$

$$A_h = (1 - e^{-\lambda_h t_1}) / \lambda_h$$

$$A_i = (1 - e^{-\lambda_i t_1}) / \lambda_i$$

$$A_j = (1 - e^{-\lambda_j t_1}) / \lambda_j$$

$$C_h = \frac{\lambda_i^b \lambda_h^b f_i f_h D_5}{\lambda_h}$$

For the lung, the dose is computed by Eq. 17;

$$D_{1LUNG}(t_1) = \frac{51.15 E_{LUNG} P_0}{M_{LUNG}}\left\{D_4 \sum_{j=c}^{d}\frac{f_j(1-A_j)}{\lambda_j} + D_5 \sum_{j=e}^{h}\frac{f_j(1-A_j)}{\lambda_j} + D_{1LM}(t_1)\right\} \qquad 17.$$

where $D_{1LM}(t)$: the contribution from radioactive material deposited in the L region;

for $\lambda_h \neq \lambda_i$, i.e. class Y solubility,

$$D_1LM(t_1) = \frac{D_s f_h}{\lambda_h}\left[f_i\left\{\frac{t_1 - A_i}{\lambda_i} - \frac{A_i - A_h}{\lambda_h - \lambda_i}\right.\right.$$

$$\left.\left. + (1 - f_i)\left\{\frac{t_1 - A_r}{\lambda^r} - \frac{A_r - A_h}{\lambda_h - \lambda^r}\right\}\right]$$

for $\lambda_h = \lambda_i$, i.e. class D and W solubilities,

$$D_1LM(t_1) = \frac{D_s f_h f_i}{\lambda_h}\left\{\frac{t_1 - A_i}{\lambda_i} - \frac{A_i - t_1 e^{-\lambda_i t_1}}{\lambda_i}\right\}$$

E_{LUNG} : the effective absorbed energy per disintegration for the lung, in MeV/dis.

M_{LUNG} : the mass of the lung, in grams.

and

$$A_j = \frac{1 - e^{-\lambda_j t_1}}{\lambda_j}$$

$$A_i = \frac{1 - e^{-\lambda_i t_1}}{\lambda_i}$$

$$A_h = \frac{1 - e^{-\lambda_h t_1}}{\lambda_h}$$

$$A_r = \frac{1 - e^{-\lambda^r t_1}}{\lambda^r}$$

Post-intake Period

For the post-intake period, the quantity of radioactive material in the compartment j of the region k is computed by Eq. 18;

$$Q_{2jk}(t_2) = Q_{1jk}(T_1)e^{-\lambda_j t_2} \qquad 18.$$

where $Q_{2jk}(t_2)$: the quantity of radioactive material in the compartment j of the region k at a time t_2 following the termination of intake.

and

$$Q_{1jk}(T_1) = f_j D_k P_0 \frac{1 - e^{-\lambda_j T_1}}{\lambda_j} \qquad 19.$$

After the termination of inhalation, i.e., $P_0 = 0$, the burden to NP, TB and P regions begins to decrease at once. While the burden to the n-th organ or tissue decreases more slowly because the supply of radioactive material from the respiratory tract is continued by the time that the burden to the tract is throughly removed.

Therefore, to evaluate the burden to the n-th organ or tissue, preceding eight transfer routes must be considered again.

For the routes 1, 3 and 5, the quantity during post-intake period is computed by Eq. 20;

$$\frac{dQ_{2n}(t_2)}{dt_2} = f_2' \lambda_j^b Q_{2jk}(t_2) - \lambda_n Q_{2n}(t_2) \qquad 20.$$

If $Q_{2n}(0) = 0$, then Eq. 21 is derived from Eq. 18 and Eq. 20;

$$Q_{2n}(t_2) = \frac{f_2' \lambda_j^b Q_{1jk}(T_1)}{\lambda_j - \lambda_n} (e^{-\lambda_n t_2} - e^{-\lambda_j t_2}) \qquad 21.$$

where j = a for the route 1 (k = 3), c for the route 3 (k = 4) and e for the route 5 (k = 5).

For thr routes 2,4,6 and 7, Eq. 22 is given;

$$\frac{dQ_{2n}(t_2)}{dt_2} = f_1 f_2' \lambda_j^b Q_{2jk}(t_2) - \lambda_n Q_{2n}(t_2) \qquad 22.$$

If $Q_{2n}(0) = 0$, then Eq. 23 is derived from Eq. 18 and Eq. 22;

$$Q_{2n}(t_2) = \frac{f_1 f_2' \lambda_j^b Q_{1jk}(T_1)}{\lambda_j - \lambda_n} (e^{-\lambda_n t_2} - e^{-\lambda_j t_2}) \qquad 23.$$

where j = b for the route 2 (k = 3), d for the route 4 (k = 4), f for the route 6(k = 5) and g for the route 7(k = 5).

For the route 8, the following two cases must be considered;

route 8 : h ⟶ i ⟶ body fluids ⟶ organ

route 8': i ⟶ body fluids ⟶ organ

For the route 8', Eq. 24 is derived;

$$\frac{dQ_{2n}(t_2)}{dt_2} = f_2'\lambda_i^b Q_{2LMi}(t_2) - \lambda_n Q_{2n}(t_2) \qquad 24.$$

where $Q_{2LMi}(t_2)$: the quantity of radioactive material in the compartment i of the L region after the termination of intake.

$$Q_{2LMi}(t_2) = Q_{1LMi}(T_1)e^{-\lambda_i t_2}$$

If $Q_{2n}(0) = 0$, then Eq. 25 is derived for the route 8';

$$Q_{2n}(t_2) = f_2'\lambda_i^b Q_{1LMi}(T_1)\frac{e^{-\lambda_i t_2} - e^{-\lambda_n t_2}}{\lambda_n - \lambda_i} \qquad 25.$$

where

if $\lambda_h \neq \lambda_i$, i.e., class Y solubility,

$$Q_{1LMi}(T_1) = \frac{\lambda_h^b f_i f_h D_5 P_0}{\lambda_h}\left(\frac{1-e^{-\lambda_i T_1}}{\lambda_i} - \frac{e^{-\lambda_i T_1} - e^{-\lambda_n T_1}}{\lambda_n - \lambda_i}\right) \qquad 26.$$

if $\lambda_h = \lambda_i$, i.e., class D and W solubilities,

$$Q_{1LMi}(T_1) = \frac{\lambda_h^b f_i f_h D_5 P_0}{\lambda_h}\left(\frac{1-e^{-\lambda_i T_1}}{\lambda_i} - T_1 e^{-\lambda_i T_1}\right) \qquad 27.$$

For the route 8, Eq. 28 and Eq. 29 are derived;

$$\frac{dQ_{2LMi}(t_2)}{dt_2} = \lambda_h^b f_i Q_{2h_5}(t_2) - \lambda_i Q_{2LMi}(t_2) \qquad 28.$$

$$\frac{dQ_{2n}(t_2)}{dt_2} = \lambda_i^b f_2' Q_{2LMi}(t_2) - \lambda_n Q_{2n}(t_2) \qquad 29.$$

where $Q_{2h_5}(t_2)$: the burden to the compartment h of the region 5 (P) after the intake period.

$$Q_{2h_5}(t_2) = Q_{1h_5}(T_1)e^{-\lambda_h t_2}$$

and

$$Q_{1h_5}(T_1) = f_h D_5 P_0 \frac{1-e^{-\lambda_h T_1}}{\lambda_h}$$

From Eq. 28,

if $\lambda_h \neq \lambda_i$, i.e. class Y solubility,

$$Q_{2LMi}(t_2) = \frac{f_i \lambda_h^b Q_{1h_5}(T_1)}{\lambda_h - \lambda_i}(e^{-\lambda_i t_2} - e^{-\lambda_h t_2}) \qquad 30.$$

if $\lambda_h = \lambda_i$, i.e. class D and W solubilities,

$$Q_{2LMi}(t_2) = f_i \lambda_h^b Q_{1hs}(T_1) t_2 e^{-\lambda_i t_2} \qquad 31.$$

Using Eq. 30 and Eq. 31, Eq. 32 and Eq. 33 are derived from Eq. 29 to compute the route 8;
If $\lambda_h \neq \lambda_i$, i.e., class Y solubility,

$$Q_{2n}(t_2) = \frac{f_2' f_i \lambda_h^b \lambda_i^b Q_{1hs}(T_1)}{\lambda_h - \lambda_i} \left(\frac{e^{-\lambda_n t_2} - e^{-\lambda_i t_2}}{\lambda_i - \lambda_n} - \frac{e^{-\lambda_n t_2} - e^{-\lambda_h t_2}}{\lambda_h - \lambda_n} \right) \qquad 32.$$

If $\lambda_h = \lambda_i$, i.e., class D and W solubilities,

$$Q_{2n}(t_2) = f_2' f_i \lambda_i^b \lambda_h^b Q_{1hs}(T_1) \frac{[e^{-\lambda_n t_2} - \{(\lambda_i - \lambda_n) t_2 + 1\} e^{-\lambda_i t_2}]}{(\lambda_i - \lambda_n)^2} \qquad 33.$$

Using the preceding equations, the equation to compute the quantity of radioactive material in the n-th organ or tissue as a function of time (t_2) after the termination of intake can be expressed in Eq. 34 and Eq. 35;
If $\lambda_h \neq \lambda_i$, i.e., class Y solubility,

$$Q_{2n}(t_2) = Q_{1n}(T_1) e^{-\lambda_n t_2} + f_2' \lambda_i^b Q_{1LMi}(T_1) \frac{e^{-\lambda_i t_2} - e^{-\lambda_n t_2}}{\lambda_n - \lambda_i}$$

$$+ f_2' \left[\sum_{j=a}^{g} \frac{C_j'}{\lambda_j - \lambda_n} (e^{-\lambda_n t_2} - e^{-\lambda_j t_2}) \right.$$

$$\left. + \frac{C_h'}{\lambda_h - \lambda_i} \left\{ \frac{e^{-\lambda_n t_2} - e^{-\lambda_i t_2}}{\lambda_i - \lambda_n} - \frac{e^{-\lambda_n t_2} - e^{-\lambda_h t_2}}{\lambda_h - \lambda_n} \right\} \right] \qquad 34.$$

If $\lambda_h = \lambda_i$, i.e., class D and W solubilities,

$$Q_{2n}(t_2) = Q_{1n}(T_1) e^{-\lambda_n t_2} + f_2' \lambda_i^b Q_{1LMi}(T_1) \frac{e^{-\lambda_i t_2} - e^{-\lambda_n t_2}}{\lambda_n - \lambda_i}$$

$$+ f_2' \left[\sum_{j=a}^{g} \frac{C_j'}{\lambda_j - \lambda_n} (e^{-\lambda_n t_2} - e^{-\lambda_j t_2}) \right.$$

$$\left. + \frac{C_h'}{(\lambda_i - \lambda_n)^2} \left\{ e^{-\lambda_n t_2} - \{(\lambda_i - \lambda_n) t_2 + 1\} e^{-\lambda_i t_2} \right\} \right] \qquad 35.$$

where

$$C'_a = \lambda_a^b Q_{1a_3}(T_1)$$

$$C'_b = \lambda_b^b Q_{1b_3}(T_1) f_1$$

$$C'_c = \lambda_c^b Q_{1c_4}(T_1)$$

$$C'_d = \lambda_d^b Q_{1d_4}(T_1) f_1$$

$$C'_e = \lambda_e^b Q_{1e_5}(T_1)$$

$$C'_f = \lambda_f^b Q_{1f_5}(T_1) f_1$$

$$C'_g = \lambda_g^b Q_{1g_5}(T_1) f_1$$

$$C'_h = \lambda_h^b Q_{1h_5}(T_1) f_1 \lambda_i^b$$

and

$$Q_{1LMi}(T_1) = \text{Eq. 26 for } \lambda_h \neq \lambda_i$$

$$Q_{1LMi}(T_1) = \text{Eq. 27 for } \lambda_h = \lambda_i$$

For the lung, the equation to compute the burden of radioactive materials is described by Eq. 36;

$$Q_{2LUNG}(t_2) = \sum_{j=c}^{d} Q_{1j_4}(T_1) e^{-\lambda_j t_2} + \sum_{j=e}^{h} Q_{1j_5}(T_1) e^{-\lambda_j t_2} + Q_{2LM}(t_2) \quad 36.$$

where $Q_{1j_4}(T_1)$: the burden of radioactive materials to the compartment j of the TB region at the termination of intake, in μCi.

$$Q_{1j_4}(T_1) = f_j D_4 P_0 \frac{1 - e^{-\lambda_j T_1}}{\lambda_j}$$

$Q_{1j_5}(T_1)$: the burden of radioactive materials to the compartment j of the P region at the termination of intake, in μCi.

$$Q_{1j_5}(T_1) = f_j D_5 P_0 \frac{1 - e^{-\lambda_j T_1}}{\lambda_j}$$

and $Q_{2LM}(t_2)$: the burden of radioactive materials to the pulmonary lymph nodes after the termination of intake, in μCi.

if $\lambda_h \neq \lambda_i$, i.e., class Y solubility,

$$Q_2LM(t_2) = Q_1h_5(T_1)\ f_i\lambda_h^b \frac{e^{-\lambda_i t_2} - e^{-\lambda_h t_2}}{\lambda_h - \lambda_i}$$

$$+ \frac{P_0 D_5 f_h f_i \lambda_h^b}{\lambda_h}\left(\frac{1 - e^{-\lambda_i T_1}}{\lambda_i} - \frac{e^{-\lambda_i T_1} - e^{-\lambda_h T_1}}{\lambda_h - \lambda_i}\right)e^{-\lambda_i t_2}$$

$$+ Q_1h_5(T_1)\ (1 - f_i)\ \lambda_h^b \frac{e^{-\lambda^r t_2} - e^{-\lambda_h t_2}}{\lambda_h - \lambda^r}$$

$$+ \frac{P_0 D_5 f_h (1 - f_i) \lambda_h^b}{\lambda_h}\left(\frac{1 - e^{-\lambda^r T_1}}{\lambda^r} - \frac{e^{-\lambda^r T_1} - e^{-\lambda_h T_1}}{\lambda_h - \lambda^r}\right)e^{-\lambda^r t_2}$$

if $\lambda_h = \lambda_i$, i.e., class D and W solubilities,

$$Q_2LM(t_2) = f_i\lambda_h^b P_0 D_5 f_h \frac{1 - e^{-\lambda_h T_1}}{\lambda_h} t_2 e^{-\lambda_i t_2}$$

$$+ \frac{P_0 D_5 \lambda_h^b f_h f_i}{\lambda_h}\left(\frac{1 - e^{-\lambda_i T_1}}{\lambda_i} - T_1 e^{-\lambda_i T_1}\right)e^{-\lambda_i t_2}$$

The dose to the n-th organ or tissue is computed by Eq. 37 and Eq. 38;

$$D_{2n}(t_2) = 51.15 \frac{E_n}{M_n}\left[Q_{1n}(T_1)B_n + f_2'\left\{\frac{\lambda_i^b Q_{1LMi}(T_1)}{\lambda_n - \lambda_i}\ (B_i - B_n)\right.\right.$$

$$\left.\left. + G\left(\frac{B_n - B_i}{\lambda_i - \lambda_n} - Z\right) + \sum_{j=a}^{g} \frac{C_j'}{\lambda_j - \lambda_n}(B_n - B_j)\right\}\right] \qquad 37.$$

$$D_n(t_2) = D_{1n}(T_1) + D_{2n}(t_2) \qquad 38.$$

where

$$B_n = \frac{1 - e^{-\lambda_n t_2}}{\lambda_n}$$

$$B_h = \frac{1 - e^{-\lambda_h t_2}}{\lambda_h}$$

$$B_i = \frac{1 - e^{-\lambda_i t_2}}{\lambda_i}$$

$$B_j = \frac{1 - e^{-\lambda_j t_2}}{\lambda_j} .$$

and if $\lambda_h \neq \lambda_i$, i.e., class Y solubility,

$D_{1n}(T_1)$ = Eq. 15

$Q_{1n}(T_1)$ = Eq. 10

$Q_{1LMi}(T_1)$ = Eq. 8

$$G = \frac{C_h'}{\lambda_h - \lambda_i}$$

$$Z = \frac{B_n - B_h}{\lambda_h - \lambda_n}$$

if $\lambda_h = \lambda_i$, i.e., class D and W solubilities,

$D_{1n}(T_1)$ = Eq. 16

$Q_{1n}(T_1)$ = Eq. 10

$Q_{1LMi}(T_1)$ = Eq. 9

$$G = \frac{C_h'}{\lambda_i - \lambda_n}, \quad Z = \frac{1}{\lambda_i^2}\left\{1 - (\lambda_i t_2 + 1)e^{-\lambda_i t_2}\right\}$$

For the lung, the dose is computed by Eq. 39 and Eq. 40;

$$D_{2LUNG}(t_2) = 51.15 \frac{E_{LUNG} P_0}{M_{LUNG}} \left\{ \sum_{j=c}^{d} f_j \frac{1 - e^{-\lambda_j t_2}}{\lambda_j} B_j + \sum_{j=e}^{h} f_j \frac{1 - e^{-\lambda_j t_2}}{\lambda_j} B_j + D_{2LM}(t_2) \right\} \quad 39.$$

$$D_{LUNG}(t_2) = D_{1LUNG}(T_1) + D_{2LUNG}(t_2) \quad 40.$$

where $D_{2LM}(t_2)$: the dose to the L region;

if $\lambda_h \neq \lambda_i$, i.e., class Y solubility,

$$D_{2LM}(t_2) = D_5 f_h \frac{1 - e^{-\lambda_h T_1}}{\lambda_h} \left\{ f_i \lambda_h^b \frac{B_i - B_h}{\lambda_h - \lambda_i} + (1 - f_i)\lambda_h^b \frac{B_r - B_h}{\lambda_h - \lambda^r} \right\}$$

$$+ \frac{D_5 f_h \lambda_h^b}{\lambda_h} \left[f_i \left\{ \left(\frac{1 - e^{-\lambda_i T_1}}{\lambda_i} - \frac{e^{-\lambda_i T_1} - e^{-\lambda_h T_1}}{\lambda_h - \lambda_i} \right) \frac{1 - e^{-\lambda_i T_1}}{\lambda_i} \right\} \right.$$

$$\left. + (1 - f_i) \left\{ \left(\frac{1 - e^{-\lambda^r T_1}}{\lambda^r} - \frac{e^{-\lambda^r T_1} - e^{-\lambda_h T_1}}{\lambda_h - \lambda^r} \right) \frac{1 - e^{-\lambda^r T_1}}{\lambda^r} \right\} \right]$$

if $\lambda_h = \lambda_i$, i.e., class D and W solubilities,

$$D_2LM(t_2) = \frac{D_5 f_h f_i \lambda_h^b}{\lambda_h}\left(\frac{1-e^{-\lambda_i t_2}}{\lambda_i} - t_2 e^{-\lambda_i t_2}\right)\frac{1-e^{-\lambda_i T_1}}{\lambda_i} + \frac{D_5 f_h f_i \lambda_h^b}{\lambda_h}\left(\frac{1-e^{-\lambda_i T_1}}{\lambda_i} - T_1 e^{-\lambda_i T_1}\right)\frac{1-e^{-\lambda_i t_2}}{\lambda_i}$$

and

$$B_j = \frac{1-e^{-\lambda_j t_2}}{\lambda_j}$$

$$B_h = \frac{1-e^{-\lambda_h t_2}}{\lambda_h}$$

$$B_i = \frac{1-e^{-\lambda_i t_2}}{\lambda_i}$$

$$B_r = \frac{1-e^{-\lambda^r t_2}}{\lambda^r}$$

3. GI-tract Model

A four-compartment model that is shown in Fig. 2 is used to evaluate the internal exposure to the GI-tract. The GI-tract has been considered as an organ that consists of four distinct compartments, i.e., the stomach, the small intestine, the upper large intestine and the lower large intestine, in the model.[1],[3] Material that enters the GI-tract through the stomach passes these compartments in turn and the absorption into the body fluids occurs only at the small intestine.

The GI-tract model programmed in ACRO has referred to REDIQ code of BNWL.[4] The ICRP has presented a new GI-model in ICRP Pub. 30,[5] so that the model of ACRO may be reformed to the new model.

To determine the quantity of radioactive material reaching to the GI-tract from the compartment j of the region k of the respiratory tract, it is necessary to know the burden of radioactive material to the compartment b, d, f and g.

Equations found in this chapter have refered to REDIQ code.[4]

Intake Period

The total transfered quantity of radioactive material during intake period is computed by Eq. 41;

$$Q_{1G}(t_1) = P_0 \sum_{j=b,c,d,g} C_j \left(t_1 - \frac{1 - e^{-\lambda j t_1}}{\lambda_j} \right) \qquad 41.$$

where

$$C_j = \frac{\lambda_j^b f_j D_k}{\lambda_j}$$

Post-intake Period

The total quantity of radioactive material reaches to the GI-tract after the termination of intake is computed by Eq. 42;

$$Q_{2G}(t_2) = P_0 \sum_{j=b,c,d,g} \frac{C_j}{\lambda_j} (1 - e^{-\lambda j T_1})(1 - e^{-\lambda j t_2}) \qquad 42.$$

The total quantity of radioactive material transfered to GI-tract at a time after the start of intake is computed by Eq. 43;

$$Q_G(t) = Q_{1G}(t) + Q_{2G}(t) \qquad 43.$$

where t : the elapsed time from the start of intake, in day.

Equations to compute the dose to the GI-tract are expressed as follows;

Stomach (S)

$$D_S = 25.57 \frac{E_S Q_G}{m_s} \left(\frac{1 - e^{-\lambda^r \tau_s}}{\lambda^r} \right) \qquad 44.$$

where D_S : the dose commitment to the stomach, in rem.

E_S : the effective absorbed energy for the stomach, in MeV/dis.

m_S : the mass of contents in the stomach, in grams.

τ_S : the residence time in the stomach, in days.

and the constant is the conversion factor;

$$\frac{1}{2} \cdot 3.7\times10^4 \left(\frac{\text{dis/sec}}{\mu\text{Ci}}\right) \cdot 1.6\times10^{-6} \left(\frac{\text{erg}}{\text{MeV}}\right) \cdot 10^{-2} \left(\frac{\text{rad}}{\text{erg/g}}\right) \cdot 86400 \left(\frac{\text{sec}}{\text{day}}\right) = 25.57$$

Small Intestine (SI)

$$D_{SI} = 25.57 \frac{E_{SI} Q_G}{m_{SI}} e^{-\lambda^r \tau_s} \left(\frac{1 - e^{-\lambda_{SI} \tau_{SI}}}{\lambda_{SI}} \right) \qquad 45.$$

where D_{SI} : the dose commitment to the small intestine, in rem.

E_{SI} : the effective absorbed energy for the small intestine, in MeV/dis.

m_{SI} : the mass of contents in the small intestine, in grams.

τ_{SI} : the residence time in the small intestine, in days.

$e^{-\lambda^r \tau_s}$: the decay in passing through the stomach.

and λ_{SI} : the effective removal constant, in day^{-1}.

$$\lambda_{SI} = \lambda^r + \lambda_a$$

The removal constant, λ_a, is expressed as follow;

$$\lambda_a = \frac{1}{\tau_{SI}} \ln \frac{1}{1 - f_1}$$

f_1 must be less than unity in the formula. If f_1=1, then it is set to 0.95 in ACRO code according to REDIQ code.

Upper Large Intestine (ULI)

The amount of material is reduced by decay in passing through the S and SI and by absorption in the SI.

The equation to compute the dose is expressed as follow;

$$D_{ULI} = 25.57 \tau_{ULI} e^{-\lambda^r (\tau_S + \tau_{SI})} \frac{E_{ULI} Q_G}{m_{ULI}} (1 - f_1) \qquad 46.$$

where D_{ULI} : the dose commitment to the upper large intestine, in rem.

E_{ULI} : the effective absorbed energy for the upper large intestine, in MeV/dis.

m_{ULI} : the mass of contents in the upper large intestine, in grams.

τ_{ULI} : the residence time in the upper large intestine, in days.

$e^{-\lambda^r(\tau_S+\tau_{SI})}$: the decay in passing the stomach and the small intestine, in day^{-1}.

Lower Large Intestine

$$D_{LLI} = 25.57\tau_{LLI}e^{-\lambda^r(\tau_S+\tau_{SI}+\tau_{ULI})}\frac{E_{LLI}Q_G}{m_{LLI}}(1-f_1) \quad 47.$$

where D_{LLI} : the dose to the lower large intestine, in rem.

E_{LLI} : the effective absorbed energy for the lower large intestine, in MeV/dis.

m_{LLI} : the mass of contents in the lower large intestine, in grams.

τ_{LLI} : the residence time in the lower large intestine, in days.

$e^{-\lambda^r(\tau_S+\tau_{SI}+\tau_{ULI})}$: the decay in passing through the stomach, the small intestine and the upper large intestine.

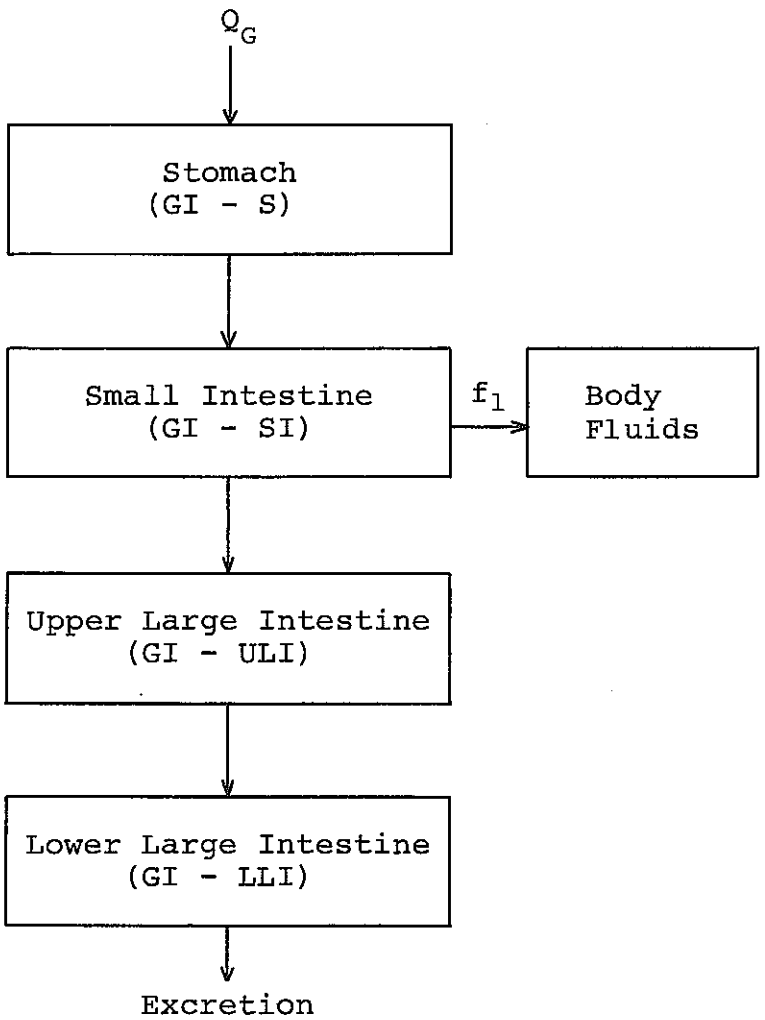


Fig. 2 Schematic diagram of[4] GI-tract

Table 2. Constants for use with GI-tract model[5]

COMPARTMENT	RESIDENCE TIME (DAYS)	TIME TO REACH (DAYS)
GI - S	1 / 24	-
GI - SI	4 / 24	1 / 24
GI - ULI	13 / 24	5 / 24
GI - LLI	24 / 24	18 / 24

4. Ingestion Model

A simple model of ICRP Pub. 2 is used to evaluate the burden and dose to the n-th organ or tissue by ingestion of radioactive material.

Equations are given for both acute and chronic ingestions.

Acute Single Intake

For a single ingestion, the quantity of radioactive material in the n-th organ or tissue is computed by Eq. 48;

$$\frac{dQ_n(t)}{dt} = -\lambda_n Q_n(t) \qquad 48.$$

If $Q_n(0) = 0$

$$Q_n(t) = Q_0 f_w e^{-\lambda_n t} \qquad 49.$$

where Q_0 : the total quantity of ingested radioactive material, in μCi.

The integrated dose to the n-th organ or tissue is computed by Eq. 50;

$$D_n(t) = 51.15 \frac{E_n}{M_n} Q_0 f_w \frac{1 - e^{-\lambda_n t}}{\lambda_n} \qquad 50.$$

where

$$\lambda_n = \lambda^r + \lambda_n^b$$

The dose to the GI-tract can be computed by Eq. 44 - Eq. 47 where Q_G is set to Q_0.

Chronic Intake

For chronic ingestion, the intake rate is defined as follow;

$$P_0 = \frac{Q_0}{T_1}$$

The quantity of radioactive material in the n-th organ or tissue during intake period is computed by Eq. 51;

$$\frac{dQ_{1n}(t_1)}{dt_1} = P_0 f_w - \lambda_n Q_{1n}(t_2) \qquad 51.$$

If $Q_{1n}(0) = 0$,

$$Q_{1n}(t_1) = P_0 f_w \frac{1 - e^{-\lambda_n t_1}}{\lambda_n} \qquad 52.$$

The dose to the n-th organ or tissue during intake period is computed by Eq. 53;

$$D_{1n}(t_1) = 51.15 P_0 f_w \frac{E_n}{M_n} \left(t_1 - \frac{1 - e^{-\lambda_n t_1}}{\lambda_n} \right) \qquad 53.$$

The quantity of radioactive material in the n-th organ or tissue after the termination of intake is computed by Eq. 54;

$$Q_{2n}(t_2) = Q_{1n}(T_1)e^{-\lambda_n t_2} \qquad 54.$$

The dose is also computed by Eq. 55;

$$D_{2n}(t_2) = 51.15P_0 f_w \frac{E_n}{M_n}\left(\frac{1-e^{-\lambda_n T_1}}{\lambda_n}\right)\frac{1-e^{-\lambda_n t_2}}{\lambda_n} \qquad 55.$$

$$D_n(t_2) = D_{1n}(T_1) + D_{2n}(t_2) \qquad 56.$$

The dose for the GI-tract is computed by Eq. 44 - Eq. 47, where Q_G is set as follow;

$$Q_G = P_0 t_1$$

5. Descriptions of the Program

Program ACRO is written in IBM FORTRAN H compiler and run by IBM 360/370 computer.

The program structure of ACRO is shown in Fig. 3, and the extended descriptions are given using the following HIPO* work sheets.

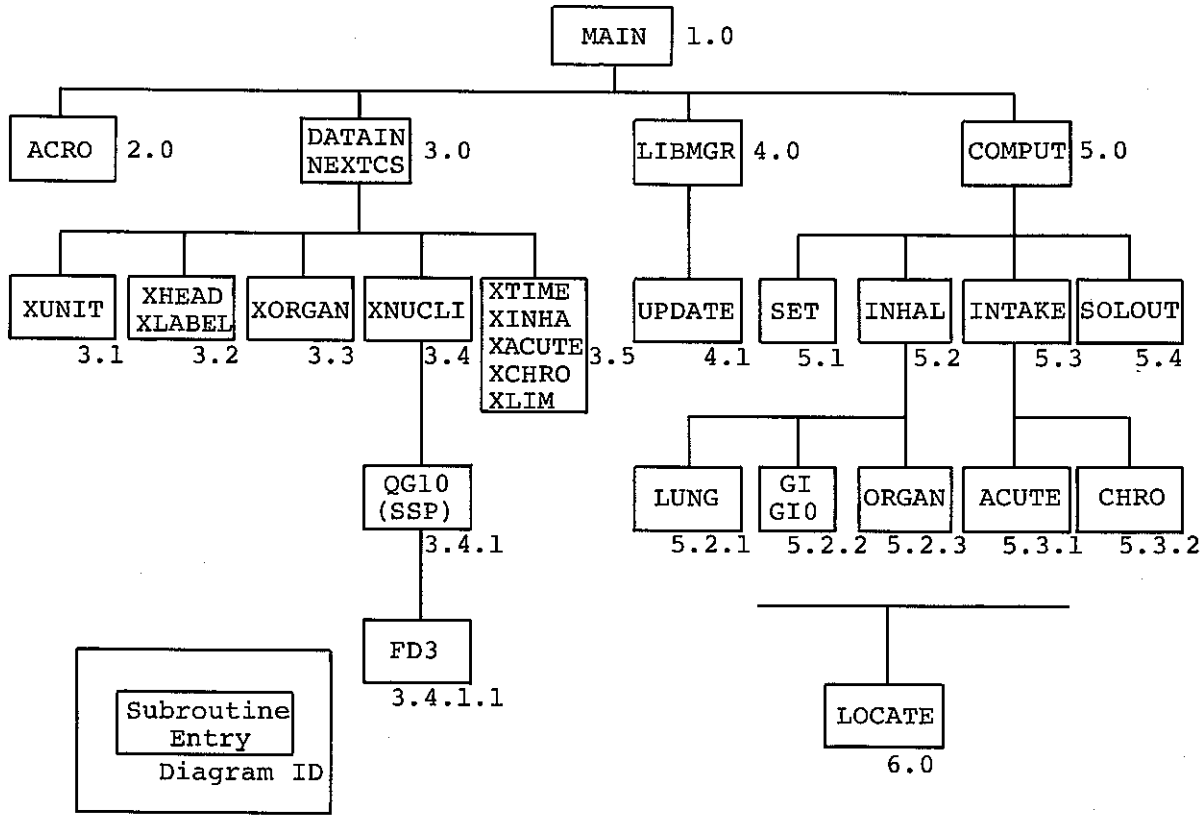


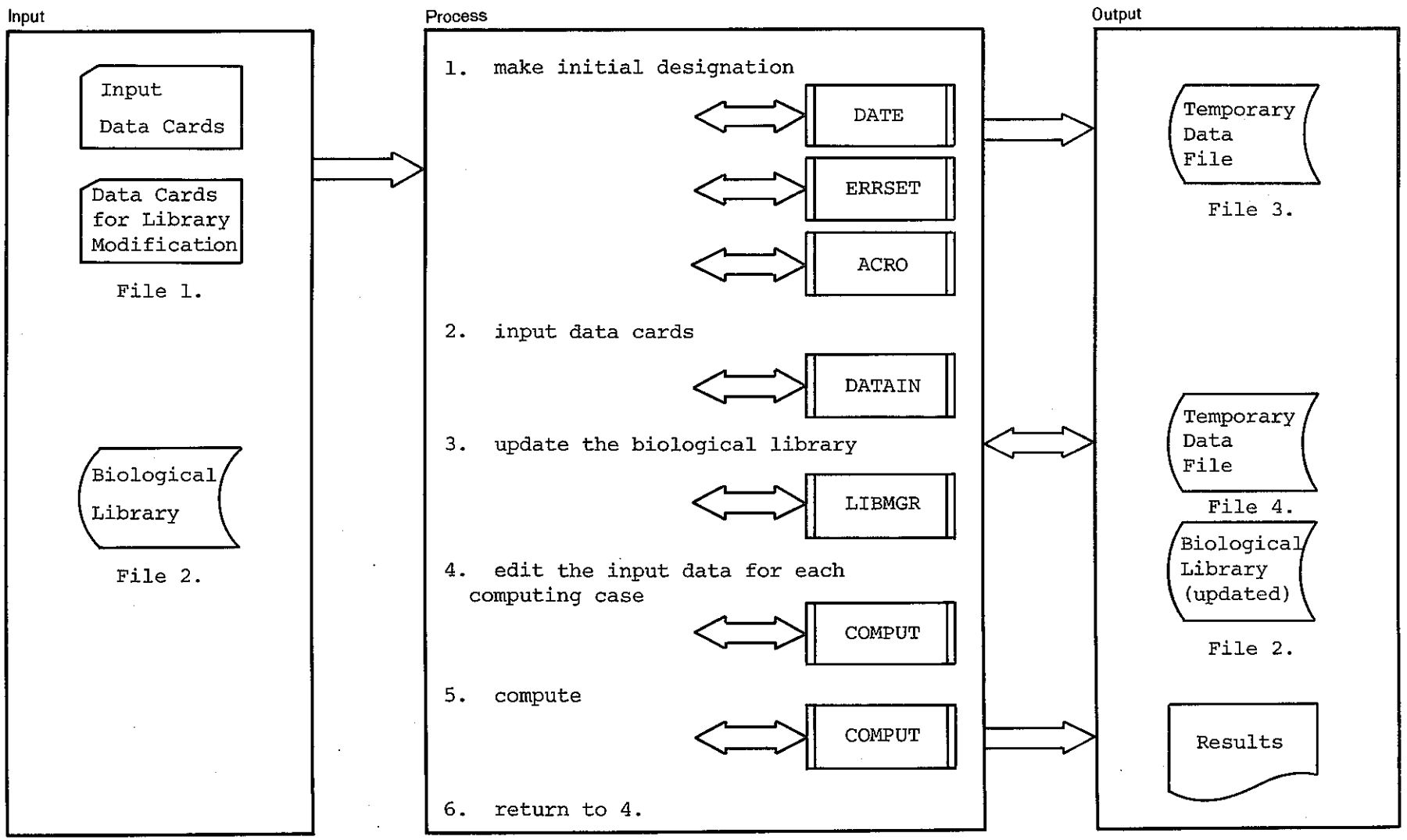
Fig. 3 Program Structure of ACRO

* HIPO : Hierarchical Input Process Output

HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 1 of 16

Diagram ID: 1.0 Name: ACRO main Description: _____



Extended Description

Notes			Ref.
1. File 1., File 2. and File 3. are card image files. 2. The specifications of File 4. are LRECL = 89 BLKSIZE = 8900 RECFM = FB 3. File 4. is necessary only when the biological library are updated. 4. Functions of subroutines for initialization. DATE gives the date of computation. ERRSET eliminates underflows. ACRO prints the cover of output listing.			

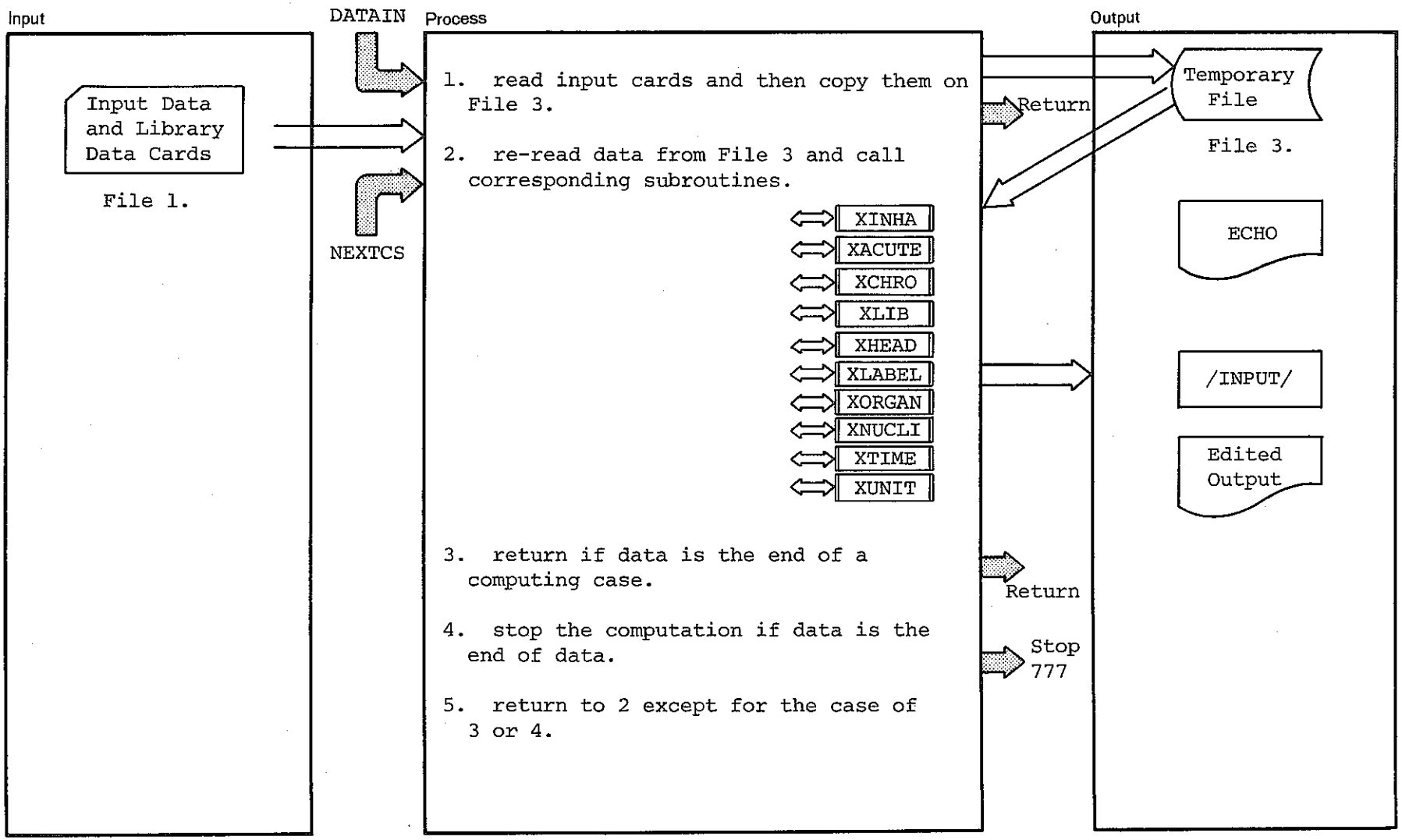
Extended Description

Notes			Ref.

HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 2 of 16

Diagram ID: 3.0 Name: DATAIN Description: _____



Extended Description

Notes			Ref.
1. The end of a computing case is given by a INHALATION, ACUTE or CHRONIC card. 2. The end of data is given by a 999 card. 3. 999 card is prepared by DATAIN.			

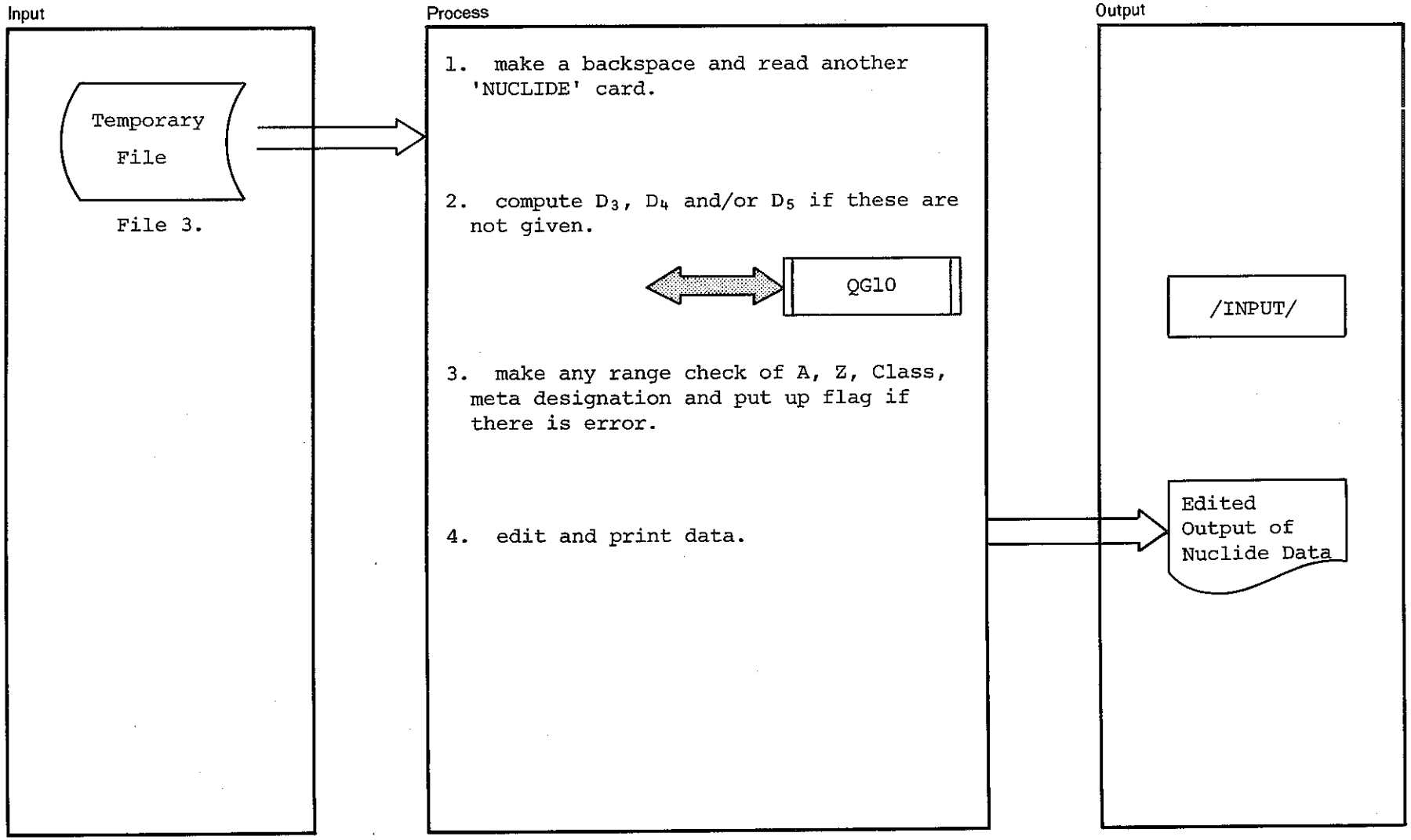
Extended Description

Notes			Ref.

HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 3 of 16

Diagram ID: 3.4 Name: XNUCLI Description: _____



Extended Description

Notes			Ref.
1. The flow of HIPO is the same among XINHA, XACUTE, XCHRO, XLIB, XHEAD, XLABEL, XORGAN, XNUCLI, XTIME and XUNIT.			

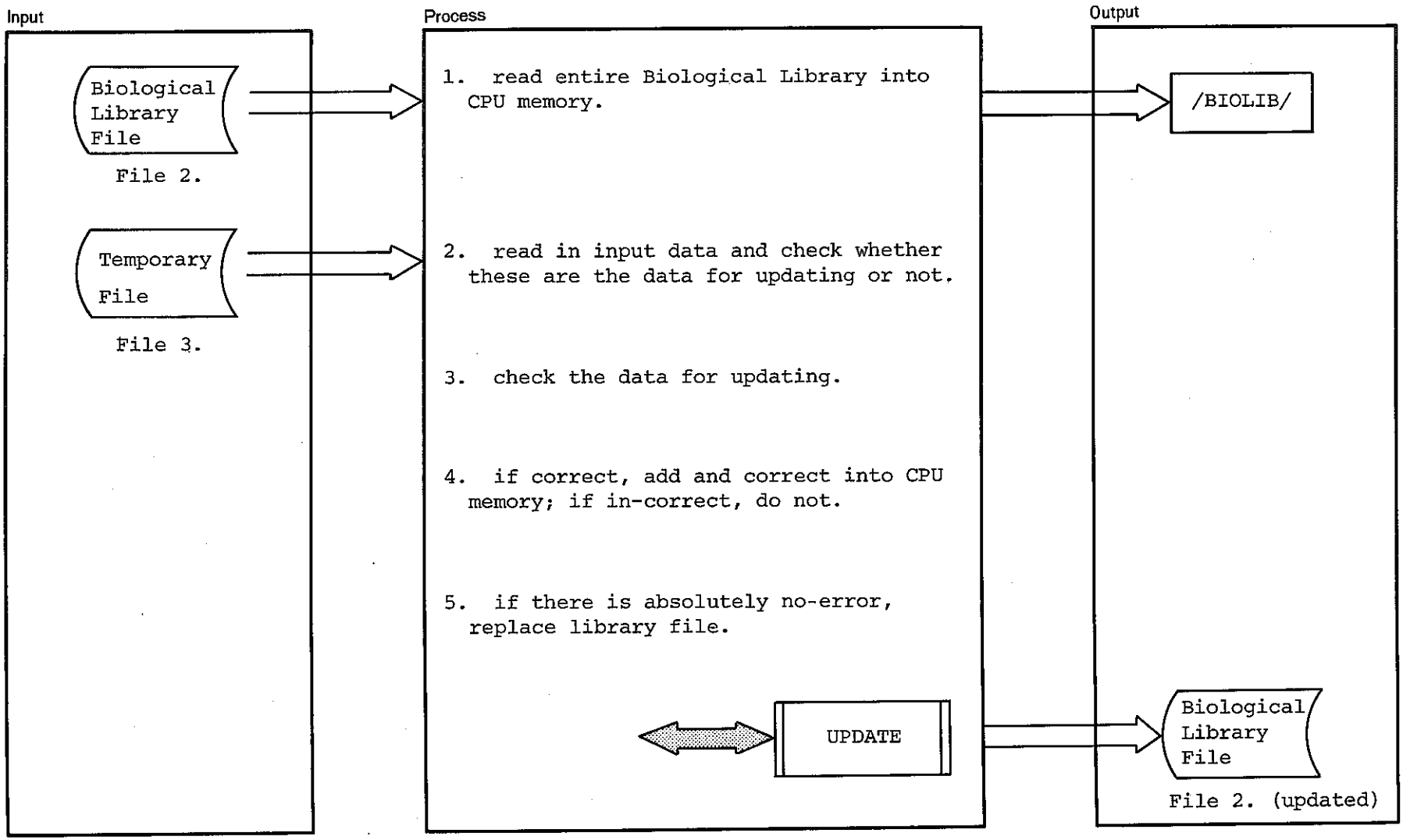
Extended Description

Notes			Ref.

HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 4 of 16

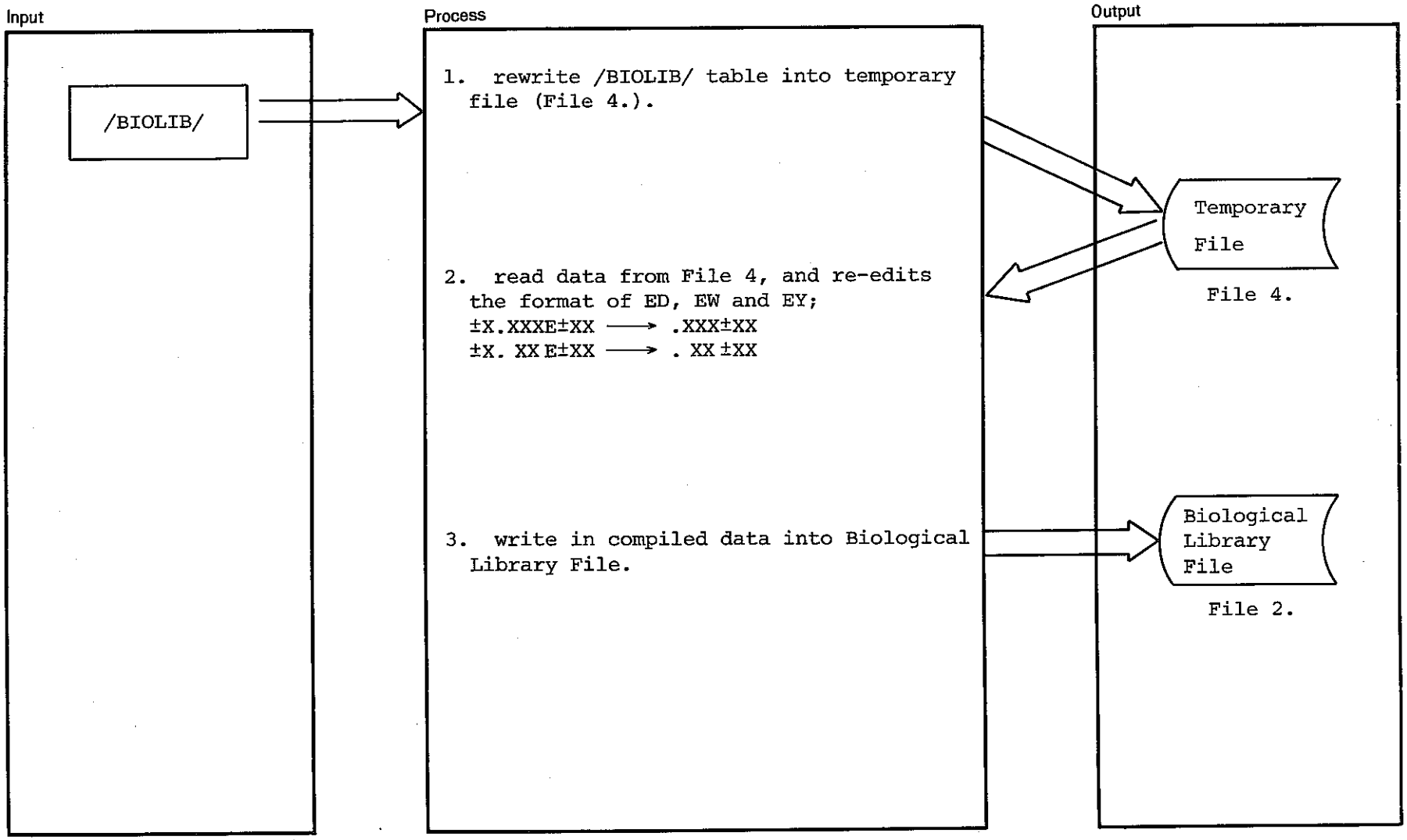
Diagram ID: 4.0 Name: LIBMGR Description: _____



HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 5 of 16

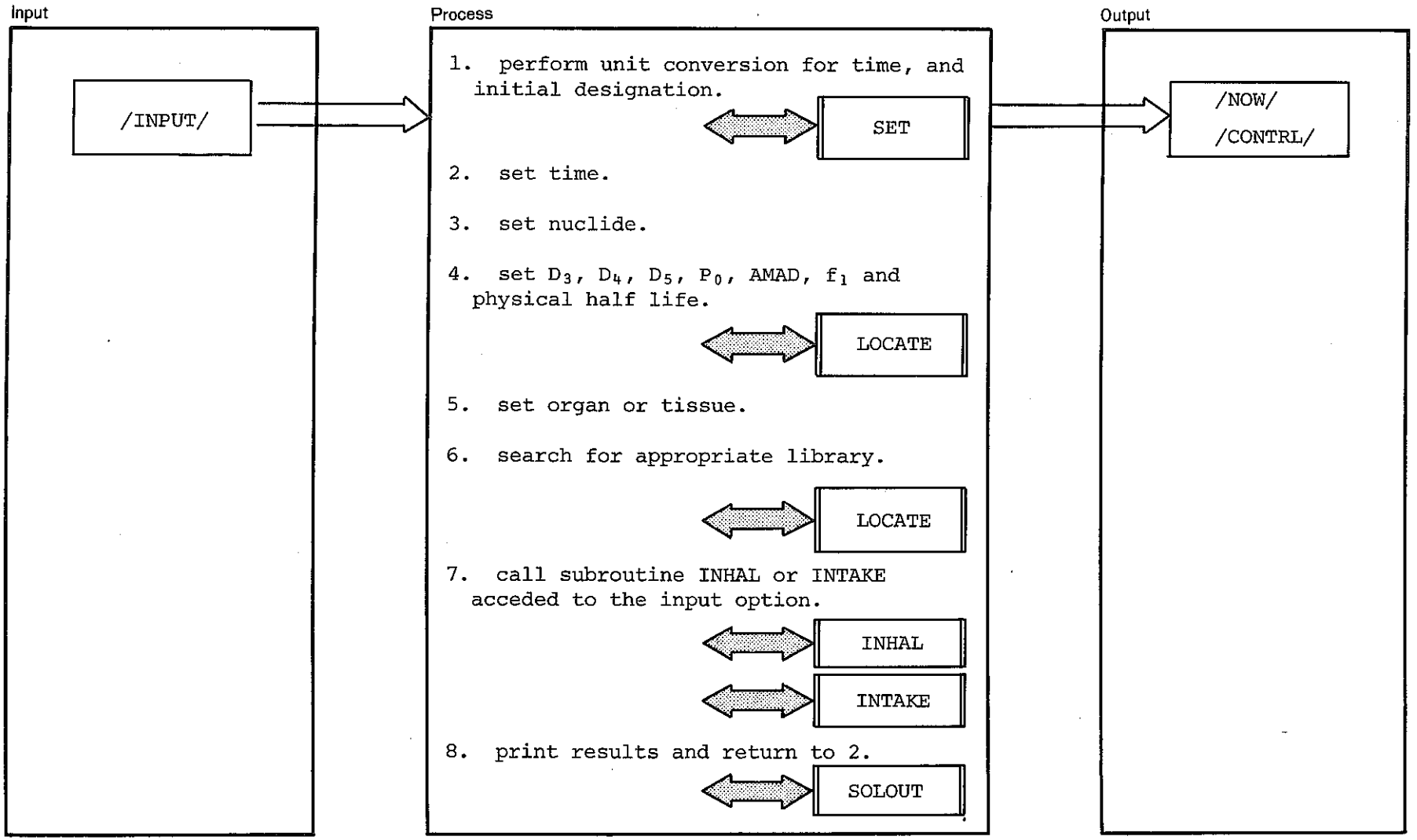
Diagram ID: 4.1 Name: UPDATE Description: _____



HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 6 of 16

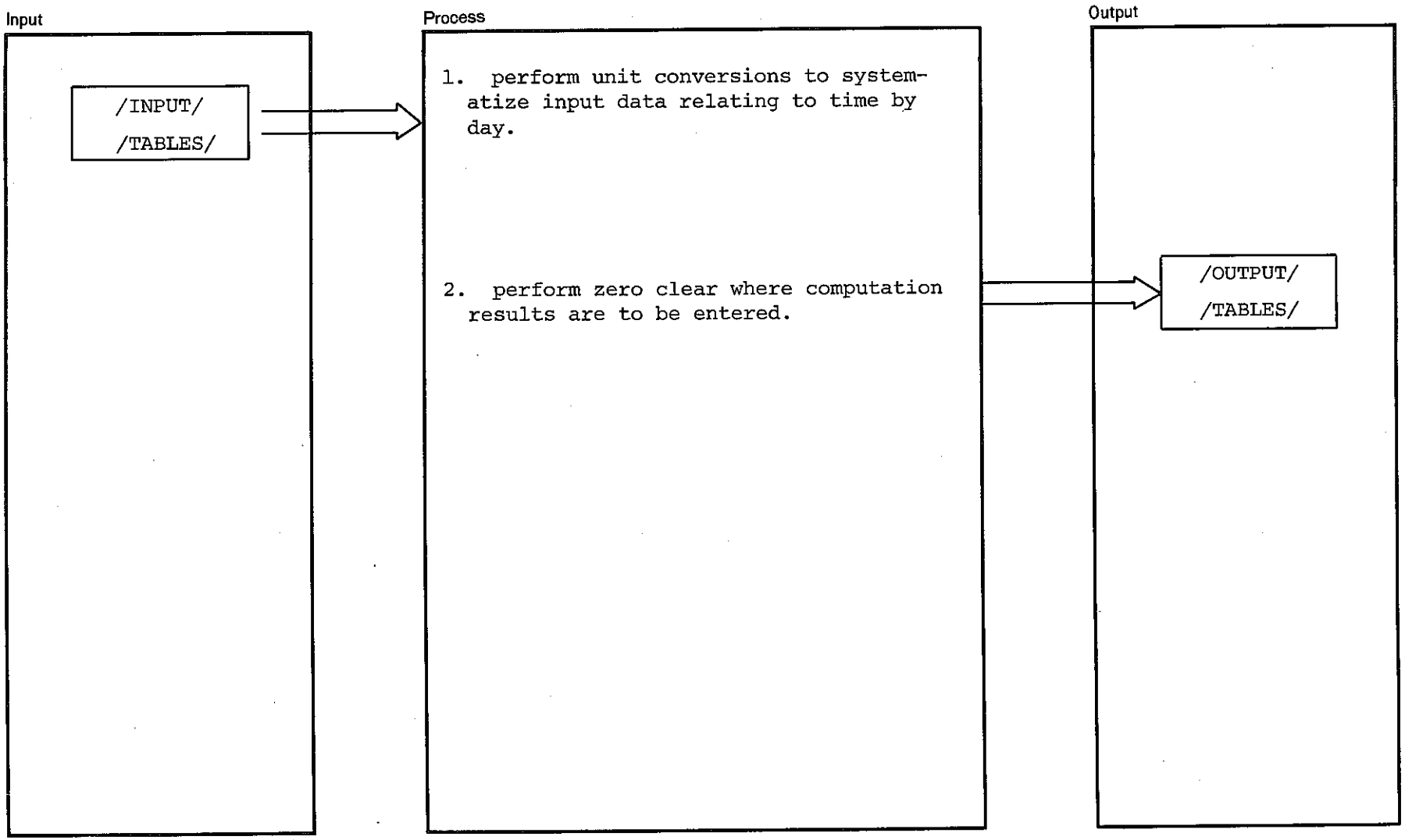
Diagram ID: 5.0 Name: COMPUT Description: _____



HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 7 of 16

Diagram ID: 5.1 Name: SET Description: _____



HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 8 of 16

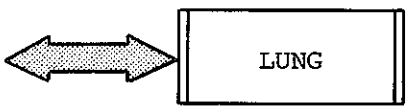
Diagram ID: 5.2 Name: INHAL Description: _____

Input

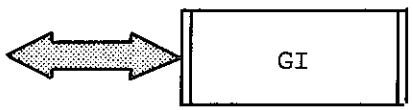
/INPUT/
/NOW/

Process

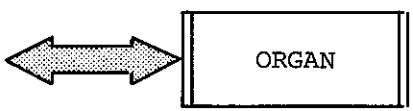
1. for organ code = 8, call subroutine LUNG



2. for organ code ≥ 19, call subroutine GI



3. for other organ code, call subroutine ORGAN

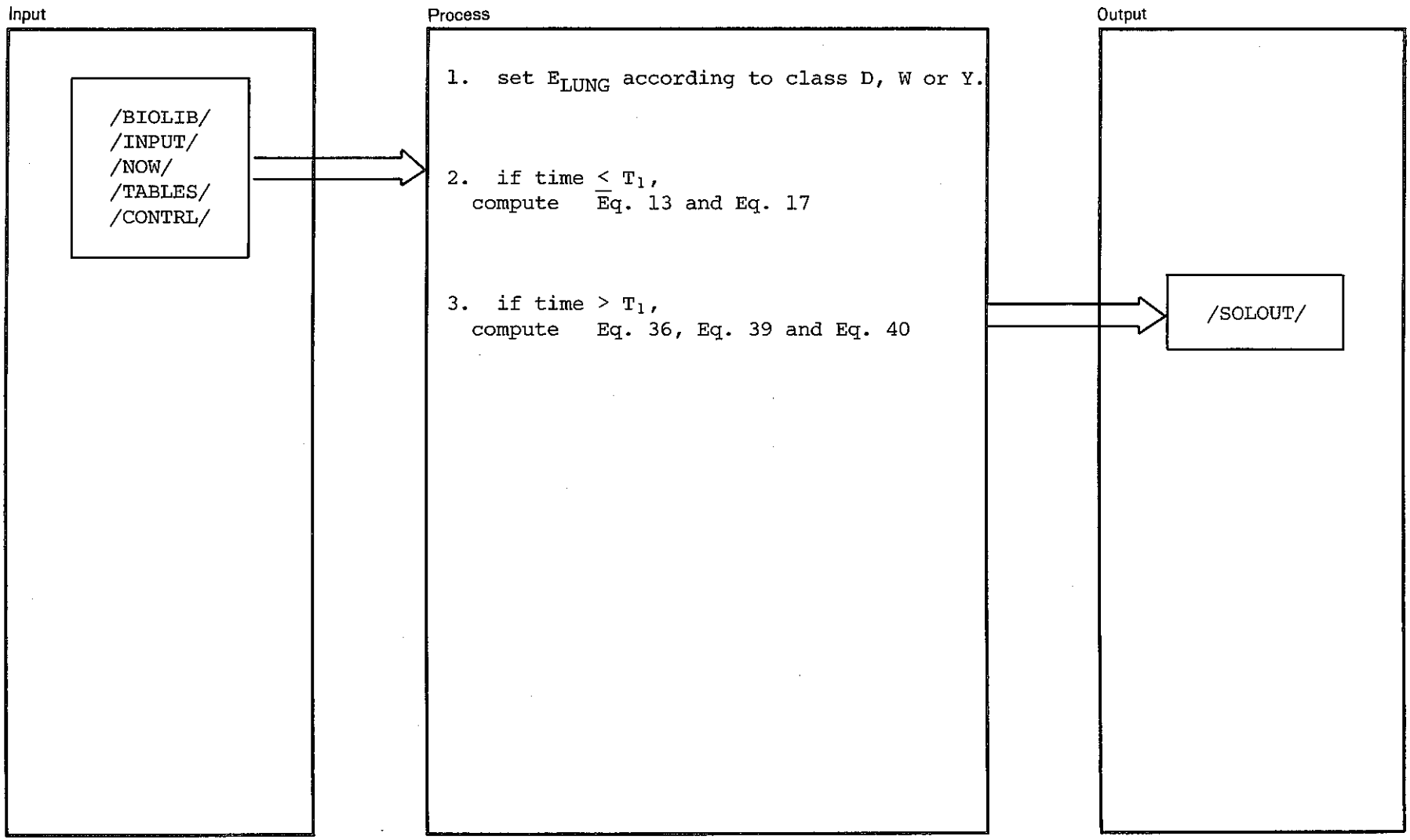


Output

HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 9 of 16

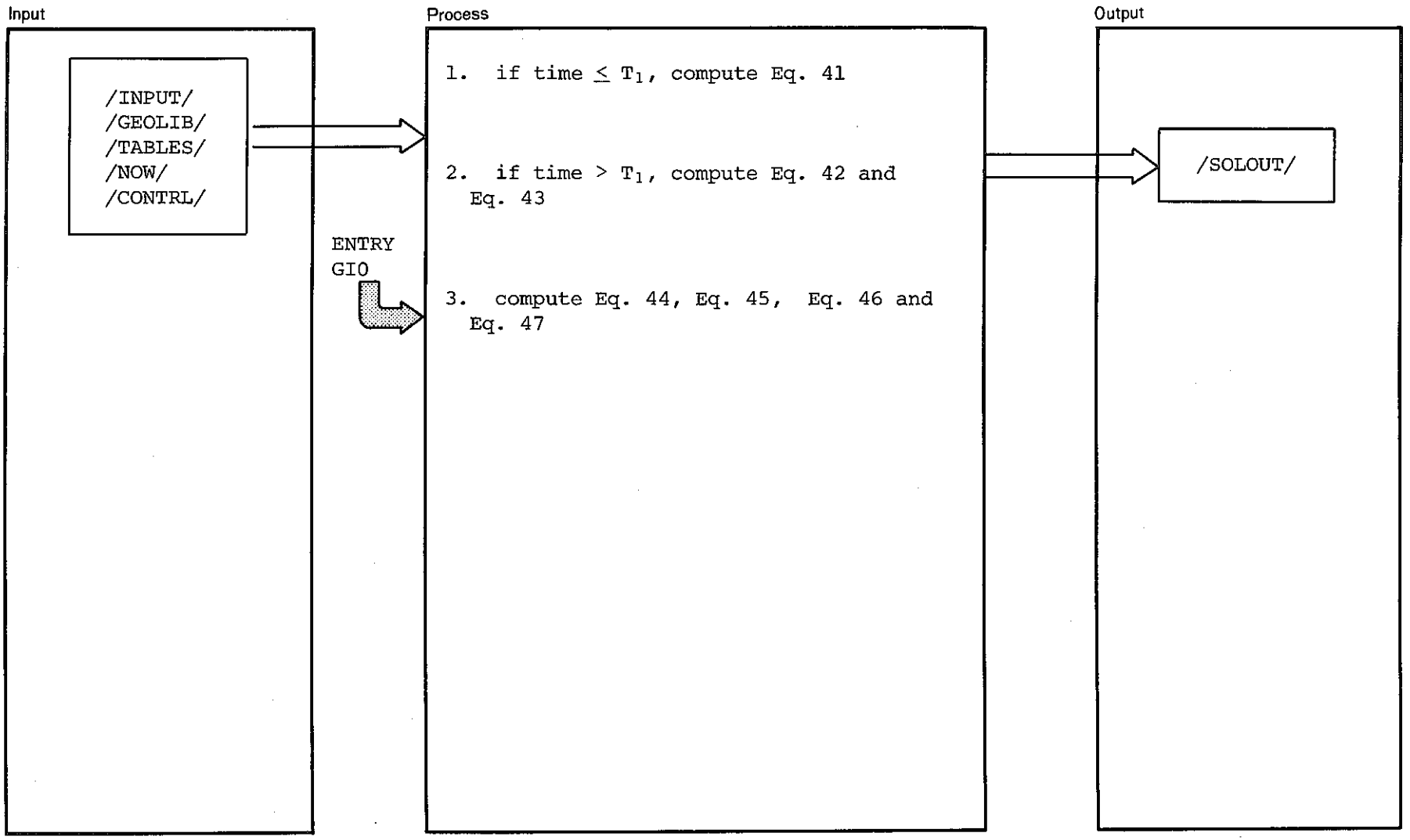
Diagram ID: 5.2.1 Name: LUNG Description: _____



HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 10 of 16

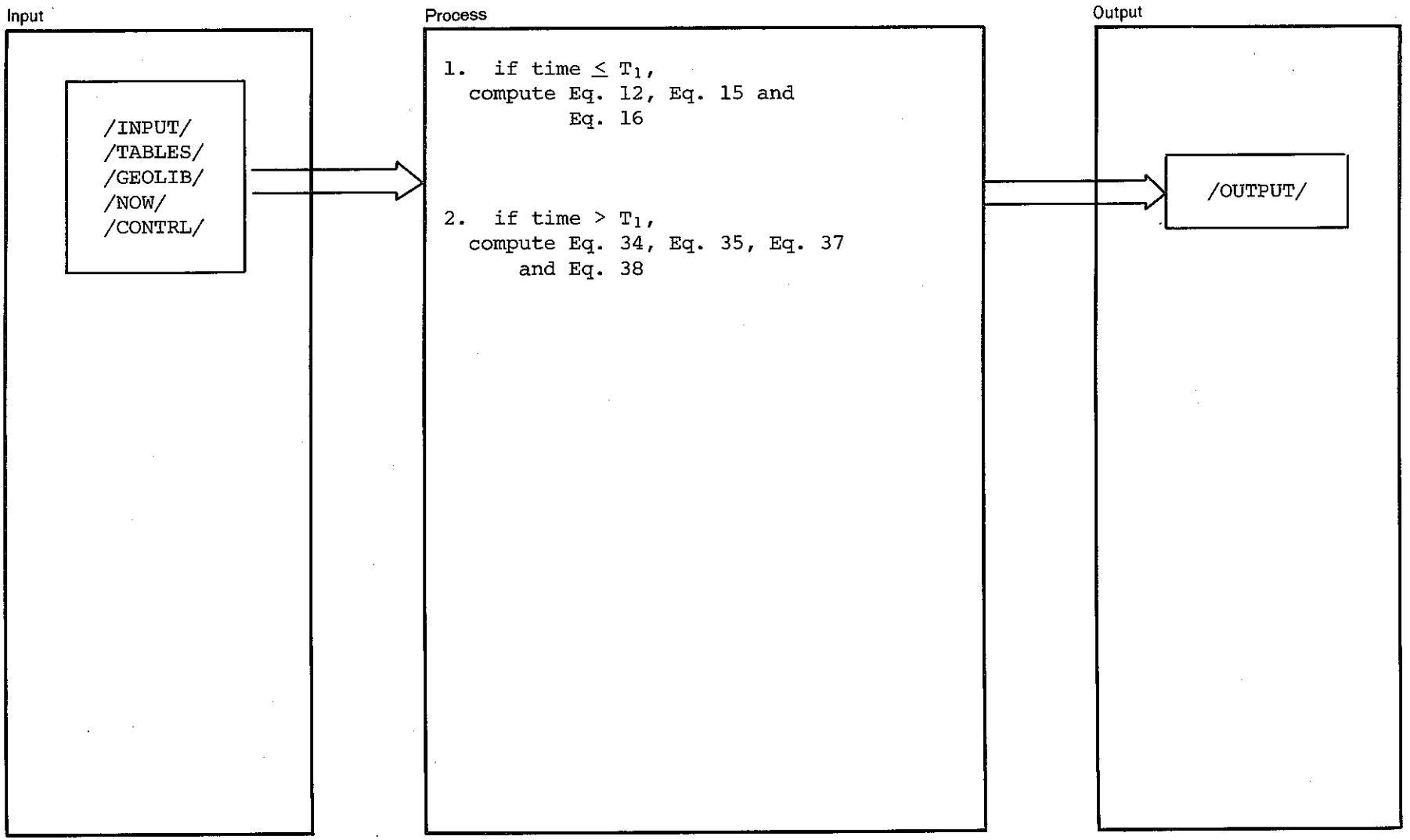
Diagram ID: 5.2.2 Name: GI Description: _____



HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 11 of 16

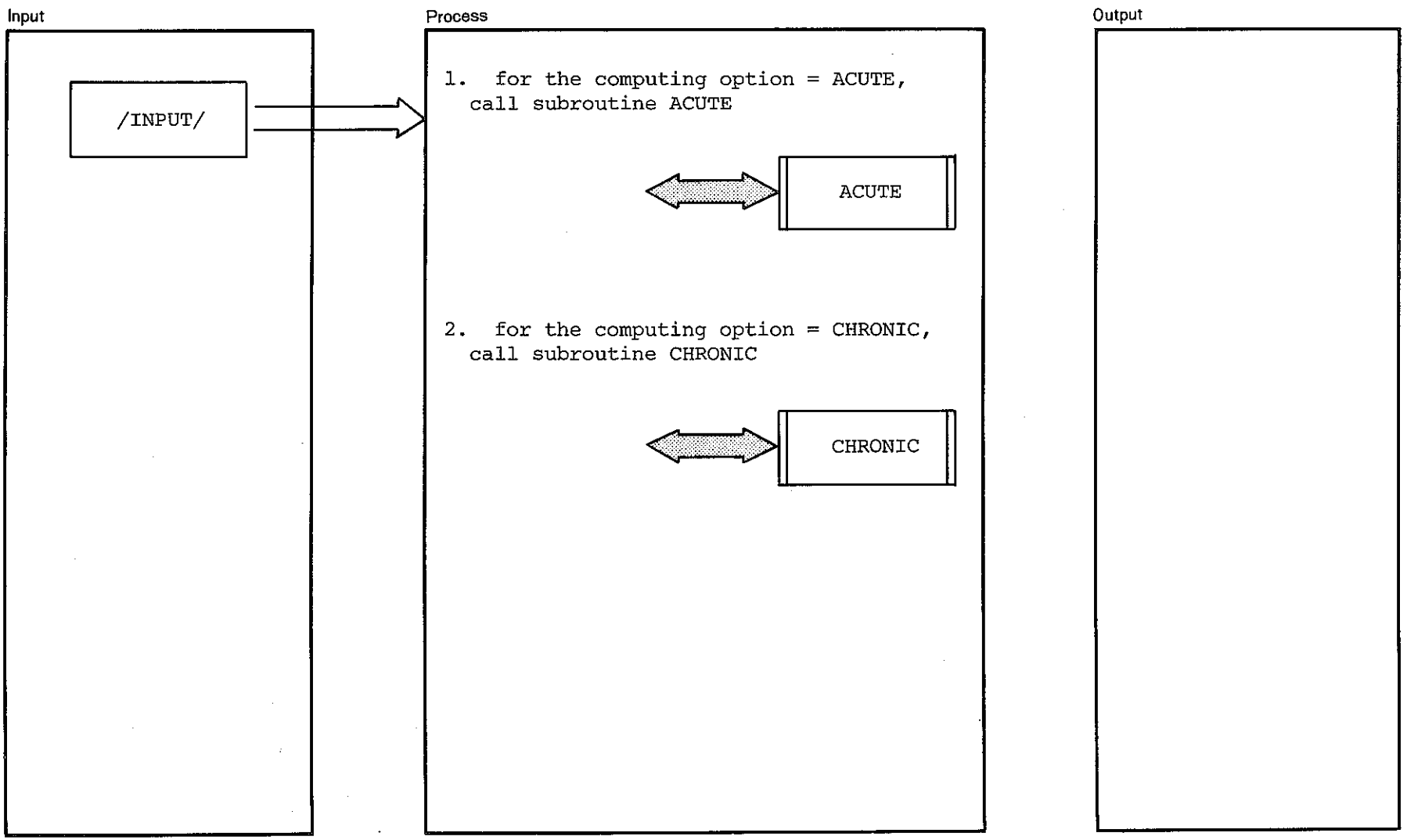
Diagram ID: 5.2.3 Name: ORGAN Description: _____



HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 12 of 16

Diagram ID: 5.3 Name: INTAKE Description: _____

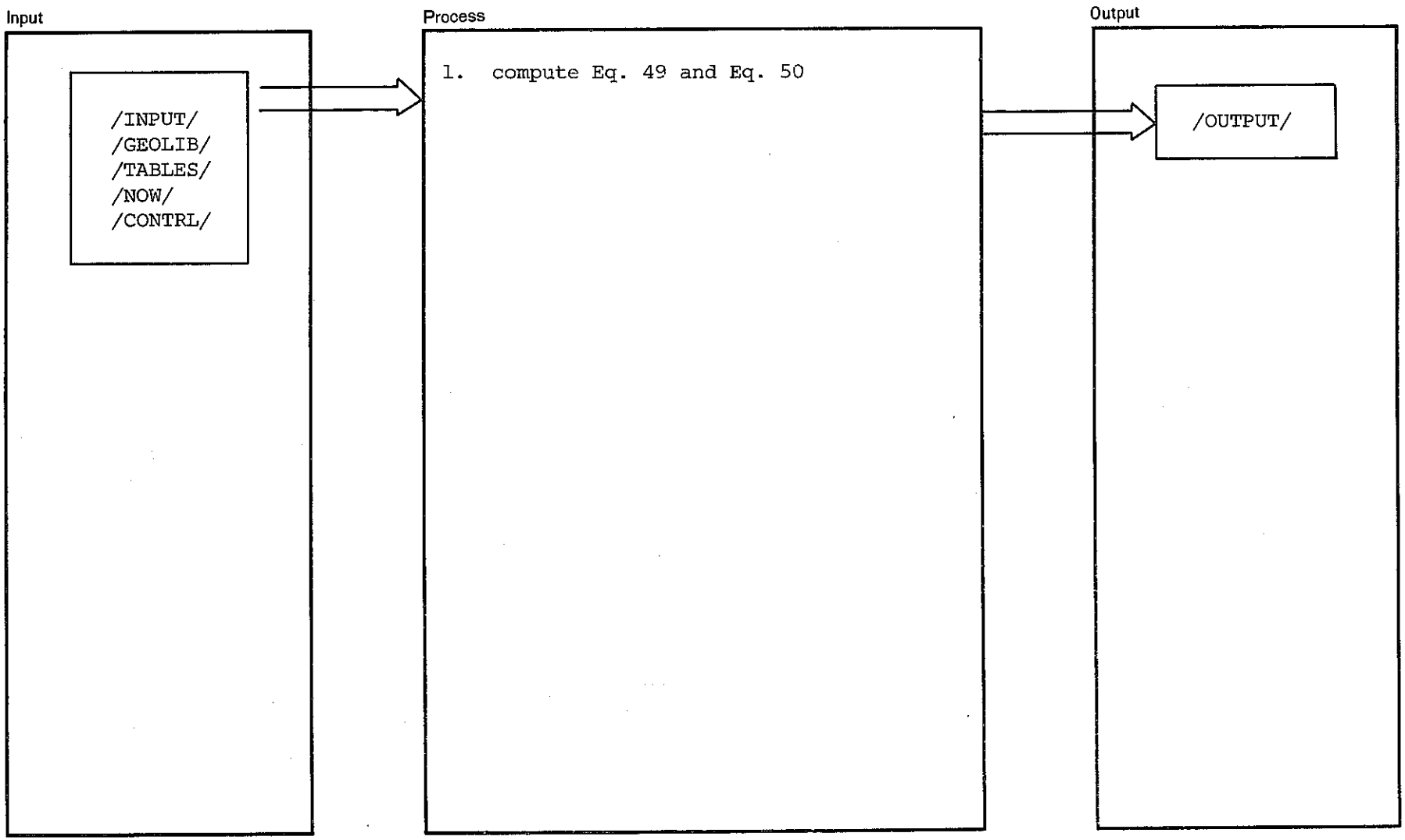


PNCT843-80-11

HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 13 of 16

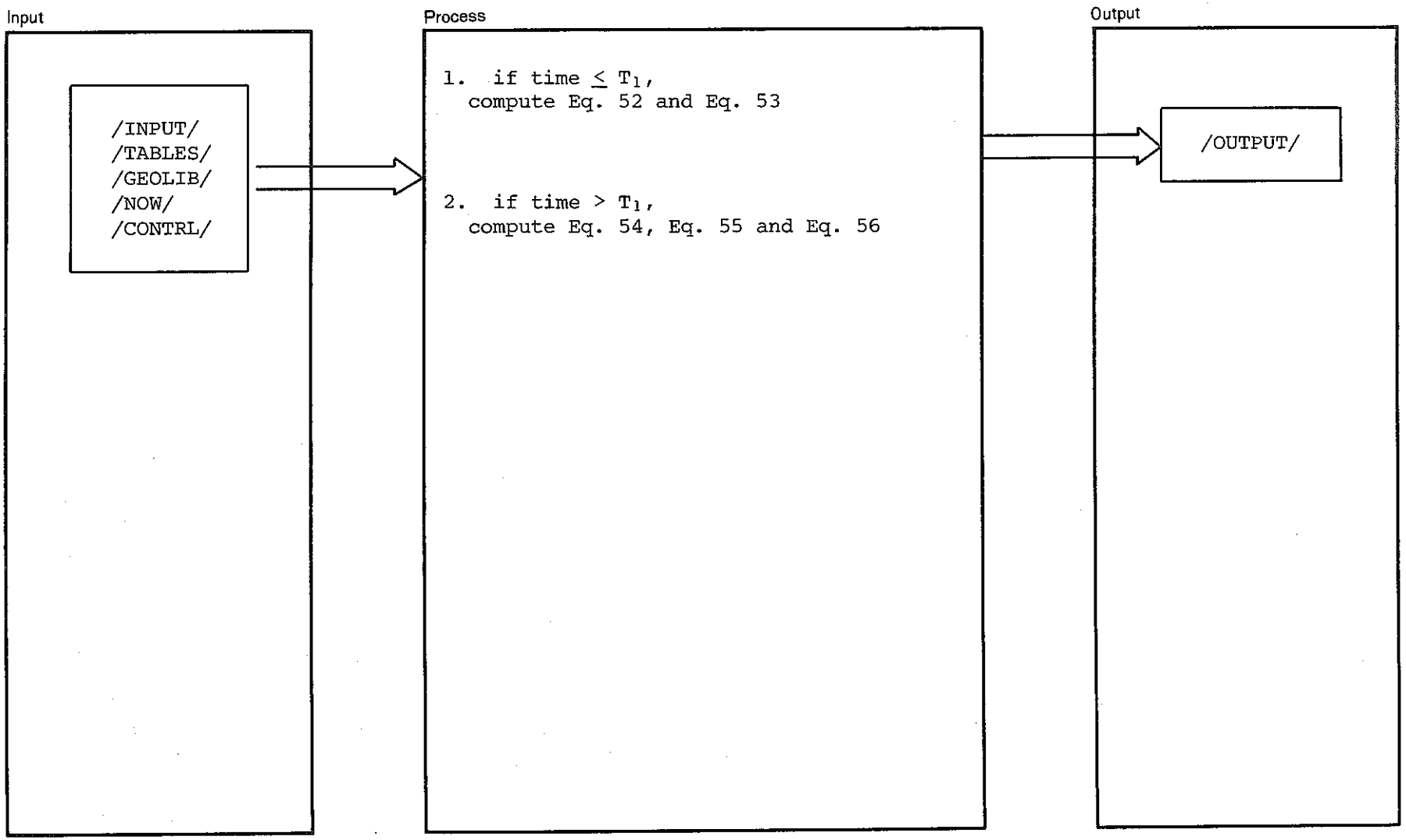
Diagram ID: 5.3.1 Name: ACUTE Description: _____



HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 14 of 16

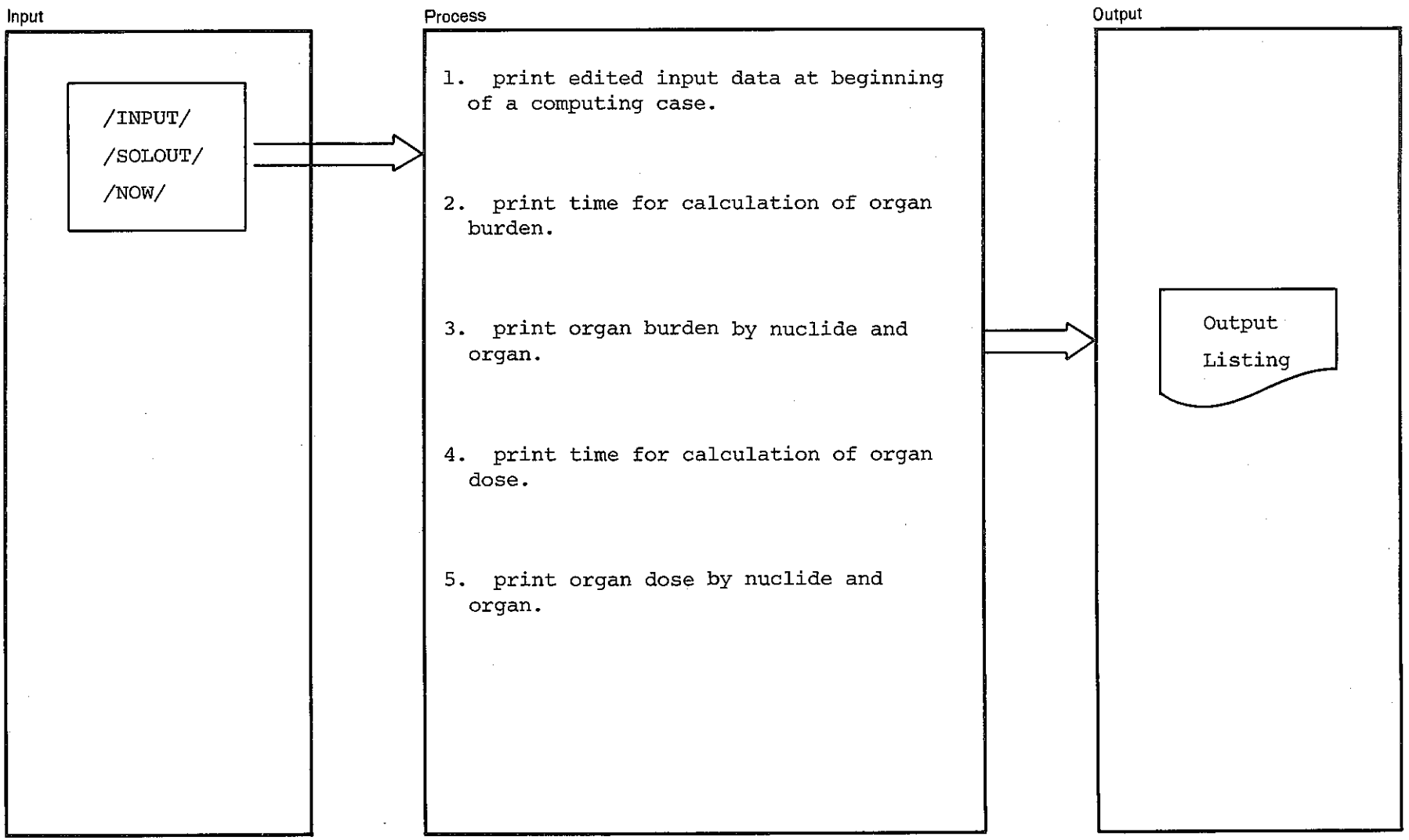
Diagram ID: 5.3.2 Name: CHRO Description: _____



HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 15 of 16

Diagram ID: 5.4 Name: SOLOUT Description: _____



HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 16 of 16

Diagram ID: 6.0 Name: LOCATE Description: _____

Input

/INPUT/

/GEOLIB/

/NOW/

Process

1. scan Biological Library table using atomic number, atomic mass, class, meta-flag and organ code as keys.

2. should there be a corresponding key in the table, set its number in the IP.

3. if not, set IP = 0.

4. make error messages for overlapping keys. for overlapping IR, replace IR by (IR-2).

Output

/CONTRL/

IP, IR

HIPO WORKSHEET EXTENDED DESCRIPTIONS

Author: _____ System/Program: ACRO Date: _____ Page: 1 of 9

Diagram ID: _____ Name: COMMON/INPUT/ Description: input data table

Notes		Descriptions	Ref.
HEAD	(18)	title (HEAD (18) is DATE.)	
LABEL	(18)	subtitle	
NORG		number of input organ codes	
KORG	(30)	organ code	
NON		number of input nuclides	
NZ	(30)	atomic number	
MASS	(30)	atomic mass	
KLASS	(30)	solubility class { = 1 : D; = 2 : W; = 3 : Y	
METAIN	(30)	isotopic state { = 0 : ground state; = 1 : meta-stable state	
ID	(2, 30)	nuclide name	
NOPT		computing option { = 1 : inhalation; = 2 : acute ingestion; = 3 : chronic ingestion; = 4 : library update	
MOPT		human type { = 0 : standard man; = 1 : reference man	
TIT	(30)	intake period (every nuclides)	
TIMET	(8)	time for computation	
D3T	(30)	deposition fraction in NP (every nuclides)	
D4T	(30)	deposition fraction in TB (every nuclides)	
D5T	(30)	deposition fraction in P (every nuclides)	

HIPO WORKSHEET EXTENDED DESCRIPTIONS

Author: _____ System/Program: ACRO Date: _____ Page: 2 of 9

Diagram ID: _____ Name: COMMON/INPUT/ Description: _____

Notes		Descriptions	Ref.
POT	(30)	inhalation or ingestion rate (every nuclides)	
AMADT	(30)	AMAD, in μm	
IUNIT		option of a unit of time { = 0 second; = 1 hour; = 2 day; = 3 year	
UNIT		unit of time	

HIPO WORKSHEET EXTENDED DESCRIPTIONS

Author: _____ System/Program: ACRO Date: _____ Page: 3 of 9

Diagram ID: _____ Name: COMMON/BIOLIB/ Description: biological library table

Notes		Descriptions	Ref.
LZ	(3000)	atomic number	
LA	(3000)	atomic mass	
META	(3000)	isotopic state	
ZID	(3000)	nuclide name	
KODE	(3000)	organ code	
PHLF	(3000)	physical half life, in day	
BHLF	(3000)	biological half life, in day	
FW	(3000)	f_w	
FA	(3000)	f_a	
F2D	(3000)	f_2'	
ED	(3000)	effective absorbed energy for class D, in MeV	
EW	(3000)	effective absorbed energy for class W, in MeV	
EY	(3000)	effective absorbed energy for class Y, in MeV	

HIPO WORKSHEET EXTENDED DESCRIPTIONS

Author: _____ System/Program: ACRO Date: _____ Page: 4 of 9

Diagram ID: _____ Name: COMMON/TABLES/ Description: constant tables

Notes		Descriptions	Ref.
ORGNAM	(23)	organ name (real * 8)	
ORGMAS	(23, 2)	organ mass { (23, 1) = standard man; (23, 2) = reference man }	ICRP Pub.2 ICRP Pub.23
GIS	(3)	constant for the stomach	
GISI	(3)	constant for the small intestine	
GIULI	(3)	constant for the upper large intestine	
GILLI	(3)	constant for the lower large intestine { (1) = residence time, in day (2) = time to reach, in day (3) = mass of contents, in gram	
F3	(2, 3)	1 : D , 2 : W , 3 : Y	
		1 : f_a, 2 : f_b	
F4	(2, 3)	1 : D , 2 : W , 3 : Y	
		1 : f_c, 2 : f_d	
F5	(4, 3)	1 : D , 2 : W , 3 : Y	
		1 : f_e, 2 : f_f, 3 : f_g, 4 : f_h	
F6	(1, 3)	1 : D , 2 : W , 3 : Y	
		1 : f_i	

HIPO WORKSHEET EXTENDED DESCRIPTIONS

Author: _____ System/Program: ACRO Date: _____ Page: 5 of 9

Diagram ID: _____ Name: COMMON/TABLES/ Description: _____

Notes		Descriptions	Ref.
T3	(2, 3)	1 : D , 2 : W , 3 : Y	
		1 : T_a, 2 : T_b	
T4	(2, 3)	1 : D , 2 : W , 3 : Y	
		1 : T_c, 2 : T_d	
T5	(4, 3)	1 : D , 2 : W , 3 : Y	
		1 : T_e, 2 : T_f, 3 : T_g, 4 : T_h	
T6	(1, 3)	1 : D , 2 : W , 3 : Y	
		1 : T_i	

HIPO WORKSHEET EXTENDED DESCRIPTIONS

Author: _____ System/Program: ACRO Date: _____ Page: 6 of 9

Diagram ID: _____ Name: COMMON/CONTRL/ Description: _____

Notes	Descriptions	Ref.
DAY	date (real * 8)	
TIME	current time for computation	
ITIME	unused	
IER	error code { = 0 no error; ≠ 0 error }	
KNU	current nuclide table pointer	
KOR	current organ table pointer	
IP	current biological library table pointer	
IR	degree of overlap of data	
NPAGE	output page counter	
FAC	factor for conversion of a unit of time	

HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 7 of 9

Diagram ID: _____ Name: COMMON/NOW/ Description: _____

Notes	Descriptions	Ref.
TI	intake time, in day	
D3	current D_3	
D4	current D_4	
D5	current D_5	
P0	current intake rate	
AMAD	current AMAD	
F1	current f_1	

HIPO WORKSHEET EXTENDED DESCRIPTIONS

Author: _____ System/Program: ACRO Date: _____ Page: 8 of 9

Diagram ID: _____ Name: COMMON/OUTPUT/ Description: _____

Notes		Descriptions	Ref.
Q1	(30, 30)	organ burden at a time during intake period, in μCi	
Q2	(30, 30)	organ burden at a time after termination of intake, in μCi	
D1	(30, 30)	organ dose commitment during intake period, in rem	
D2	(30, 30)	organ dose commitment after termination of intake, in rem	
D	(30, 30)	total dose commitment, in rem $D = D_1 + D_2$	
EN	(30, 30)	effective absorbed energy, in MeV/dis.	
HLF	(30)	physical half life, in day	
		→ organ	
		for quadratic arrays	
		(* , *) → nuclide → organ	

HIPO WORKSHEET

Author: _____ System/Program: ACRO Date: _____ Page: 9 of 9

Diagram ID: _____ Name: program restrictions Description: _____

Notes	Descriptions	Ref.
restrictions	1. memory requirement : about 260 KB 2. the maximum number of input data for organ : 30 3. the maximum number of input data for nuclide : 30 4. the maximum number of input data for time to compute : 8 5. the maximum number of records of biological library : 3000	

References

(1). ICRP, Report of Committee II on Permissible Dose for Internal Radiation, ICRP Publication 2, Pergamon Press, 1959

(2). ICRP Task Group on Lung Dynamics, Deposition and Retention Models for Internal Dosimetry of the Human Respiratory Tract, Health Physics, vol. 12, 173, 1966

(3). ICRP, Recommendations of the International Commission on Radiological Protection, ICRP Publication 26, Annals of the ICRP, vol. 1, No. 3, 1977

(4). Strenge, D.L., E. C. Watson and W. E. Kennedy, REDIQ-A Computer Program for Estimating Health Effects from Inhalation and Ingestion of Radionuclide, BNWL-2110, 1976

(5). ICRP, Limits for Intakes of Radionuclides by Workers, ICRP Publication 30 Part 1, Annals of the ICRP, vol. 2, No. 3/4, 1979

(6). ICRP, Metabolism of Compounds of Plutonium and Other Actinides, ICRP Publication 19, Pergamon Press, 1972

Appendix 1. Input Data Preparation and Biological Data Library

1. Input Data Preparation

Card No.	Variable	Description	Column	Format
# 1		Give title & date.		
		1. Key word: HEAD	1 - 8	A8
	HEAD	2. Title: Words entered are reprinted as a title on the listing.	9 - 72	16A4
	DATE	3. Date: yy/mm/dd	73 - 80	2A4
# 2		Give sub-title.		
		1. Key word: LABEL	1 - 8	A8
	LABEL	2. Sub-title: Words entered are reprinted as a sub-title.	9 - 72	16A4
# 3		Give organ codes.		
		1. Key word: ORGAN	1 - 8	A8
	KORG	2. Organ code	9 - 72	16I4

Organ	Code
Total Body	1
Soft Tissue	2
Kidneys	3
Liver	4
Spleen	5
Bone	6
Fat	7
Lungs	8
Adrenals	9
Testes	10
Ovaries	11
Skin	12
Brain	13
Muscle	14
Prostate	15
Thyroid	16
Pancreas	17
Heart	18
Stomach	20
GI-SI	21
GI-ULI	22
GI-LLI	23

The maximum number of organ codes for each card are 16.

# 4		Give atomic number, atomic mass, solubility class and isotopic state.		
		1. Key word: NUCLIDE	1 - 8	A8
	NZ	2. Atomic number	9 - 12	I4
	MASS	3 Atomic mass	13 - 16	I4
	KLASS	4. Solubility class (1=D, 2=W, 3=Y)	17 - 18	I2
	METAIN	5. Isotopic state 0 = ground state 1 = meta - stable	19 - 20	I2

Card No.	Variable	Description	Column	Format
# 5		Give intake period, total radioactivity of intake, AMAD and deposition fractions. This card must be entered as a pair with a # 4 card.		
		1. Key word: blank space	1 - 8	8X
	TIT	2. Inhalation or ingestion period(unit is defined by #7).	9 - 16	E8.3
	POT	3. Total radioactivity of intake during TIT. (micro Ci)	17 - 24	E8.3
	AMADT	4. AMAD (micron)	25 - 32	E8.3
	D3T	5. D_3: deposition fraction in the NP region	33 - 40	
	D4T	6. D_4: deposition fraction in the TB region	41 - 48	E8.3
	D5T	7. D_5: deposition fraction in the P region	49 - 56	E8.3
		If D_3, D_4 and D_5 are not given, these are calculated by the program.		
		The maximum limit within 30 sets of card #4 and card #5 can be read in.		
# 6		Give times for dose calculation.		
		1. Key word: TIME	1 - 8	A8
	TI	2. Time for dose calculation (maximum:8),(elapsed time from the start of intake) (unit is defined by # 7).	9 - 72	8E8.3
# 7		Define time unit.		
		1. Key word: UNIT	1 - 8	A8
	UNIT	2. Time unit SEC=second, HR=hour, DAY=day or YEAR=year	9 - 16	A8
# 8		Give intake mode and human type.		
		1. Key word: INHALATION for acute and chronic inhalation, ACUTE for acute ingestion or CHRONIC for chronic ingestion.	1 - 8	A8
		2. Blank space	9 - 16	8X
	MOPT	3. Human type 0=standard man 1=reference man	17	I1

Sample Input

```
HEAD     A C R O -- SAMPLE RUN
LABEL    INHALATION OF PLUTONIUM (AMAD=1 MICRON, CLASS=D, W & Y, 1 YEAR INTAKE)
ORGAN    1   3   4   6   8  23
NUCLIDE  94 238 1  0
         1.0     1.0     1.0
NUCLIDE  94 239 1  0
         1.0     1.0     1.0
NUCLIDE  94 240 1  0
         1.0     1.0     1.0
NUCLIDE  94 242 1  0
         1.0     1.0     1.0
NUCLIDE  94 238 2  0
         1.0     1.0     1.0
NUCLIDE  94 239 2  0
         1.0     1.0     1.0
NUCLIDE  94 240 2  0
         1.0     1.0     1.0
NUCLIDE  94 242 2  0
         1.0     1.0     1.0
NUCLIDE  94 238 3  0
         1.0     1.0     1.0
NUCLIDE  94 239 3  0
         1.0     1.0     1.0
NUCLIDE  94 240 3  0
         1.0     1.0     1.0
NUCLIDE  94 242 3  0
         1.0     1.0     1.0
TIME     10.     50.
UNIT     YEAR
INHALATION    1
```

Input Data Stream

/JOB CONTROL LANGUAGE

Cards for modification of the biological library — Not prepare except for the case of update of the library.

1 card
2 card
3 card
4 card
5 card
4 card
5 card
:
6 card
7 card
8 card
/

Maximum: 30 sets

2. Description of Biological Data Library

Column	Format	Variable
1 - 3	I3	Atomic number
4 - 6	I3	Atomic mass
7	I1	Isotope type: blank - ground state 1 - meta-stable state
8 - 9	A2	Element name
10 - 11	I2	Organ code
12 - 19	E8.3	Physical half life,in days
20 - 27	E8.3	Biological half life in the organ or tissues,in days
28 - 35	E8.3	f_w , fraction of material taken into the organ by ingestion
36 - 43	E8.3	f_a , fraction of material taken into the organ by inhalation (not used by ACRO)
44 - 51	E8.3	f_2' , fraction of the nuclide in the blood that reaches the organ
52 - 59	E8.3	Effective absorbed energy of the radionuclide and daughters in the organ, in MeV/dis. For the lung, this is for D type materials.
60 - 65	E6.2	Weighted value of the effective energy of the radioniclide and daughters, For the lung,this is for W type materials.
66 - 71	E6.2	Weighted value of the effective energy of the radionuclide and daughters, For the lung,this is for Y type materials.

3. Mass of Organs or Tissues

Organ	Standard Man[1]	Reference Man[2]
Total Body	70,000 g	70,000 g
Soft Tissue	43,000	63,000
Kidneys	300	310
Liver	1,700	1,800
Spleen	150	180
Bone	7,000	5,000
Fat	10,000	13,500
Lungs	1,000	1,000
Adrenals	20	14
Testes	40	35
Ovaries	8	11
Skin	2,000	2,600
Brain	1,500	1,400
Muscle	30,000	28,000
Prostate	20	16
Thyroid	20	20
Pancreas	70	100
Heart	300	330
Stomach	250	250
GI - SI	1,100	400
GI - ULI	135	220
GI - LLI	150	135

(1). ICRP Publication 2, 1959

(2). ICRP Publication 23, 1975

Appendix 2. Program Listing

```
*LEVEL 2.3.0 (JUNE 78)          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.25       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

                                                                                                  00000100
      C                                                                                           00000200
      C                                                                                           00000300
      C                                                                                           00000400
      C                                                                                           00000500
      C         ***********************************************                                   00000600
      C         ***********************************************                                   00000700
      C                                                                                           00000800
      C                 A  C  R  O     P  R  O  G  R  A  M                                       00000900
      C                                                                                           00001000
      C         ***********************************************                                   00001100
      C         ***********************************************                                   00001200
      C                                                                                           00001300
      C                                                                                           00001400
      C                                                                                           00001500
      C         CALCULATING ORGAN DOSE FROM INHALATION AND                                        00001600
      C                                                                                           00001700
      C         INGESTION OF RADIONUCLIDE .                                                       00001800
      C                                                                                           00001900
      C          BASED ON ICRP TASK GROUP LUNG MODEL ,                                            00002000
      C                                                                                           00002100
      C          AND BOTH RADIQ AND DACRIN CODE BY BNWL .                                         00002200
      C                                                                                           00002300
      C                                                                                           00002400
      C                                                                                           00002500
      C                                                                                           00002600
      C                              PROGRAMMED ON NOV.15('77)                                    00002700
      C                                                                                           00002800
      C                              IBM DCS JAPAN AND PNC TOKAI-WORKS                            00002900
      C                                                                                           00003000
      C                              DOCUMENT: PNCT841-78-01 (JANUARY 1978)                       00003100
      C                                                                                           00003200
      C                                                                                           00003300
      C -------------------------------------------------------------------------------------     00003400
      C                                                                                           00003500
      C ================ C O M M O N ========================================================     00003600
      C                                                                                           00003700
      C                                                                                           00003800
ISN 0002              REAL*8 ORGNAM,DAY                                                           00003900
      C                                                                                           00004000
      C  INPUT...                                                                               00004100
      C                                                                                           00004200
ISN 0003              COMMON /INPUT/                                                            00004300
     A                   HEAD(18)          ,LABEL(18)          ,NORG                          00004400
     B                  ,KORG(30)          ,NON                ,NZ(30)                        00004500
     C                  ,MASS(30)          ,KLASS(30)          ,METAIN(30)                    00004600
     D                  ,ID(2,30)          ,NOPT               ,MOPT                          00004700
     E                  ,TIT(30)           ,TIMET(8)           ,DTIME                         00004800
     F                  ,D3T(30)           ,D4T(30)            ,D5T(30)                       00004900
     G                  ,P0T(30)           ,AMADT(30)          ,IUNIT                         00005000
     H                  ,UNIT                                                                  00005100
      C                                                                                           00005200
      C BIOLOGICAL LIBRARY RECORD ...                                                           00005300
      C
```

```
*LEVEL 2.3.0 (JUNE 78)          MAIN          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.25       PAGE   2

  ISN 0004          COMMON /BIOLIB/                                                                    00005400
                   A    LZ    (3000)      ,LA    (3000)      ,META  (3000)                           00005500
                   B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                           00005600
                   C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                           00005700
                   D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                           00005800
                   E   ,EY    (3000)                                                                  00005900
                C                                                                                     00006000
                C DATA TABLES...                                                                      00006100
                C                                                                                     00006200
  ISN 0005          COMMON /TABLES/                                                                    00006300
                   A    ORGNAM(23)         ,ORGMAS(23,2)       ,GIS(3)                             00006400
                   B   ,GISI(3)            ,GIUL(3)            ,GILL(3)                            00006500
                   C   ,F3(2,3)            ,F4(2,3)            ,F5(4,3)                            00006600
                   D   ,F6(1,3)            ,T3(2,3)            ,T4(2,3)                            00006700
                   E   ,T5(4,3)            ,T6(1,3)                                                00006800
                C                                                                                     00006900
                C CONTROL PARAMETERS...                                                               00007000
                C                                                                                     00007100
  ISN 0006          COMMON /CONTRL/                                                                    00007200
                   A    DAY                ,TIME               ,INIT                               00007300
                   B   ,TAFT               ,IER                ,KNU                                00007400
                   C   ,KOR                ,IP                 ,IR                                 00007500
                   D   ,NLIB               ,NPAGE              ,FAC                                00007600
                C                                                                                     00007700
                C OUTPUT STORAGE FOR CURRENT TIME STEP...                                             00007800
                C                                                                                     00007900
  ISN 0007          COMMON /OUTPUT/                                                                    00008000
                   A    Q1 (30,30)         ,Q2(30,30)          ,D1(30,30)                          00008100
                   B   ,D2 (30,30)         ,D (30,30)          ,EN(30,30)                          00008200
                   C   ,HLF(30)             ,Q(30,30)          ,HLFOUT(30,30)                      00008300
                C                                                                                     00008400
                C CURRENT VARIABLES                                                                   00008500
                C                                                                                     00008600
  ISN 0008          COMMON /NOW/                                                                       00008700
                   A    TI        ,D3       ,D4       ,D5       ,P0       ,AMAD                     00008800
                   B   ,F1                                                                           00008900
                C ..................................................................................  00009000
  ISN 0009          IER=0                                                                           00009100
  ISN 0010          NPAGE=1                                                                         00009200
  ISN 0011          NON=0                                                                           00009300
                C                                                                                     00009400
                C DATE IS GIVEN BY HEAD CARD COL.73-80                                                00009500
                C INSTEAD OF SUBROUTINE DATE                                                          00009600
                C                                                                                     00009700
                C*    CALL DATE(DAY)                                                                  00009800
                C*    CALL ERRSET(208,256,-1,1)                                                       00009900
                C                                                                                     00010000
                C UNDERFLOW SUPRESSION BY ERRSET NEGLECTED                                            00010100
                C FOR DOS/VS FORTRAN                                                                  00010200
                C                                                                                     00010300
                C                                                                                     00010400
  ISN 0012          CALL ACRO                                                                       00010500
                C                                                                                     00010600
                C INPUT DATA (INCLUDING LIBRARY DATA FOR UPDATE)                                      00010700
                C                                                                                     00010800
  ISN 0013      100 CALL DATAIN                                                                     00010900
                C                                                                                     00011000
                C MAINTAIN BIOLOGICAL LIBRARY                                                         00011100
```

```
*LEVEL 2.3.0 (JUNE 78)          MAIN          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.25       PAGE   3

                C                                                                                        00011200
  ISN 0014            CALL LIBMGR (IST)                                                                  00011300
  ISN 0015            IF(IER.EQ.1) WRITE(6,1000)                                                         00011400
  ISN 0017            IF(IST.EQ.3 .OR. IER.EQ.1) GO TO 900                                               00011500
                C                                                                                        00011600
  ISN 0019       200  WRITE(6,3000) NPAGE                                                               00011700
  ISN 0020       3000 FORMAT('1',T115,'PAGE',/T115,I3)                                                   00011800
  ISN 0021            INIT=1                                                                             00011900
  ISN 0022            CALL NEXTCS                                                                        00012000
  ISN 0023       4000 FORMAT(1X,T115,A8)                                                                 00012100
                C                                                                                        00012200
  ISN 0024            IF (IER.EQ.1) WRITE(6,1000)                                                        00012300
  ISN 0026            IF (IST.EQ.3 .OR. IER.EQ.1) GO TO 900                                              00012400
  ISN 0028       1100 FORMAT('0 COMPLETED ALL THE PROCESS .....')                                        00012500
  ISN 0029       1000 FORMAT(' PROGRAM TERMINATED BEFORE EVALUATION DUE TO INVALID INPUT00012600
                     A DATA')                                                                            00012700
                C                                                                                        00012800
  ISN 0030            CALL COMPUT                                                                        00012900
  ISN 0031            NPAGE=NPAGE+1                                                                      00013000
  ISN 0032            GO TO 200                                                                          00013100
                C                                                                                        00013200
  ISN 0033       900  WRITE(6,1100)                                                                      00013300
  ISN 0034            STOP                                                                               00013400
  ISN 0035            END                                                                                00013500
```

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*LEVEL 2.3.0 (JUNE 78)                    OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.26      PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

   ISN 0002          SUBROUTINE DATAIN                                                              00013600
   ISN 0003          REAL*4 $HEAD/'HEAD'/,$LABEL/'LABE'/,$ORGAN/'ORGA'/,$NUCLI/'NUCL'/,00013700
                    A $TIME/'TIME'/,$INHA/'INHA'/,$ACUTE/'ACUT'/,$CHRO/'CHRO'/,         00013800
                    B $LIBR/'LIBR'/,$D/'D   '/,$PO/'PO  '/,$AMAD/'AMAD'/,$999/'9999'/, 00013900
                    C $UNIT/'UNIT'/                                                             00014000
   ISN 0004          REAL*4 CARD(18)                                                             00014100
                    C                                                                           00014200
                    C =============== C O M M O N ==========================================00014300
   ISN 0005          REAL*8 ORGNAM,DAY                                                           00014400
                    C                                                                           00014500
                    C  INPUT...                                                                 00014600
                    C                                                                           00014700
   ISN 0006          COMMON /INPUT/                                                              00014800
                     A    HEAD(18)          ,LABEL(18)          ,NORG                         00014900
                     B   ,KORG(30)          ,NON                ,NZ(30)                       00015000
                     C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                   00015100
                     D   ,ID(2,30)          ,NOPT               ,MOPT                         00015200
                     E   ,TIT(30)           ,TIMET(8)           ,DTIME                        00015300
                     F   ,D3T(30)           ,D4T(30)            ,D5T(30)                      00015400
                     G   ,P0T(30)           ,AMADT(30)          ,IUNIT                        00015500
                     H   ,UNIT                                                                  00015600
                    C                                                                           00015700
                    C BIOLOGICAL LIBRARY RECORD ...                                             00015800
                    C                                                                           00015900
   ISN 0007          COMMON /BIOLIB/                                                             00016000
                     A    LZ    (3000)      ,LA    (3000)      ,META  (3000)                 00016100
                     B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                 00016200
                     C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                 00016300
                     D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                 00016400
                     E   ,EY    (3000)                                                           00016500
                    C                                                                           00016600
                    C DATA TABLES...                                                            00016700
                    C                                                                           00016800
   ISN 0008          COMMON /TABLES/                                                             00016900
                     A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                       00017000
                     B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                      00017100
                     C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                      00017200
                     D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                      00017300
                     E   ,T5(4,3)           ,T6(1,3)                                          00017400
                    C                                                                           00017500
                    C CONTROL PARAMETERS...                                                     00017600
                    C                                                                           00017700
   ISN 0009          COMMON /CONTRL/                                                             00017800
                     A    DAY               ,TIME               ,INIT                         00017900
                     B   ,TAFT              ,IER                ,KNU                          00018000
                     C   ,KOR               ,IP                 ,IR                           00018100
                     D   ,NLIB              ,NPAGE              ,FAC                          00018200
                    C                                                                           00018300
                    C OUTPUT STORAGE FOR CURRENT TIME STEP...                                   00018400
                    C                                                                           00018500
   ISN 0010          COMMON /OUTPUT/                                                             00018600
                     A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                    00018700
                     B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                    00018800
```

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*LEVEL 2.3.0 (JUNE 78)        DATAIN          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.26       PAGE   2

                      C   ,HLF(30)             ,Q(30,30)          ,HLFOUT(30,30)        00018900
                     C                                                                   00019000
                     C CURRENT VARIABLES                                                 00019100
                     C                                                                   00019200
   ISN 0011                COMMON /NOW/                                                  00019300
                          A    TI       ,D3       ,D4       ,D5       ,P0       ,AMAD   00019400
                          B   ,F1                                                        00019500
                     C ..................................................................00019600
   ISN 0012                WRITE(6,1000) NPAGE                                         00019700
   ISN 0013           1000 FORMAT('1 * ECHO LINES ',T115,'PAGE',/T115,I3)              00019800
   ISN 0014                WRITE(6,1500)                                               00019900
   ISN 0015           1500 FORMAT('0.--------.---.---.---.---.---.---.---.---.---.---.---.---.---.---.00020000
                          A---.---.---.---.---.---.---.---')                           00020100
                     C                                                                 00020200
   ISN 0016            200  READ (5,10,END=100) CARD                                   00020300
   ISN 0017            10   FORMAT(20A4)                                              00020400
   ISN 0018                 WRITE(6,1010)CARD                                         00020500
   ISN 0019            1010 FORMAT(1X,20A4)                                          00020600
   ISN 0020                 WRITE(1,10) CARD                                          00020700
   ISN 0021                 GO TO 200                                                 00020800
                     C                                                               00020900
   ISN 0022            100  WRITE (1,10) $999                                        00021000
   ISN 0023                 REWIND 1                                                  00021100
   ISN 0024                 WRITE(6,1500)                                             00021200
   ISN 0025                 WRITE(6,1300)                                             00021300
   ISN 0026            1300 FORMAT('0 ----- END OF ECHO')                            00021400
   ISN 0027                 RETURN                                                    00021500
                     C                                                               00021600
   ISN 0028                 ENTRY NEXTCS                                              00021700
   ISN 0029                 KOR=0                                                     00021800
   ISN 0030                 KNU=0                                                     00021900
   ISN 0031                 NON=0                                                     00022000
   ISN 0032                 NORG=0                                                    00022100
   ISN 0033            300  READ(1,10) CARD                                          00022200
                     C                                                               00022300
   ISN 0034                 IF (CARD(1).EQ.$INHA) CALL XINHA                          00022400
   ISN 0036                 IF (CARD(1).EQ.$ACUTE) CALL XACUTE                        00022500
   ISN 0038                 IF (CARD(1).EQ.$CHRO ) CALL XCHRO                         00022600
   ISN 0040                 IF (CARD(1).EQ.$LIBR ) CALL XLIB                          00022700
   ISN 0042                 IF (CARD(1).EQ. $HEAD) CALL XHEAD                         00022800
   ISN 0044                 IF (CARD(1).EQ. $LABEL) CALL XLABEL                       00022900
   ISN 0046                 IF (CARD(1).EQ. $ORGAN) CALL XORGAN                       00023000
   ISN 0048                 IF (CARD(1).EQ. $NUCLI) CALL XNUCLI                       00023100
   ISN 0050                 IF (CARD(1).EQ. $TIME ) CALL XTIME                        00023200
   ISN 0052                 IF (CARD(1).EQ. $UNIT ) CALL XUNIT                        00023300
   ISN 0054                 IF(CARD(1).NE.$999) GO TO 400                             00023400
   ISN 0056                 WRITE(6,1200)                                             00023500
   ISN 0057           1200 FORMAT('0.... A C R O  TERMINATED DUE TO END OF DATA.....',/ 00023600
                          A       '0     COMPLETED ALL THE PROCESS              .....') 00023700
   ISN 0058                 STOP 777                                                  00023800
   ISN 0059            400  IF(CARD(1).EQ.$INHA .OR. CARD(1).EQ.$ACUTE               00023900
                          A .OR. CARD(1).EQ.$CHRO .OR. CARD(1).EQ.$LIBR)             00024000
                          B RETURN                                                   00024100
   ISN 0061                 GO TO 300                                                 00024200
   ISN 0062                 END                                                       00024300
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*LEVEL 2.3.0 (JUNE 78)                  OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.27      PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

   ISN 0002            SUBROUTINE XHEAD                                                          00024400
                     C                                                                         00024500
   ISN 0003            REAL*4 CARD(18)                                                           00024600
                     C                                                                         00024700
                     C =============== C O M M O N ========================================== 00024800
   ISN 0004            REAL*8 ORGNAM,DAY                                                         00024900
                     C                                                                         00025000
                     C  INPUT...                                                               00025100
                     C                                                                         00025200
   ISN 0005            COMMON /INPUT/                                                          00025300
                      A     HEAD(18)          ,LABEL(18)          ,NORG                      00025400
                      B    ,KORG(30)          ,NON                ,NZ(30)                    00025500
                      C    ,MASS(30)          ,KLASS(30)          ,METAIN(30)                00025600
                      D    ,ID(2,30)          ,NOPT               ,MOPT                      00025700
                      E    ,TIT(30)           ,TIMET(8)           ,DTIME                     00025800
                      F    ,D3T(30)           ,D4T(30)            ,D5T(30)                   00025900
                      G    ,P0T(30)           ,AMADT(30)          ,IUNIT                     00026000
                      H    ,UNIT                                                             00026100
                     C                                                                         00026200
                     C BIOLOGICAL LIBRARY RECORD ...                                           00026300
                     C                                                                         00026400
   ISN 0006            COMMON /BIOLIB/                                                         00026500
                      A     LZ    (3000)      ,LA    (3000)      ,META  (3000)              00026600
                      B    ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)              00026700
                      C    ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)              00026800
                      D    ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)              00026900
                      E    ,EY    (3000)                                                     00027000
                     C                                                                         00027100
                     C DATA TABLES...                                                          00027200
                     C                                                                         00027300
   ISN 0007            COMMON /TABLES/                                                         00027400
                      A     ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                    00027500
                      B    ,GISI(3)           ,GIUL(3)            ,GILL(3)                   00027600
                      C    ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                   00027700
                      D    ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                   00027800
                      E    ,T5(4,3)           ,T6(1,3)                                       00027900
                     C                                                                         00028000
                     C CONTROL PARAMETERS...                                                   00028100
                     C                                                                         00028200
   ISN 0008            COMMON /CONTRL/                                                         00028300
                      A     DAY               ,TIME               ,INIT                      00028400
                      B    ,TAFT              ,IER                ,KNU                       00028500
                      C    ,KOR               ,IP                 ,IR                        00028600
                      D    ,NLIB              ,NPAGE              ,FAC                       00028700
                     C                                                                         00028800
                     C OUTPUT STORAGE FOR CURRENT TIME STEP...                                 00028900
                     C                                                                         00029000
   ISN 0009            COMMON /OUTPUT/                                                         00029100
                      A     Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                 00029200
                      B    ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                 00029300
                      C    ,HLF(30)            ,Q(30,30)          ,HLFOUT(30,30)             00029400
                     C                                                                         00029500
                     C CURRENT VARIABLES                                                       00029600
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*LEVEL 2.3.0 (JUNE 78)        XHEAD          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.27      PAGE   2

                C                                                                                        00029700
   ISN 0010           COMMON /NOW/                                                                       00029800
                     A    TI        ,D3       ,D4       ,D5       ,P0       ,AMAD                      00029900
                     B   ,F1                                                                            00030000
                C ..................................................................................... 00030100
   ISN 0011           BACKSPACE 1                                                                        00030200
   ISN 0012           READ(1,10) CARD(1),CARD(2),HEAD,DAY                                                00030300
   ISN 0013      10   FORMAT(20A4,T65,A8)                                                                00030400
   ISN 0014           HEAD(15)=HEAD(17)                                                                  00030500
   ISN 0015           HEAD(16)=HEAD(17)                                                                  00030600
   ISN 0016           WRITE(6,1000) HEAD                                                                 00030700
   ISN 0017      1000 FORMAT(' HEADING ...',T16,18A4)                                                    00030800
   ISN 0018           RETURN                                                                             00030900
                C                                                                                        00031000
   ISN 0019           ENTRY XLABEL                                                                       00031100
                C                                                                                        00031200
   ISN 0020           BACKSPACE 1                                                                        00031300
   ISN 0021           READ(1,10) CARD(1),CARD(2),LABEL                                                   00031400
   ISN 0022           WRITE(6,1010) LABEL                                                                00031500
   ISN 0023      1010 FORMAT(' LABEL ...',T16,18A4)                                                      00031600
   ISN 0024           RETURN                                                                             00031700
   ISN 0025           END                                                                                00031800
```

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*LEVEL 2.3.0 (JUNE 78)                  OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.27       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

   ISN 0002           SUBROUTINE XORGAN                                                    00031900
                 C                                                                      00032000
   ISN 0003           REAL*4 CARD(18)                                                      00032100
                 C                                                                      00032200
                 C ================ C O M M O N ==========================================00032300
   ISN 0004           REAL*8 ORGNAM,DAY                                                    00032400
                 C                                                                      00032500
                 C  INPUT...                                                            00032600
                 C                                                                      00032700
   ISN 0005           COMMON /INPUT/                                                       00032800
                     A    HEAD(18)          ,LABEL(18)          ,NORG                   00032900
                     B   ,KORG(30)          ,NON                ,NZ(30)                 00033000
                     C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)             00033100
                     D   ,ID(2,30)          ,NOPT               ,MOPT                   00033200
                     E   ,TIT(30)           ,TIMET(8)           ,DTIME                  00033300
                     F   ,D3T(30)           ,D4T(30)            ,D5T(30)                00033400
                     G   ,P0T(30)           ,AMADT(30)          ,IUNIT                  00033500
                     H   ,UNIT                                                          00033600
                 C                                                                      00033700
                 C BIOLOGICAL LIBRARY RECORD ...                                        00033800
                 C                                                                      00033900
   ISN 0006           COMMON /BIOLIB/                                                      00034000
                     A    LZ    (3000)      ,LA    (3000)       ,META  (3000)           00034100
                     B   ,IDZ   (3000)      ,KODE  (3000)       ,PHLF  (3000)           00034200
                     C   ,BHLF  (3000)      ,FW    (3000)       ,FA    (3000)           00034300
                     D   ,F2D   (3000)      ,ED    (3000)       ,EW    (3000)           00034400
                     E   ,EY    (3000)                                                  00034500
                 C                                                                      00034600
                 C DATA TABLES...                                                       00034700
                 C                                                                      00034800
   ISN 0007           COMMON /TABLES/                                                      00034900
                     A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                 00035000
                     B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                00035100
                     C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                00035200
                     D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                00035300
                     E   ,T5(4,3)           ,T6(1,3)                                    00035400
                 C                                                                      00035500
                 C CONTROL PARAMETERS...                                                00035600
                 C                                                                      00035700
   ISN 0008           COMMON /CONTRL/                                                      00035800
                     A    DAY               ,TIME               ,INIT                   00035900
                     B   ,TAFT              ,IER                ,KNU                    00036000
                     C   ,KOR               ,IP                 ,IR                     00036100
                     D   ,NLIB              ,NPAGE              ,FAC                    00036200
                 C                                                                      00036300
                 C OUTPUT STORAGE FOR CURRENT TIME STEP...                              00036400
                 C                                                                      00036500
   ISN 0009           COMMON /OUTPUT/                                                      00036600
                     A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)              00036700
                     B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)              00036800
                     C   ,HLF(30)            ,Q(30,30)          ,HLFOUT(30,30)          00036900
                 C                                                                      00037000
                 C CURRENT VARIABLES                                                    00037100
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                C                                                                00037200
   ISN 0010           COMMON /NOW/                                               00037300
                     A    TI       ,D3       ,D4       ,D5       ,P0       ,AMAD 00037400
                     B   ,F1                                                     00037500
                C ..................................................................00037600
   ISN 0011           BACKSPACE 1                                                00037700
   ISN 0012           NORG1=NORG+1                                               00037800
   ISN 0013           NORG2=NORG+16                                              00037900
   ISN 0014           READ (1,10) CARD(1),CARD(2),(KORG(N),N=1,16)               00038000
   ISN 0015        10 FORMAT(2A4,16I4)                                           00038100
   ISN 0016           DO 100 N=NORG1,NORG2                                       00038200
   ISN 0017           IF (KORG(N).LT.30) GO TO 110                               00038300
   ISN 0019           WRITE(6,1000) KORG(N)                                      00038400
   ISN 0020      1000 FORMAT(' ?ERROR IN ORGAN CODE DATA',I4)                    00038500
   ISN 0021           IER = 1                                                    00038600
   ISN 0022       110 IF (KORG(N).LE.0) GO TO 100                                00038700
   ISN 0024            NORG=NORG+1                                               00038800
   ISN 0025       100 CONTINUE                                                   00038900
                C                                                                00039000
   ISN 0026           WRITE (6,1010) (KORG(N),ORGNAM(KORG(N)),N=NORG1,NORG)     00039100
   ISN 0027      1010 FORMAT('0ORGAN CODE ...',(T16,I4,3X,A8))                   00039200
   ISN 0028           RETURN                                                    00039300
   ISN 0029           END                                                       00039400
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*LEVEL 2.3.0 (JUNE 78)                    OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.28       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

   ISN 0002            SUBROUTINE XNUCLI                                                          00039500
                     C                                                                          00039600
   ISN 0003            REAL*4 CARD(18)                                                            00039700
                     C                                                                          00039800
                     C =============== C O M M O N ========================================== 00039900
   ISN 0004            REAL*8 ORGNAM,DAY                                                          00040000
                     C                                                                          00040100
                     C  INPUT...                                                                00040200
                     C                                                                          00040300
   ISN 0005            COMMON /INPUT/                                                             00040400
                      A    HEAD(18)          ,LABEL(18)          ,NORG                         00040500
                      B   ,KORG(30)          ,NON                ,NZ(30)                       00040600
                      C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                   00040700
                      D   ,ID(2,30)          ,NOPT               ,MOPT                         00040800
                      E   ,TIT(30)           ,TIMET(8)           ,DTIME                        00040900
                      F   ,D3T(30)           ,D4T(30)            ,D5T(30)                      00041000
                      G   ,POT(30)           ,AMADT(30)          ,IUNIT                        00041100
                      H   ,UNIT                                                                 00041200
                     C                                                                          00041300
                     C BIOLOGICAL LIBRARY RECORD ...                                            00041400
                     C                                                                          00041500
   ISN 0006            COMMON /BIOLIB/                                                          00041600
                      A    LZ    (3000)      ,LA    (3000)      ,META  (3000)                 00041700
                      B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                 00041800
                      C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                 00041900
                      D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                 00042000
                      E   ,EY    (3000)                                                        00042100
                     C                                                                          00042200
                     C DATA TABLES...                                                           00042300
                     C                                                                          00042400
   ISN 0007            COMMON /TABLES/                                                          00042500
                      A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                       00042600
                      B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                      00042700
                      C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                      00042800
                      D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                      00042900
                      E   ,T5(4,3)           ,T6(1,3)                                          00043000
                     C                                                                          00043100
                     C CONTROL PARAMETERS...                                                    00043200
                     C                                                                          00043300
   ISN 0008            COMMON /CONTRL/                                                          00043400
                      A    DAY               ,TIME               ,INIT                         00043500
                      B   ,TAFT              ,IER                ,KNU                          00043600
                      C   ,KOR               ,IP                 ,IR                           00043700
                      D   ,NLIB              ,NPAGE              ,FAC                          00043800
                     C                                                                          00043900
                     C OUTPUT STORAGE FOR CURRENT TIME STEP...                                  00044000
                     C                                                                          00044100
   ISN 0009            COMMON /OUTPUT/                                                          00044200
                      A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                    00044300
                      B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                    00044400
                      C   ,HLF(30)            ,Q(30,30)          ,HLFOUT(30,30)                00044500
                     C                                                                          00044600
                     C CURRENT VARIABLES                                                        00044700
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                C                                                                00044800
                                                                                 00044900
ISN 0010            COMMON /NOW/                                                 00045000
                   A    TI       ,D3       ,D4       ,D5       ,P0       ,AMAD  00045100
                   B   ,F1                                                       00045200
                C ...............................................................00045300
ISN 0011            EXTERNAL FD3                                                 00045400
                C                                                                00045500
ISN 0012            NON=NON+1                                                    00045600
ISN 0013            BACKSPACE 1                                                  00045700
ISN 0014            READ (1,10) NZ(NON),MASS(NON),KLASS(NON),METAIN(NON),ID(1,NON),  00045800
                   A ID(2,NON),                                                  00045900
                   A  TIT(NON),P0T(NON),AMADT(NON),D3T(NON),D4T(NON),D5T(NON)     00046000
ISN 0015         10   FORMAT(8X,2I4,2I2,2A8,/8X,8E8.3)                          00046100
                C                                                                00046200
ISN 0016            IF(D3T(NON).NE.0.) GO TO 100                                 00046300
                C                                                                00046400
                C D3T(NON)                                                       00046500
                C                                                                00046600
ISN 0018            DP=2.0                                                       00046700
ISN 0019            SP=3.95                                                      00046800
ISN 0020            XP=(ALOG10(AMADT(NON))-ALOG10(DP))/ALOG10(SP)                00046900
ISN 0021            CALL QG10(-5. ,XP , FD3,D3T(NON))                            00047000
ISN 0022            D3T(NON)  =  D3T(NON)                                        00047100
                C                                                                00047200
                C D4T(NON)                                                       00047300
                C                                                                00047400
ISN 0023         100  IF (D4T(NON).EQ.0.) D4T(NON)=0.08                          00047500
                C                                                                00047600
                C D5T(NON)                                                       00047700
                C                                                                00047800
ISN 0025            IF (D5T(NON).NE.0.) GO TO 200                                00047900
ISN 0027            DP=0.2                                                       00048000
ISN 0028            SP=10.9                                                      00048100
ISN 0029            XP=(ALOG10(AMADT(NON))-ALOG10(DP))/ALOG10(SP)                00048200
ISN 0030            CALL QG10(-5.0,XP,FD3,D5T(NON))                              00048300
ISN 0031            D5T(NON)=1.-D5T(NON)                                         00048400
ISN 0032            D5T(NON)  =  D5T(NON)                                        00048500
ISN 0033         200  CONTINUE                                                   00048600
                C                                                                00048700
ISN 0034            IF (NZ(NON).LT.150) GO TO 1010                               00048800
ISN 0036            IER=1                                                        00048900
ISN 0037            WRITE(6,1000) NZ(NON)                                        00049000
ISN 0038         1000 FORMAT(' ?ERROR IN ATOMIC NUMBER',I4)                      00049100
                C                                                                00049200
ISN 0039         1010 IF (MASS(NON).LT.300) GO TO 1025                           00049300
ISN 0041            IER=1                                                        00049400
ISN 0042            WRITE(6,1020) MASS(NON)                                      00049500
ISN 0043         1020 FORMAT(' ?ERROR IN ATOMIC MASS',I4)                        00049600
                C                                                                00049700
ISN 0044         1025 IF (KLASS(NON).LE.3 .AND. KLASS(NON).GT.0) GO TO 1035      00049800
ISN 0046            IER=1                                                        00049900
ISN 0047            WRITE(6,1030) KLASS(NON)                                     00050000
ISN 0048         1030 FORMAT(' ?ERROR IN CLASS',I2)                              00050100
ISN 0049            IF (METAIN(NON).LE.1) GO TO 1035                             00050200
ISN 0051            IER=1                                                        00050300
ISN 0052            WRITE(6,1040) METAIN(NON)                                    00050400
ISN 0053         1040 FORMAT(' ?ERROR IN META',I2)                               00050500
ISN 0054         1035 CONTINUE
```

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*LEVEL 2.3.0 (JUNE 78)        XNUCLI          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.28       PAGE   3

                C                                                                                          00050600
   ISN 0055           WRITE(6,1050) NZ(NON),MASS(NON),KLASS(NON),METAIN(NON),ID(1,NON)                     00050700
                     A ,ID(2,NON)                                                                          00050800
   ISN 0056       1050 FORMAT('0NUCLIDE (Z,A,KLASS,META,ID) ....',2I5,2I3,1X,2A8)                         00050900
   ISN 0057           WRITE(6,1060)TIT(NON),D3T(NON),D4T(NON),D5T(NON),P0T(NON),                          00051000
                     A  AMADT(NON)                                                                         00051100
   ISN 0058       1060 FORMAT('                INTAKE TIME .....',1PE10.3, /                           00051200
                     A       '                D3,D4,D5     ....',3E10.3 , /                              00051300
                     B       '          TOTAL INTAKE(MIC. CI.)  ....', E10.3,  /                        00051400
                     C       '                AMAD(MICRON) ....', E10.3     )                           00051500
                C                                                                                          00051600
   ISN 0059           RETURN                                                                              00051700
   ISN 0060           END                                                                                 00051800
```



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*LEVEL 2.3.0 (JUNE 78)                        OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.28       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

   ISN 0002           FUNCTION FD3(X)                                                                     00051900
                C                                                                                          00052000
                C     CALLED BY QG10                                                                       00052100
                C                                                                                          00052200
                C                                                                                          00052300
   ISN 0003           Y=EXP(-0.5*X**2)/SQRT(6.28319)                                                      00052400
   ISN 0004           FD3=Y                                                                               00052500
                C                                                                                          00052600
   ISN 0005           RETURN                                                                              00052700
   ISN 0006           END                                                                                 00052800
```

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*LEVEL 2.3.0 (JUNE 78)                    OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.29      PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

                 C                                                                                    00052900
                                                                                                      00053000
   ISN 0002            SUBROUTINE XTIME                                                               00053100
   ISN 0003            COMPLEX*16 A(2)/'STANDARD MAN    ','REFERENCE MAN   '/                         00053200
   ISN 0004            REAL*4 CARD(18)                                                                00053300
                 C                                                                                    00053400
                 C =============== C O M M O N ==========================================            00053500
   ISN 0005            REAL*8 ORGNAM,DAY                                                              00053600
                 C                                                                                    00053700
                 C  INPUT...                                                                          00053800
                 C                                                                                    00053900
   ISN 0006            COMMON /INPUT/                                                                 00054000
                      A    HEAD(18)          ,LABEL(18)          ,NORG                              00054100
                      B   ,KORG(30)          ,NON                ,NZ(30)                            00054200
                      C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                        00054300
                      D   ,ID(2,30)          ,NOPT               ,MOPT                              00054400
                      E   ,TIT(30)           ,TIMET(8)           ,DTIME                             00054500
                      F   ,D3T(30)           ,D4T(30)            ,D5T(30)                           00054600
                      G   ,P0T(30)           ,AMADT(30)          ,IUNIT                             00054700
                      H   ,UNIT                                                                       00054800
                 C                                                                                    00054900
                 C BIOLOGICAL LIBRARY RECORD ...                                                      00055000
                 C                                                                                    00055100
   ISN 0007            COMMON /BIOLIB/                                                                00055200
                      A    LZ    (3000)     ,LA    (3000)     ,META  (3000)                          00055300
                      B   ,IDZ   (3000)     ,KODE  (3000)     ,PHLF  (3000)                          00055400
                      C   ,BHLF  (3000)     ,FW    (3000)     ,FA    (3000)                          00055500
                      D   ,F2D   (3000)     ,ED    (3000)     ,EW    (3000)                          00055600
                      E   ,EY    (3000)                                                               00055700
                 C                                                                                    00055800
                 C DATA TABLES...                                                                     00055900
                 C                                                                                    00056000
   ISN 0008            COMMON /TABLES/                                                                00056100
                      A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                            00056200
                      B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                           00056300
                      C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                           00056400
                      D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                           00056500
                      E   ,T5(4,3)           ,T6(1,3)                                               00056600
                 C                                                                                    00056700
                 C CONTROL PARAMETERS...                                                              00056800
                 C                                                                                    00056900
   ISN 0009            COMMON /CONTRL/                                                                00057000
                      A    DAY               ,TIME               ,INIT                              00057100
                      B   ,TAFT              ,IER                ,KNU                               00057200
                      C   ,KOR               ,IP                 ,IR                                00057300
                      D   ,NLIB              ,NPAGE              ,FAC                               00057400
                 C                                                                                    00057500
                 C OUTPUT STORAGE FOR CURRENT TIME STEP...                                            00057600
                 C                                                                                    00057700
   ISN 0010            COMMON /OUTPUT/                                                                00057800
                      A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                         00057900
                      B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                         00058000
                      C   ,HLF(30)            ,Q(30,30)          ,HLFOUT(30,30)                     00058100
                 C
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*LEVEL 2.3.0 (JUNE 78)        XTIME          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.29      PAGE   2

                C CURRENT VARIABLES                                                                    00058200
                C                                                                                      00058300
  ISN 0011            COMMON /NOW/                                                                     00058400
                     A    TI       ,D3       ,D4       ,D5       ,P0       ,AMAD                     00058500
                     B   ,F1                                                                           00058600
                C ..................................................................................   00058700
  ISN 0012            BACKSPACE 1                                                                      00058800
  ISN 0013            READ(1,10)     TIMET                                                             00058900
  ISN 0014       10   FORMAT(8X,8E8.2)                                                                 00059000
  ISN 0015            WRITE(6,1000)     TIMET                                                          00059100
  ISN 0016       1000 FORMAT(                                                                          00059200
                     A       '0      EVALUATION TIME       ..',1P8E10.3)                             00059300
  ISN 0017            RETURN                                                                           00059400
                C                                                                                      00059500
                C                                                                                      00059600
                C                                                                                      00059700
  ISN 0018            ENTRY XINHA                                                                      00059800
  ISN 0019            BACKSPACE 1                                                                      00059900
  ISN 0020            NOPT=1                                                                           00060000
  ISN 0021            READ(1,20) MOPT1                                                                 00060100
  ISN 0022            MOPT=MOPT1+1                                                                     00060200
  ISN 0023            WRITE(6,2000) A(MOPT)                                                            00060300
  ISN 0024            WRITE (6,1040)                                                                   00060400
  ISN 0025       1040 FORMAT(' * INHALATION OPTION ACCEPTED ')                                         00060500
  ISN 0026       20   FORMAT(T17,I1)                                                                   00060600
  ISN 0027            RETURN                                                                           00060700
                C                                                                                      00060800
  ISN 0028            ENTRY XACUTE                                                                     00060900
  ISN 0029            BACKSPACE 1                                                                      00061000
  ISN 0030            NOPT=2                                                                           00061100
  ISN 0031            READ(1,20) MOPT1                                                                 00061200
  ISN 0032            MOPT=MOPT1+1                                                                     00061300
  ISN 0033            WRITE(6,2000) A(MOPT)                                                            00061400
  ISN 0034            WRITE(6,1050)                                                                    00061500
  ISN 0035       1050 FORMAT(' * ACUTE OPTION ACCEPTED ')                                              00061600
  ISN 0036       2000 FORMAT(1X,2A8,'ADAPTED')                                                         00061700
  ISN 0037            RETURN                                                                           00061800
                C                                                                                      00061900
  ISN 0038            ENTRY XCHRO                                                                      00062000
  ISN 0039            BACKSPACE 1                                                                      00062100
  ISN 0040            NOPT=3                                                                           00062200
  ISN 0041            READ(1,20)MOPT1                                                                  00062300
  ISN 0042            MOPT=MOPT1+1                                                                     00062400
  ISN 0043            WRITE(6,2000) A(MOPT)                                                            00062500
  ISN 0044            WRITE(6,1060)                                                                    00062600
  ISN 0045       1060 FORMAT(' * CHRONIC OPTION ACCEPTED ')                                            00062700
  ISN 0046            RETURN                                                                           00062800
  ISN 0047            ENTRY XLIB                                                                       00062900
  ISN 0048            WRITE(6,1070)                                                                    00063000
  ISN 0049            NOPT=4                                                                           00063100
  ISN 0050       1070 FORMAT('0* LIBRARY OPTION ACCEPTED ')                                            00063200
  ISN 0051            RETURN                                                                           00063300
  ISN 0052            END                                                                              00063400
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*LEVEL 2.3.0 (JUNE 78)                  OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.29       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

  ISN 0002            SUBROUTINE LIBMGR (IST)                                                  00063500
  ISN 0003            REAL*4 CARD(18),CARDT(18,1)                                              00063600
  ISN 0004            REAL*4 $HEAD/'HEAD'/,$LABEL/'LABE'/,$ORGAN/'ORGA'/,$NUCLI/'NUCL'/,      00063700
                     A $TIME/'TIME'/,$INHA/'INHA'/,$ACUTE/'ACUT'/,$CHRO/'CHRO'/,              00063800
                     B $LIBR/'LIBR'/,$D/'D   '/,$P0/'P0  '/,$AMAD/'AMAD'/,$999/'9999'/,       00063900
                     C $UNIT/'UNIT'/                                                          00064000
                C                                                                             00064100
                C =============== C O M M O N ==========================================      00064200
  ISN 0005            REAL*8 ORGNAM,DAY                                                        00064300
                C                                                                             00064400
                C  INPUT...                                                                   00064500
                C                                                                             00064600
  ISN 0006            COMMON /INPUT/                                                           00064700
                     A    HEAD(18)          ,LABEL(18)          ,NORG                       00064800
                     B   ,KORG(30)          ,NON                ,NZ(30)                     00064900
                     C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                 00065000
                     D   ,ID(2,30)          ,NOPT               ,MOPT                       00065100
                     E   ,TIT(30)           ,TIMET(8)           ,DTIME                      00065200
                     F   ,D3T(30)           ,D4T(30)            ,D5T(30)                    00065300
                     G   ,P0T(30)           ,AMADT(30)          ,IUNIT                      00065400
                     H   ,UNIT                                                              00065500
                C                                                                             00065600
                C BIOLOGICAL LIBRARY RECORD ...                                               00065700
                C                                                                             00065800
  ISN 0007            COMMON /BIOLIB/                                                          00065900
                     A    LZ    (3000)      ,LA    (3000)      ,META  (3000)               00066000
                     B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)               00066100
                     C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)               00066200
                     D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)               00066300
                     E   ,EY    (3000)                                                      00066400
                C                                                                             00066500
                C DATA TABLES...                                                              00066600
                C                                                                             00066700
  ISN 0008            COMMON /TABLES/                                                          00066800
                     A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                     00066900
                     B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                    00067000
                     C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                    00067100
                     D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                    00067200
                     E   ,T5(4,3)           ,T6(1,3)                                        00067300
                C                                                                             00067400
                C CONTROL PARAMETERS...                                                       00067500
                C                                                                             00067600
  ISN 0009            COMMON /CONTRL/                                                          00067700
                     A    DAY               ,TIME               ,INIT                       00067800
                     B   ,TAFT              ,IER                ,KNU                        00067900
                     C   ,KOR               ,IP                 ,IR                         00068000
                     D   ,NLIB              ,NPAGE              ,FAC                        00068100
                C                                                                             00068200
                C OUTPUT STORAGE FOR CURRENT TIME STEP...                                     00068300
                C                                                                             00068400
  ISN 0010            COMMON /OUTPUT/                                                          00068500
                     A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                  00068600
                     B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                  00068700
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                C   ,HLF(30)          ,Q(30,30)          ,HLFOUT(30,30)        00068800
              C                                                                 00068900
              C CURRENT VARIABLES                                               00069000
              C                                                                 00069100
ISN 0011            COMMON /NOW/                                                00069200
                   A    TI      ,D3       ,D4       ,D5       ,P0       ,AMAD  00069300
                   B   ,F1                                                      00069400
              C .....                                                           00069500
ISN 0012            NPAGE=NPAGE+1                                               00069600
ISN 0013            IC=0                                                        00069700
ISN 0014            REWIND 10                                                   00069800
ISN 0015            WRITE(6,1060)NPAGE                                          00069900
ISN 0016     1060 FORMAT('1* BIOLOGICAL LIBRARY ',T115,'PAGE',/T115,I3)         00070000
ISN 0017            NLIB=0                                                      00070100
ISN 0018            DO 200 I=1,10000                                            00070200
ISN 0019            READ (10,1000,END=100) LZ(I),LA(I),META(I),IDZ(I),KODE(I),  00070300
                   A PHLF(I),BHLF(I),FW(I),FA(I),F2D(I),ED(I),EW(I),EY(I)       00070400
ISN 0020      200   NLIB=I                                                      00070500
ISN 0021      100   REWIND 10                                                   00070600
ISN 0022     1000 FORMAT(2I3,I1,A2,I2,6E8.3,2E6.2)                              00070700
ISN 0023            IST=0                                                       00070800
ISN 0024            NLIBO=NLIB                                                  00070900
              C                                                                 00071000
ISN 0025      300   READ(1,1010) XD                                             00071100
              C                                                                 00071200
ISN 0026     1010 FORMAT(A4,T1,2I3,I1,A2,I2,6E8.3,2E6.2,T1,20A4)                00071300
ISN 0027            IF(XD.EQ.$HEAD .OR. XD.EQ.$LABEL .OR. XD.EQ.$ORGAN .OR.     00071400
                   A $NUCLI.EQ.XD .OR. XD.EQ.$TIME .OR. $INHA.EQ.XD .OR.        00071500
                   B $ACUTE.EQ.XD .OR. $CHRO.EQ.XD .OR.                         00071600
                   C $D.EQ.XD .OR. $P0.EQ.XD .OR. $AMAD.EQ.XD ) GO TO 920       00071700
ISN 0029            IF($LIBR.EQ.XD) GO TO 300                                   00071800
ISN 0031            IF (XD.EQ.$999) GO TO 930                                   00071900
              C                                                                 00072000
ISN 0033            BACKSPACE 1                                                 00072100
              C                                                                 00072200
ISN 0034            READ(1,1010) XD,LZI  ,LAI  ,METAI  ,IDZI  ,KODEI  ,         00072300
                   A PHLFI  ,BHLFI  ,FWI ,FAI ,F2DI ,EDI ,EWI  ,EYI,CARD        00072400
              C                                                                 00072500
ISN 0035            IF (LZI.LT.150 .AND. LAI.LT.300 .AND. METAI.LE.1 .AND. METAI.GE.0 00072600
                   A .AND. KODEI.LE.23) GO TO 410                               00072700
ISN 0037            WRITE(6,1020) CARD                                          00072800
ISN 0038     1020 FORMAT('0*ERROR IN LIBRARY CARD ',18A4,/T25,18('----'))        00072900
ISN 0039            IER=1                                                       00073000
ISN 0040            GO TO 300                                                   00073100
              C                                                                 00073200
ISN 0041      410   DO 420 N=1,NLIB                                             00073300
ISN 0042            IF (LZI.NE.LZ(N) .OR . LAI.NE.LA(N) .OR . METAI.NE.META(I)  00073400
                   A  .OR. KODEI.NE.KODE(I))  GO TO 420                         00073500
              C                          * REPLACE *                           00073600
ISN 0044            IDZ(N)=IDZI                                                 00073700
ISN 0045            PHLF(N)=PHLFI                                               00073800
ISN 0046            BHLF(N)=BHLFI                                               00073900
ISN 0047            FW(N)=FWI                                                   00074000
ISN 0048            FA(N)=FAI                                                   00074100
ISN 0049            F2D(N)=F2DI                                                 00074200
ISN 0050            ED(N)=EDI                                                   00074300
ISN 0051            EW(N)=EWI                                                   00074400
ISN 0052            EY(N)=EYI                                                   00074500
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*LEVEL 2.3.0 (JUNE 78)        LIBMGR          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.29       PAGE   3

ISN 0053            IC=1                                                                                    00074600
ISN 0054            DO 425 M=1,18                                                                           00074700
ISN 0055       425   CARDT(M,N)=CARD(M)                                                                     00074800
                   C                                                                                       00074900
ISN 0056            GO TO 430                                                                               00075000
ISN 0057        420 CONTINUE                                                                               00075100
                   C                          # ADDITION *                                                 00075200
ISN 0058            NLIB=NLIB+1                                                                             00075300
ISN 0059            LZ  (NLIB) = LZI                                                                        00075400
ISN 0060            LA  (NLIB) = LAI                                                                        00075500
ISN 0061            META(NLIB) = METAI                                                                      00075600
ISN 0062            IDZ (NLIB) = IDZI                                                                       00075700
ISN 0063            KODE(NLIB) = KODEI                                                                      00075800
ISN 0064            PHLF(NLIB) = PHLFI                                                                      00075900
ISN 0065            BHLF(NLIB) = BHLFI                                                                      00076000
ISN 0066            FW  (NLIB) = FWI                                                                        00076100
ISN 0067            FA  (NLIB) = FAI                                                                        00076200
ISN 0068            F2D (NLIB) = F2DI                                                                       00076300
ISN 0069            ED  (NLIB) = EDI                                                                        00076400
ISN 0070            EW  (NLIB) = EWI                                                                        00076500
ISN 0071            EY  (NLIB) = EYI                                                                        00076600
ISN 0072            IC=2                                                                                    00076700
ISN 0073            DO 435 M=1,18                                                                           00076800
ISN 0074       435   CARDT(M,N)=CARD(M)                                                                     00076900
                   C                                                                                       00077000
ISN 0075            WRITE(6,1030) CARD                                                                      00077100
ISN 0076       1030 FORMAT(1X,18A4,' *ADDED TO LIBRARY')                                                    00077200
ISN 0077            GO TO 300                                                                               00077300
                   C                                                                                       00077400
ISN 0078        430 WRITE(6,1040) CARD                                                                     00077500
ISN 0079       1040 FORMAT(1X,18A4,' *REPLACED TO LIBRARY')                                                00077600
ISN 0080            GO TO 300                                                                               00077700
                   C                  * ERROR EXISTS*                                                      00077800
ISN 0081        900 IER=1                                                                                  00077900
ISN 0082            IST=3                                                                                   00078000
ISN 0083            GO TO 950                                                                               00078100
                   C                  * NEXT OPTION FOUND *                                                00078200
ISN 0084        920 BACKSPACE 1                                                                            00078300
ISN 0085            GO TO 940                                                                               00078400
                   C                  * END OF DATA ISSUED *                                               00078500
ISN 0086        930 IST=3                                                                                  00078600
ISN 0087        940 CONTINUE                                                                               00078700
                   C                                                                                       00078800
                   C UPDATE ALL LIBRARY DATA                                                               00078900
                   C                                                                                       00079000
ISN 0088            IF(IC.EQ.0) GO TO 950                                                                   00079100
ISN 0090              CALL UPDATE                                                                           00079200
ISN 0091        500 CONTINUE                                                                               00079300
ISN 0092            WRITE(6,1050) NLIBO,NLIB                                                                00079400
ISN 0093       1050 FORMAT('0NOW BIOLOGICAL DATA LIBRAY UPDATED ...',/                                      00079500
                  A '0  OLD LIBRARY',I5,' RECORDS',/'0  NEW LIBRARY',I5,' RECORDS')                        00079600
                   C                                                                                       00079700
ISN 0094            RETURN                                                                                  00079800
ISN 0095        950 NPAGE=NPAGE+1                                                                          00079900
ISN 0096            WRITE(6,1070)                                                                           00080000
ISN 0097       1070 FORMAT('0   NOT UPDATED')                                                               00080100
ISN 0098            END                                                                                     00080200
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*LEVEL 2.3.0 (JUNE 78)                OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.30       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

 ISN 0002          SUBROUTINE XUNIT                                                                00080300
 ISN 0003          INTEGER*2 LU1/'S '/,LU2/'H '/,LU3/'D '/,LU4/'Y '/,LU                            00080400
                   C                                                                               00080500
                   C =============== C O M M O N ==========================================        00080600
 ISN 0004          REAL*8 ORGNAM,DAY                                                               00080700
                   C                                                                               00080800
                   C  INPUT...                                                                     00080900
                   C                                                                               00081000
 ISN 0005          COMMON /INPUT/                                                                  00081100
                   A    HEAD(18)          ,LABEL(18)          ,NORG                            00081200
                   B   ,KORG(30)          ,NON                ,NZ(30)                          00081300
                   C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                      00081400
                   D   ,ID(2,30)          ,NOPT               ,MOPT                            00081500
                   E   ,TIT(30)           ,TIMET(8)           ,DTIME                           00081600
                   F   ,D3T(30)           ,D4T(30)            ,D5T(30)                         00081700
                   G   ,POT(30)           ,AMADT(30)          ,IUNIT                           00081800
                   H   ,UNIT                                                                      00081900
                   C                                                                               00082000
                   C BIOLOGICAL LIBRARY RECORD ...                                                 00082100
                   C                                                                               00082200
 ISN 0006          COMMON /BIOLIB/                                                                 00082300
                   A    LZ    (3000)      ,LA    (3000)      ,META  (3000)                       00082400
                   B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                       00082500
                   C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                       00082600
                   D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                       00082700
                   E   ,EY    (3000)                                                              00082800
                   C                                                                               00082900
                   C DATA TABLES...                                                                00083000
                   C                                                                               00083100
 ISN 0007          COMMON /TABLES/                                                                 00083200
                   A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                          00083300
                   B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                         00083400
                   C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                         00083500
                   D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                         00083600
                   E   ,T5(4,3)           ,T6(1,3)                                             00083700
                   C                                                                               00083800
                   C CONTROL PARAMETERS...                                                         00083900
                   C                                                                               00084000
 ISN 0008          COMMON /CONTRL/                                                                 00084100
                   A    DAY               ,TIME               ,INIT                            00084200
                   B   ,TAFT              ,IER                ,KNU                             00084300
                   C   ,KOR               ,IP                 ,IR                              00084400
                   D   ,NLIB              ,NPAGE              ,FAC                             00084500
                   C                                                                               00084600
                   C OUTPUT STORAGE FOR CURRENT TIME STEP...                                       00084700
                   C                                                                               00084800
 ISN 0009          COMMON /OUTPUT/                                                                 00084900
                   A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                       00085000
                   B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                       00085100
                   C   ,HLF(30)            ,Q(30,30)          ,HLFOUT(30,30)                   00085200
                   C                                                                               00085300
                   C CURRENT VARIABLES                                                             00085400
                   C                                                                               00085500
```

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*LEVEL 2.3.0 (JUNE 78)        XUNIT          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.30      PAGE   2

   ISN 0010           COMMON /NOW/                                                        00085600
                     A    TI       ,D3       ,D4       ,D5       ,P0       ,AMAD       00085700
                     B   ,F1                                                            00085800
                   C .....................................................................00085900
   ISN 0011           BACKSPACE 1                                                       00086000
   ISN 0012           READ(1,10) UNIT,LU                                                00086100
   ISN 0013           WRITE(6,1000) UNIT                                                00086200
   ISN 0014        10 FORMAT(8X,A4,T9,A1)                                               00086300
   ISN 0015           IF (LU.EQ.LU1) IUNIT=0                                            00086400
   ISN 0017           IF (LU.EQ.LU2) IUNIT=1                                            00086500
   ISN 0019           IF (LU.EQ.LU3) IUNIT=2                                            00086600
   ISN 0021           IF (LU.EQ.LU4) IUNIT=3                                            00086700
   ISN 0023      1000 FORMAT('0TIME UNIT ....',T33,A4)                                  00086800
   ISN 0024           RETURN                                                            00086900
   ISN 0025           END                                                               00087000
```

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*LEVEL 2.3.0 (JUNE 78)                    OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.31       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

 ISN 0002            SUBROUTINE COMPUT                                                                00087100
                                                                                                      00087200
                   C ============== C O M M O N ==========================================           00087300
 ISN 0003            REAL*8 ORGNAM,DAY                                                                00087400
                   C                                                                                  00087500
                   C  INPUT...                                                                        00087600
                   C                                                                                  00087700
 ISN 0004            COMMON /INPUT/                                                                   00087800
                     A    HEAD(18)          ,LABEL(18)          ,NORG                               00087900
                     B   ,KORG(30)          ,NON                ,NZ(30)                             00088000
                     C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                         00088100
                     D   ,ID(2,30)          ,NOPT               ,MOPT                               00088200
                     E   ,TIT(30)           ,TIMET(8)           ,DTIME                              00088300
                     F   ,D3T(30)           ,D4T(30)            ,D5T(30)                            00088400
                     G   ,P0T(30)           ,AMADT(30)          ,IUNIT                              00088500
                     H   ,UNIT                                                                        00088600
                                                                                                      00088700
                   C                                                                                  00088800
                   C BIOLOGICAL LIBRARY RECORD ...                                                    00088900
                   C                                                                                  00089000
 ISN 0005            COMMON /BIOLIB/                                                                  00089100
                     A    LZ    (3000)       ,LA    (3000)       ,META  (3000)                       00089200
                     B   ,IDZ   (3000)       ,KODE  (3000)       ,PHLF  (3000)                       00089300
                     C   ,BHLF  (3000)       ,FW    (3000)       ,FA    (3000)                       00089400
                     D   ,F2D   (3000)       ,ED    (3000)       ,EW    (3000)                       00089500
                     E   ,EY    (3000)                                                                00089600
                   C                                                                                  00089700
                   C DATA TABLES...                                                                   00089800
                   C                                                                                  00089900
 ISN 0006            COMMON /TABLES/                                                                  00090000
                     A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                             00090100
                     B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                            00090200
                     C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                            00090300
                     D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                            00090400
                     E   ,T5(4,3)           ,T6(1,3)                                                  00090500
                   C                                                                                  00090600
                   C CONTROL PARAMETERS...                                                            00090700
                   C                                                                                  00090800
 ISN 0007            COMMON /CONTRL/                                                                  00090900
                     A    DAY               ,TIME               ,INIT                               00091000
                     B   ,TAFT              ,IER                ,KNU                                00091100
                     C   ,KOR               ,IP                 ,IR                                 00091200
                     D   ,NLIB              ,NPAGE              ,FAC                                00091300
                   C                                                                                  00091400
                   C OUTPUT STORAGE FOR CURRENT TIME STEP...                                          00091500
                   C                                                                                  00091600
 ISN 0008            COMMON /OUTPUT/                                                                  00091700
                     A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                          00091800
                     B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                          00091900
                     C   ,HLF(30)           ,Q(30,30)               ,HLFOUT(30,30)                  00092000
                   C                                                                                  00092100
                   C CURRENT VARIABLES                                                                00092200
                   C                                                                                  00092300
 ISN 0009            COMMON /NOW/
```

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*LEVEL 2.3.0 (JUNE 78)        COMPUT          OS/360  FORTRAN H EXTENDED          DATE 80.023/16.15.31       PAGE   2

                      A    TI       ,D3       ,D4       ,D5       ,P0       ,AMAD       00092400
                      B   ,F1                                                           00092500
                     C ..................................................................00092600
                     C                                                                  00092700
  ISN 0010            1000 FORMAT(1X,A8)                                                00092800
                     C CONVERT & SET VALUE                                              00092900
                     C                                                                  00093000
  ISN 0011                CALL SET                                                      00093100
                     C                                                                  00093200
                     C SET TIME                                                         00093300
                     C                                                                  00093400
  ISN 0012                TIMEL=0.                                                      00093500
  ISN 0013                NSW=1                                                         00093600
  ISN 0014                N= 1                                                          00093700
  ISN 0015             50 TIME=TIMET(N)                                                 00093800
                     C                                                                  00093900
                     C SET NUCLIDE                                                      00094000
                     C                                                                  00094100
  ISN 0016                DO 110 KNU=1,NON                                            00094200
  ISN 0017                TI=TIT(KNU)                                                 00094300
                     C                                                                  00094400
  ISN 0018                IF (TIMEL.LT.TI .AND. TI.LT.TIME) GO TO 130                 00094500
  ISN 0020                  GO TO 140                                                 00094600
  ISN 0021             130 TIME=TI                                                    00094700
  ISN 0022                NSW=0                                                       00094800
  ISN 0023             140 IF(TIME.EQ.0.) GO TO 100                                   00094900
                     C                                                                  00095000
  ISN 0025                 TIMEL=TIME                                                 00095100
  ISN 0026                TAFT=TIME-TI                                                00095200
  ISN 0027                D3=D3T(KNU)                                                 00095300
  ISN 0028                D4=D4T(KNU)                                                 00095400
  ISN 0029                D5=D5T(KNU)                                                 00095500
  ISN 0030                P0=P0T(KNU)                                                 00095600
  ISN 0031                AMAD=AMADT(KNU)                                             00095700
                     C                                                                  00095800
  ISN 0032                CALL LOCATE (1,KNU,IP,IR)                                   00095900
  ISN 0033                IF(IP.EQ.0) GO TO 110                                       00096000
  ISN 0035                F1=FW(IP)/F2D(IP)                                           00096100
  ISN 0036                HLF(KNU)=PHLF(IP)                                           00096200
                     C                                                                  00096300
                     C SET ORGAN                                                        00096400
                     C                                                                  00096500
  ISN 0037                DO 120 KOR=1,NORG                                           00096600
  ISN 0038                CALL LOCATE(KORG(KOR),KNU,IP,IR)                            00096700
  ISN 0039                HLFOUT(KOR,KNU)=0.0                                         00096800
  ISN 0040                IF(IP.EQ.0) GO TO 120                                       00096900
  ISN 0042                ID(1,KNU)=IDZ(IP)                                           00097000
  ISN 0043                ID(2,KNU)=LA(IP)                                            00097100
  ISN 0044                HLFOUT(KOR,KNU)=BHLF(IP)                                    00097200
  ISN 0045                IF (IP.EQ.0) GO TO 120                                      00097300
                     C                                                                  00097400
  ISN 0047                IF (NOPT.EQ.1) CALL INHAL                                   00097500
  ISN 0049                IF (NOPT.EQ.2 .OR. NOPT.EQ.3) CALL INTAKE                   00097600
  ISN 0051             120 CONTINUE                                                   00097700
  ISN 0052             110 CONTINUE                                                   00097800
                     C                                                                  00097900
  ISN 0053                CALL SOLOUT                                                 00098000
  ISN 0054                IF(NSW.EQ.1) N=N+1                                          00098100
```

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*LEVEL 2.3.0 (JUNE 78)        COMPUT          OS/360  FORTRAN H EXTENDED        DATE 80.023/18.15.31       PAGE   3

   ISN 0056              NSH=1                                                    00098200
   ISN 0057               GO TO 50                                                00098300
   ISN 0058         100  CONTINUE                                                 00098400
                    C                                                            00098500
   ISN 0059         900  RETURN                                                   00098600
   ISN 0060              END                                                      00098700
```

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*LEVEL 2.3.0 (JUNE 78)                  OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.31       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

                 C                                                                                    00098800
ISN 0002               SUBROUTINE INHAL                                                               00098900
                 C                                                                                    00099000
                 C INHALATION                                                                         00099100
                 C                                                                                    00099200
                 C                                                                                    00099300
                 C ================ C O M M O N ==========================================            00099400
ISN 0003               REAL*8 ORGNAM,DAY                                                              00099500
                 C                                                                                    00099600
                 C  INPUT...                                                                          00099700
                 C                                                                                    00099800
ISN 0004               COMMON /INPUT/                                                                 00099900
                      A    HEAD(18)          ,LABEL(18)          ,NORG                             00100000
                      B   ,KORG(30)          ,NON                ,NZ(30)                           00100100
                      C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                       00100200
                      D   ,ID(2,30)          ,NOPT               ,MOPT                             00100300
                      E   ,TIT(30)           ,TIMET(8)           ,DTIME                            00100400
                      F   ,D3T(30)           ,D4T(30)            ,D5T(30)                          00100500
                      G   ,P0T(30)           ,AMADT(30)          ,IUNIT                            00100600
                      H   ,UNIT                                                                      00100700
                 C                                                                                    00100800
                 C BIOLOGICAL LIBRARY RECORD ...                                                      00100900
                 C                                                                                    00101000
ISN 0005               COMMON /BIOLIB/                                                                00101100
                      A    LZ    (3000)      ,LA    (3000)      ,META  (3000)                       00101200
                      B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                       00101300
                      C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                       00101400
                      D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                       00101500
                      E   ,EY    (3000)                                                              00101600
                 C                                                                                    00101700
                 C DATA TABLES...                                                                     00101800
                 C                                                                                    00101900
ISN 0006               COMMON /TABLES/                                                                00102000
                      A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                           00102100
                      B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                          00102200
                      C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                          00102300
                      D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                          00102400
                      E   ,T5(4,3)           ,T6(1,3)                                              00102500
                 C                                                                                    00102600
                 C CONTROL PARAMETERS...                                                              00102700
                 C                                                                                    00102800
ISN 0007               COMMON /CONTRL/                                                                00102900
                      A    DAY               ,TIME               ,INIT                             00103000
                      B   ,TAFT              ,IER                ,KNU                              00103100
                      C   ,KOR               ,IP                 ,IR                               00103200
                      D   ,NLIB              ,NPAGE              ,FAC                              00103300
                 C                                                                                    00103400
                 C OUTPUT STORAGE FOR CURRENT TIME STEP...                                            00103500
                 C                                                                                    00103600
ISN 0008               COMMON /OUTPUT/                                                                00103700
                      A    Q1 (30,30)        ,Q2(30,30)          ;D1(30,30)                        00103800
                      B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                        00103900
                      C   ,HLF(30)            ,Q(30,30)          ,HLFOUT(30,30)                    00104000
```

```
                C                                                                00104100
                C CURRENT VARIABLES                                              00104200
                C                                                                00104300
                                                                                 00104400
   ISN 0009           COMMON /NOW/                                               00104500
                     A    TI       ,D3       ,D4       ,D5       ,P0       ,AMAD 00104600
                     B   ,F1                                                     00104700
                C ...............................................................00104800
   ISN 0010           IF (KORG(KOR).EQ.8) GO TO 100                              00104900
   ISN 0012           IF (KORG(KOR).GE.19) GO TO 200                             00105000
                C                                                                00105100
                C OTHER THAN LUNG AND GI-TRACT                                   00105200
                C                                                                00105300
   ISN 0014           CALL ORGAN                                                 00105400
   ISN 0015           GO TO 500                                                  00105500
                C                                                                00105600
                C LUNG                                                           00105700
                C                                                                00105800
   ISN 0016         100 CALL LUNG                                               00105900
   ISN 0017           GO TO 500                                                  00106000
                C                                                                00106100
                C GI-TRACT                                                       00106200
                C                                                                00106300
   ISN 0018         200 CALL GI                                                 00106400
   ISN 0019         500 RETURN                                                  00106500
   ISN 0020           END
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*LEVEL 2.3.0 (JUNE 78)                  OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.32       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

 ISN 0002          SUBROUTINE LUNG                                                                  00106600
                  C                                                                                 00106700
                  C TGLM EVALUATION                                                                 00106800
                  C                                                                                 00106900
                  C                                                                                 00107000
                  C =============== C O M M O N ==========================================          00107100
 ISN 0003             REAL*8 ORGNAM,DAY                                                             00107200
 ISN 0004             REAL*8  $                                                                     00107300
 ISN 0005             REAL*8  RAMDA , RAMDX , RAMDI , RAMDH , RAMDR                                 00107400
                  C                                                                                 00107500
                  C  INPUT...                                                                       00107600
                  C                                                                                 00107700
 ISN 0006             COMMON /INPUT/                                                                00107800
                     A    HEAD(18)          ,LABEL(18)          ,NORG                             00107900
                     B   ,KORG(30)          ,NON                ,NZ(30)                           00108000
                     C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                       00108100
                     D   ,ID(2,30)          ,NOPT               ,MOPT                             00108200
                     E   ,TIT(30)           ,TIMET(8)           ,DTIME                            00108300
                     F   ,D3T(30)           ,D4T(30)            ,D5T(30)                          00108400
                     G   ,P0T(30)           ,AMADT(30)          ,IUNIT                            00108500
                     H   ,UNIT                                                                      00108600
                  C                                                                                 00108700
                  C BIOLOGICAL LIBRARY RECORD ...                                                   00108800
                  C                                                                                 00108900
                                                                                                    00109000
 ISN 0007             COMMON /BIOLIB/                                                               00109100
                     A    LZ    (3000)      ,LA    (3000)      ,META  (3000)                     00109200
                     B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                     00109300
                     C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                     00109400
                     D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                     00109500
                     E   ,EY    (3000)                                                           00109600
                  C                                                                                 00109700
                  C DATA TABLES...                                                                  00109800
                  C                                                                                 00109900
 ISN 0008             COMMON /TABLES/                                                               00110000
                     A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                           00110100
                     B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                          00110200
                     C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                          00110300
                     D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                          00110400
                     E   ,T5(4,3)           ,T6(1,3)                                              00110500
                  C                                                                                 00110600
                  C CONTROL PARAMETERS...                                                           00110700
                  C                                                                                 00110800
 ISN 0009             COMMON /CONTRL/                                                               00110900
                     A    DAY               ,TIME               ,INIT                             00111000
                     B   ,TAFT              ,IER                ,KNU                              00111100
                     C   ,KOR               ,IP                 ,IR                               00111200
                     D   ,NLIB              ,NPAGE              ,FAC                              00111300
                  C                                                                                 00111400
                  C OUTPUT STORAGE FOR CURRENT TIME STEP...                                         00111500
                  C                                                                                 00111600
 ISN 0010             COMMON /OUTPUT/                                                               00111700
                     A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                        00111800
                     B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                        00111800
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*LEVEL 2.3.0 (JUNE 78)          LUNG          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.32       PAGE   2

                     C   ,HLF(30)              ,Q(30,30)          ,HLFOUT(30,30)        00111900
                C                                                                        00112000
                C CURRENT VARIABLES                                                      00112100
                C                                                                        00112200
   ISN 0011           COMMON /NOW/                                                       00112300
                      A    TI       ,D3       ,D4       ,D5       ,P0       ,AMAD       00112400
                      B   ,F1                                                            00112500
                C ---------------------------------------------------------------------00112600
   ISN 0012           DIMENSION Q1P0(4),D1P0(4),AJ(4)                                   00112700
   ISN 0013           DIMENSION  BJ(4) , CJ(4) , DJ(4)                                  00112800
   ISN 0014           EXP($) = DEXP($)                                                  00112900
   ISN 0015           Q1P=0.                                                            00113000
   ISN 0016           D1P=0.                                                            00113100
   ISN 0017           Q1P2=0.                                                           00113200
   ISN 0018           D1P2=0.                                                           00113300
   ISN 0019           Q2P=0.                                                            00113400
   ISN 0020           D2P=0.                                                            00113500
   ISN 0021           Q2P2= 0.                                                          00113600
   ISN 0022           D2P2= 0.                                                          00113700
   ISN 0023           Q1P31 = 0.                                                        00113800
   ISN 0024           Q1P32 = 0.                                                        00113900
   ISN 0025           Q1P3  = 0.                                                        00114000
   ISN 0026           D1P31 = 0.                                                        00114100
   ISN 0027           D1P32 = 0.                                                        00114200
   ISN 0028           D1P3  = 0.                                                        00114300
   ISN 0029           Q2P31 = 0.                                                        00114400
   ISN 0030           Q2P32 = 0.                                                        00114500
   ISN 0031           Q2P3  = 0.                                                        00114600
   ISN 0032           D2P31 = 0.                                                        00114700
   ISN 0033           D2P32 = 0.                                                        00114800
   ISN 0034           D2P3  = 0.                                                        00114900
                C                                                                        00115000
   ISN 0035           RAMDR = ALOG(2.0)/PHLF(IP)                                        00115100
   ISN 0036           RAMDHB = ALOG(2.0) / T5(4,KLASS(KNU))                             00115200
   ISN 0037           RAMDIB = ALOG(2.0) / T6(1,KLASS(KNU))                             00115300
   ISN 0038           RAMDH  = RAMDHB + RAMDR                                           00115400
   ISN 0039           RAMDI  = RAMDIB + RAMDR                                           00115500
                C                                                                        00115600
   ISN 0040           IF (KLASS(KNU).EQ.1) EN(KOR,KNU)=ED(IP)                           00115700
   ISN 0042           IF (KLASS(KNU).EQ.2) EN(KOR,KNU)=EW(IP)                           00115800
   ISN 0044           IF (KLASS(KNU).EQ.3) EN(KOR,KNU)=EY(IP)                           00115900
                C                                                                        00116000
   ISN 0046           C1= P0*D5                                                         00116100
   ISN 0047           C2= 51.15*EN(KOR,KNU)/ORGMAS(KORG(KOR),MOPT)                      00116200
   ISN 0048           C3 = P0 * D4                                                      00116300
   ISN 0049           IF (TIME.GT.TI) GO TO 200                                         00116400
                C                                                                        00116500
                C ----------------- PULMONARY REGION ----------------------------------00116600
                C                                                                        00116700
   ISN 0051           DO 100  I=1,4                                                     00116800
   ISN 0052           RAMDA=ALOG(2.0)/T5(I,KLASS(KNU)) + RAMDR                          00116900
   ISN 0053           AJ(I)= (1.-EXP(-RAMDA*TIME)) / RAMDA                              00117000
   ISN 0054           IF(AJ(I).LT.0.) AJ(I)=TIME-0.5*RAMDA*TIME**2+RAMDA**2*TIME**3/6.  00117100
   ISN 0056           Q1P0(I) = C1* F5(I,KLASS(KNU))*AJ(I)                              00117200
   ISN 0057           Q1P     = Q1P +Q1P0(I)                                            00117300
   ISN 0058           D1P0(I) = C2* F5(I,KLASS(KNU)) * (TIME-AJ(I))/RAMDA  * C1         00117400
                C                                                                        00117500
   ISN 0059           IF(D1P0(I).LT.0.) D1P0(I)=C2*F5(I,KLASS(KNU))*(0.5*TIME**2        00117600
```

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                     A                          -RAMDA*TIME**3/6.)  * C1                00117700
                   C                                                                     00117800
ISN 0061                 D1P     = D1P + D1P0(I)                                       00117900
ISN 0062              100  CONTINUE                                                     00118000
                   C                                                                     00118100
                   C ---------------- T-B REGION ----------------------------------------00118200
                   C                                                                     00118300
ISN 0063                 DO 150  J=1,2                                                 00118400
ISN 0064                 RAMDX = ALOG(2.0)/T4(J,KLASS(KNU)) + RAMDR                    00118500
ISN 0065                 CJ(J) = (1. - EXP(-RAMDX * TIME )) / RAMDX                    00118600
ISN 0066                 IF( CJ(J).LT.0.) CJ(J) = TIME - 0.5*RAMDX*TIME**2             00118700
                        A                              + RAMDX**2*TIME**3/6.          00118800
ISN 0068                 Q1P0(J) = C3* F4(J,KLASS(KNU)) * CJ(J)                        00118900
ISN 0069                 Q1P2 = Q1P2 + Q1P0(J)                                         00119000
                   C                                                                     00119100
ISN 0070                 D1P0(J) = C2*C3* F4(J,KLASS(KNU)) * (TIME - CJ(J)) / RAMDX    00119200
ISN 0071                 IF(  D1P0(J).LT. 0.)                                          00119300
                        A  D1P0(J)=C2*C3* F4(J,KLASS(KNU))*(0.5*TIME**2-RAMDX*TIME**3/6.) 00119400
ISN 0073                 D1P2 = D1P2 + D1P0(J)                                         00119500
ISN 0074              150 CONTINUE                                                     00119600
                   C                                                                     00119700
                   C ------------------LYMPH NODE ----------------------------------------00119800
                   C                                                                     00119900
ISN 0075                 EI1 = (1. - EXP(- RAMDI*TIME)) / RAMDI                        00120000
ISN 0076                 IF( EI1 .LT. 0.) EI1 = TIME - RAMDI*TIME**2 /2.+RAMDI**2*TIME**3/600120100
ISN 0078                 EH1 = (1. - EXP(- RAMDH*TIME)) / RAMDH                        00120200
ISN 0079                 IF( EH1 .LT. 0.) EH1 = TIME-RAMDH*TIME**2/2. + RAMDH**2*TIME**3/6.00120300
ISN 0081                 ER1 = (1. - EXP(-RAMDR *TIME)) / RAMDR                        00120400
ISN 0082                 IF( ER1 .LT. 0.) ER1 = TIME-RAMDR*TIME**2/2. + RAMDR**2*TIME**3/6.00120500
                                                                                       00120600
                   C                                                                     00120700
ISN 0084                 ERH1 = ( EXP(-RAMDR*TIME) - EXP(-RAMDH*TIME)) / (RAMDH - RAMDR) 00120800
ISN 0085                 IF( ERH1 .LT. 0.) ERH1 = TIME - TIME**2 * (RAMDH+RAMDR) /2.   00120900
                        A  +TIME**3*(RAMDH**2 + RAMDH*RAMDR + RAMDR**2) /6.            00121000
                   C                                                                     00121100
ISN 0087                 IF(KLASS(KNU) .EQ. 3)  GO TO 250                              00121200
                   C                                                                     00121300
ISN 0089                 Q1P3 = C1*RAMDHB*F5(4,KLASS(KNU))*F6(1,KLASS(KNU)) / RAMDH    00121400
                        A     *( EI1 - TIME * EXP(-RAMDI * TIME) )                     00121500
ISN 0090                 IF( Q1P3 .LT. 0. )  Q1P3 = C1*RAMDHB*F5(4,KLASS(KNU))        00121600
                        A                          * F6(1,KLASS(KNU)) * TIME**2        00121700
                        B                          *(0.5 - RAMDI*TIME/3 +(RAMDI*TIME)**2/6.)00121800
                   C                                                                     00121900
ISN 0092                 D1P3 = C1*C2*RAMDHB*F5(4,KLASS(KNU)) * F6(1,KLASS(KNU)) / RAMDH 00122000
                        A     *((TIME - EI1)/ RAMDI - (EI1-TIME*EXP(-RAMDI*TIME))/ RAMDI) 00122100
ISN 0093                 IF( D1P3 .LT. 0. )  D1P3 = C1*C2*RAMDHB*F5(4,KLASS(KNU))      00122200
                        A                          * F6(1,KLASS(KNU)) * TIME**3        00122300
                        B             * ( 1.-RAMDI*TIME/ 2. + (RAMDI*TIME)**2/ 4. ) / 6. 00122400
                   C                                                                     00122500
ISN 0095                 GO TO 260                                                     00122600
                   C                                                                     00122700
ISN 0096              250 CONTINUE                                                     00122800
ISN 0097                 EIH1 = ( EXP(-RAMDI*TIME) - EXP(-RAMDH*TIME)) / (RAMDH - RAMDI) 00122900
ISN 0098                 IF( EIH1 .LT. 0.) EIH1 = TIME - TIME**2 * (RAMDH+RAMDI) /2.   00123000
                        A  +TIME**3*(RAMDH**2 + RAMDH*RAMDI + RAMDI**2) /6.            00123100
ISN 0100                 Q1P31= C1*RAMDHB*F5(4,KLASS(KNU)) * F6(1,KLASS(KNU)) / RAMDH  00123200
                        A     * ( EI1 - EIH1)                                          00123300
ISN 0101                 IF(Q1P31 .LT. 0.) Q1P31 = C1*RAMDHB * F5(4,KLASS(KNU))       00123400
                        A     * F6(1,KLASS(KNU)) * TIME**2 *(0.5-TIME*(RAMDH+RAMDI)/6.) 00123500
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*LEVEL 2.3.0 (JUNE 78)          LUNG          OS/360  FORTRAN H EXTENDED            DATE 80.023/18.15.32       PAGE   4

   ISN 0103           Q1P32 = C1*RAMDHB*F5(4,KLASS(KNU))*(1.-F6(1,KLASS(KNU))) / RAMDH  00123500
                     A       * ( ER1 - ERH1 )                                          00123600
   ISN 0104           IF( Q1P32 .LT. 0. )  Q1P32 = C1*RAMDHB*F5(4,KLASS(KNU))          00123700
                     A                   * (1.- F6(1,KLASS(KNU))) / RAMDH              00123800
                     B                   * TIME**2 * (0.5 - TIME*(RAMDH + RAMDR)/6.)   00123900
   ISN 0106           IF(PHLF(IP).GT.1.E+5) Q1P32 = C1*RAMDHB*F5(4,KLASS(KNU))          00124000
                     A                             *(1.-F6(1,KLASS(KNU))) / RAMDH      00124100
                     B                             *(TIME-EH1)                         00124200
   ISN 0108           IF(PHLF(IP).GT.1.E+5.AND.Q1P32.LT.0.) Q1P32=C1*RAMDHB             00124300
                     A                             *(1.-F6(1,KLASS(KNU)))              00124400
                     B                           * F5(4,KLASS(KNU))*TIME**2 /2.        00124500
              C                                                                        00124600
   ISN 0110           Q1P3 = Q1P31 + Q1P32                                            00124700
              C                                                                        00124800
   ISN 0111           D1P31 = C1*C2*RAMDHB*F5(4,KLASS(KNU))*F6(1,KLASS(KNU)) / RAMDH  00124900
                     A       *(( TIME - EI1 ) / RAMDI - ( EI1 - EH1 ) / (RAMDH-RAMDI) ) 00125000
   ISN 0112           IF( D1P31 .LT. 0. )  D1P31 = C1*C2*RAMDHB*F5(4,KLASS(KNU))       00125100
                     A   *F6(1,KLASS(KNU))* 1./6.*TIME**3                             00125200
   ISN 0114           D1P32 = C1*C2*RAMDHB*F5(4,KLASS(KNU))*(1.-F6(1,KLASS(KNU)))/RAMDH 00125300
                     A       *(( TIME - ER1 ) / RAMDR - (ER1 - EH1 ) /  (RAMDH-RAMDR) ) 00125400
   ISN 0115           IF( D1P32 .LT. 0. )  D1P32 = C1*C2*RAMDHB*F5(4,KLASS(KNU))       00125500
                     A   *(1.-F6(1,KLASS(KNU)))*1./6.*TIME**3                         00125600
   ISN 0117           IF(PHLF(IP).GT.1.E+5)  D1P32 = C1*C2*RAMDHB*(1.-F6(1,KLASS(KNU))) 00125700
                     A                           *F5(4,KLASS(KNU)) / RAMDH            00125800
                     B                           *(TIME**2/2.-(TIME-EH1)/RAMDH)       00125900
   ISN 0119           IF(PHLF(IP).GT.1.E+5.AND.D1P32.LT.0.) D1P32=0.                   00126000
              C                                                                        00126100
   ISN 0121           D1P3 = D1P31 + D1P32                                            00126200
              C                                                                        00126300
   ISN 0122    260 CONTINUE                                                           00126400
              C                                                                        00126500
   ISN 0123           Q1(KOR,KNU) = Q1P + Q1P2 + Q1P3                                 00126600
   ISN 0124           D1(KOR,KNU) = D1P + D1P2 + D1P3                                 00126700
   ISN 0125           GO TO 900                                                       00126800
              C                                                                        00126900
              C                                                                        00127000
   ISN 0126    200  CONTINUE                                                         00127100
              C                                                                        00127200
              C AFTER TERMINATION OF INHALATION                                       00127300
              C                                                                        00127400
              C ----------------- PULMONARY REGION ------------------------------------00127500
              C                                                                        00127600
   ISN 0127           DO 300 I=1,4                                                    00127700
   ISN 0128           RAMDA = ALOG(2.0)/T5(I,KLASS(KNU)) +RAMDR                       00127800
   ISN 0129           AJ(I)=(1.-EXP(-RAMDA*TI))/RAMDA                                 00127900
   ISN 0130           IF(AJ(I).LT.0.) AJ(I)=TI-0.5*RAMDA*TI**2.                       00128000
   ISN 0132           Q1P0(I)=C1*F5(I,KLASS(KNU))*AJ(I)                               00128100
   ISN 0133           BJ(I)=(1.-EXP(-RAMDA*TAFT))/RAMDA                               00128200
   ISN 0134           IF(BJ(I)       .LT.0.    ) BJ(I)=TAFT-0.5*RAMDA*TAFT**2.       00128300
   ISN 0136           Q2P   = Q2P + Q1P0(I)*EXP(-RAMDA*TAFT)                          00128400
   ISN 0137           D2P   = D2P + C2*F5(I,KLASS(KNU))*AJ(I)*BJ(I) * C1              00128500
   ISN 0138    300  CONTINUE                                                         00128600
              C                                                                        00128700
              C ----------------- T-B REGION ------------------------------------------00128800
              C                                                                        00128900
   ISN 0139           DO 350 J=1,2                                                    00129000
   ISN 0140           RAMDX = ALOG(2.0) / T4(J,KLASS(KNU)) + RAMDR                    00129100
   ISN 0141           CJ(J) = (1. - EXP(-RAMDX * TI)) / RAMDX                         00129200
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*LEVEL 2.3.0 (JUNE 78)          LUNG          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.32       PAGE   5

  ISN 0142           IF(CJ(J).LT.0.) CJ(J)= TI - 0.5* RAMDX * TI **2                    00129300
                    A                     + RAMDX**2*TI**3/6.                         00129400
  ISN 0144           DJ(J) = (1. - EXP(-RAMDX * TAFT)) / RAMDX                         00129500
  ISN 0145           IF(DJ(J).LT.0.) DJ(J)= TAFT - 0.5*RAMDX * TAFT**2                 00129600
                    A                     + RAMDX**2*TAFT**3/6.                       00129700
  ISN 0147           Q1P0(J)=C3 * F4(J,KLASS(KNU)) * CJ(J)                             00129800
  ISN 0148           Q2P2= Q2P2 + Q1P0(J) * EXP(-RAMDX * TAFT)                         00129900
                    C                                                                 00130000
  ISN 0149           D2P2= D2P2 + C2*C3 * F4(J,KLASS(KNU)) * CJ(J) * DJ(J)             00130100
  ISN 0150         350 CONTINUE                                                       00130200
                    C                                                                 00130300
                    C                                                                 00130400
                    C                                                                 00130500
                    C ------------------LYMPH NODE ---------------------------------- 00130600
                    C                                                                 00130700
  ISN 0151           EI2 = (1. - EXP(-RAMDI*TI)) / RAMDI                               00130800
  ISN 0152           IF( EI2 .LT. 0.) EI2 = TI - RAMDI*TI**2 /2. + RAMDI**2*TI**3 / 6. 00130900
  ISN 0154           EH2 = (1. - EXP(-RAMDH*TI)) / RAMDH                               00131000
  ISN 0155           IF( EH2 .LT. 0.) EH2 = TI - RAMDH*TI**2 /2. + RAMDH**2*TI**3 / 6. 00131100
  ISN 0157           ER2 = (1. - EXP(-RAMDR*TI)) / RAMDR                               00131200
  ISN 0158           IF( ER2 .LT. 0.) ER2 = TI - RAMDR*TI**2 /2. + RAMDR**2*TI**3 / 6. 00131300
  ISN 0160           ERH2 = ( EXP(-RAMDR*TI) - EXP(-RAMDH*TI)) / (RAMDH - RAMDR)       00131400
  ISN 0161           IF( ERH2 .LT. 0.) ERH2 = TI - TI**2 * (RAMDH + RAMDR) / 2.        00131500
                    A  + TI**3 * (RAMDH**2 + RAMDH*RAMDR + RAMDR**2) / 6.             00131600
  ISN 0163           QH1  = C1 * F5(4,KLASS(KNU)) * EH2                                00131700
                    C                                                                 00131800
  ISN 0164           EI3 = (1. - EXP(-RAMDI*TAFT)) / RAMDI                             00131900
  ISN 0165           IF( EI3 .LT. 0. ) EI3 = TAFT-RAMDI*TAFT**2/2.+RAMDI**2*TAFT**3/ 6.00132000
  ISN 0167           EH3 = (1. - EXP(-RAMDH*TAFT)) / RAMDH                             00132100
  ISN 0168           IF( EH3 .LT. 0. ) EH3 = TAFT-RAMDH*TAFT**2/2.+RAMDH**2*TAFT**3 /6.00132200
  ISN 0170           ER3 = (1. - EXP(-RAMDR*TAFT)) / RAMDR                             00132300
  ISN 0171           IF( ER3 .LT. 0. ) ER3 = TAFT-RAMDR*TAFT**2/2.+RAMDR**2*TAFT**3 /6.00132400
  ISN 0173           ERH3 = ( EXP(-RAMDR*TAFT) - EXP(-RAMDH*TAFT)) / (RAMDH - RAMDR)   00132500
  ISN 0174           IF( ERH3 .LT. 0.) ERH3 = TAFT - TAFT**2 * (RAMDH + RAMDR) / 2.    00132600
                    A  + TAFT**3 * (RAMDH**2 + RAMDH*RAMDR + RAMDR**2) / 6.           00132700
                    C                                                                 00132800
  ISN 0176           IF(KLASS(KNU) .EQ. 3)  GO TO 400                                  00132900
                    C                                                                 00133000
  ISN 0178           Q1P3 = C1*RAMDHB*F5(4,KLASS(KNU))*F6(1,KLASS(KNU)) / RAMDH        00133100
                    A      *( EI2 - TI * EXP(-RAMDI * TI) )                           00133200
  ISN 0179           IF( Q1P3 .LT. 0.)  Q1P3 = C1*RAMDHB*F5(4,KLASS(KNU))             00133300
                    A                       * F6(1,KLASS(KNU)) * TI**2                00133400
                    B                       *(0.5 - RAMDI*TI/3 +(RAMDI*TI)**2/6.)     00133500
  ISN 0181           Q2P3 = F6(1,KLASS(KNU)) * RAMDHB * QH1 * TAFT * EXP(-RAMDI*TAFT)  00133600
                    A     + Q1P3 * EXP(-RAMDI * TAFT)                                 00133700
  ISN 0182           D2P3 = C2 * F6(1,KLASS(KNU)) * RAMDHB * QH1 / RAMDI               00133800
                    A     * ( EI3 - TAFT * EXP(-RAMDI*TAFT) )                         00133900
  ISN 0183           IF(D2P3.LT.0) D2P3=C2*F6(1,KLASS(KNU)) * RAMDHB * QH1 * TAFT**2   00134000
                    A                     *(0.5 - RAMDI*TAFT/3 +(RAMDI*TAFT)**2 / 6. ) 00134100
  ISN 0185           D2P3 = D2P3 + C2*Q1P3*EI3                                         00134200
  ISN 0186           GO TO 450                                                         00134300
  ISN 0187         400 CONTINUE                                                       00134400
  ISN 0188           EIH2 = ( EXP(-RAMDI*TI) - EXP(-RAMDH*TI)) / (RAMDH - RAMDI)       00134500
  ISN 0189           IF( EIH2 .LT. 0.) EIH2 = TI - TI**2 * (RAMDH + RAMDI) / 2.        00134600
                    A  + TI**3 * (RAMDH**2 + RAMDH*RAMDI + RAMDI**2) / 6.             00134700
  ISN 0191           EIH3 = ( EXP(-RAMDI*TAFT) - EXP(-RAMDH*TAFT)) / (RAMDH - RAMDI)   00134800
  ISN 0192           IF( EIH3 .LT. 0.) EIH3 = TAFT - TAFT**2 * (RAMDH + RAMDI) / 2.    00134900
                    A  + TAFT**3 * (RAMDH**2 + RAMDH*RAMDI + RAMDI**2) / 6.           00135000
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ISN 0194          Q1P31 = C1*RAMDHB*F5(4,KLASS(KNU)) * F6(1,KLASS(KNU)) / RAMDH     00135100
                 A      * ( EI2 - EIH2)                                           00135200
ISN 0195          IF(Q1P31 .LT. 0.) Q1P31 = C1*RAMDHB * F5(4,KLASS(KNU))           00135300
                 A      * F6(1,KLASS(KNU)) * TI**2 * (0.5 - TI*(RAMDH+RAMDI) / 6.) 00135400
ISN 0197          Q1P32 = C1*RAMDHB*F5(4,KLASS(KNU)) *(1.-F6(1,KLASS(KNU))) / RAMDH 00135500
                 A      * ( ER2 - ERH2 )                                          00135600
ISN 0198          IF(Q1P32 .LT. 0.) Q1P32 = C1*RAMDHB * F5(4,KLASS(KNU))           00135700
                 A                * (1.- F6(1,KLASS(KNU))) / RAMDH                00135800
                 B                * TI**2 * (0.5 - TI*(RAMDH + RAMDR) / 6. )      00135900
ISN 0200          IF(PHLF(IP).GT.1.E+5)  Q1P32 = C1*RAMDHB*F5(4,KLASS(KNU))       00136000
                 A                             *(1.-F6(1,KLASS(KNU))) / RAMDH     00136100
                 B                             *(TI - EH2)                        00136200
ISN 0202          IF(PHLF(IP).GT.1.E+5.AND.Q1P32.LT.0.) Q1P32 = C1*RAMDHB          00136300
                 A                             *(1.-F6(1,KLASS(KNU)))             00136400
                 B                             * F5(4,KLASS(KNU))*TI**2 / 2.      00136500
ISN 0204          Q2P3 = QH1*F6(1,KLASS(KNU))*RAMDHB * EIH3+Q1P31*EXP(-RAMDI*TAFT) 00136600
                 A     + QH1*(1.-F6(1,KLASS(KNU))) * RAMDHB * ERH3                 00136700
                 B     + Q1P32 * EXP(-RAMDR * TAFT)                                00136800
ISN 0205          IF(PHLF(IP).GT.1.E+5) Q2P3 =QH1*F6(1,KLASS(KNU))*RAMDHB*EIH3    00136900
                 A                          + Q1P31 * EXP(-RAMDI*TAFT)            00137000
                 B                          +QH1*(1.-F6(1,KLASS(KNU)))*RAMDHB*EH3 00137100
                 C                          + Q1P32 * EXP(-RAMDR*TAFT)            00137200
                C                                                                  00137300
ISN 0207          D2P31 = C2*F6(1,KLASS(KNU))*RAMDHB *((EI3 - EH3) / (RAMDH-RAMDI)) 00137400
ISN 0208          IF(D2P31 .LT. 0.) D2P31 = C2*F6(1,KLASS(KNU)) * RAMDHB * TAFT    00137500
                 A                        * ( 1. - TAFT * (RAMDH + RAMDI) / 2.     00137600
                 B    + TAFT**2*(RAMDH**2 + RAMDH * RAMDI + RAMDI**2) / 6. )      00137700
ISN 0210          D2P32 = C2*(1.-F6(1,KLASS(KNU)))*RAMDHB*((ER3 - EH3) /           00137800
                 A                                        (RAMDH - RAMDR))        00137900
ISN 0211          IF(D2P32 .LT. 0.) D2P32 = C2*(1.-F6(1,KLASS(KNU))) * RAMDHB *TAFT 00138000
                 A                        * ( 1. - TAFT * (RAMDH + RAMDR) / 2.     00138100
                 B    + TAFT**2*(RAMDH**2 + RAMDH * RAMDR + RAMDR **2 ) / 6. )    00138200
ISN 0213          IF(PHLF(IP).GT.1.E+5) D2P32 =C2 * (1.-F6(1,KLASS(KNU)))*RAMDHB   00138300
                 A                             *(TAFT - EH3) / RAMDH              00138400
ISN 0215          IF(PHLF(IP).GT.1.E+5.AND.D2P32.LT.0.) D2P32 = C2*RAMDHB          00138500
                 A                             *(1.-F6(1,KLASS(KNU)))             00138600
                 B                             *TAFT**2 / 2.                      00138700
ISN 0217          IF(PHLF(IP).GT.1.E+6) ER3=TAFT                                   00138800
ISN 0219          D2P3=(D2P31+D2P32)*QH1+C2*(Q1P31*EI3+Q1P32*ER3)                   00138900
                C                                                                  00139000
ISN 0220        450 CONTINUE                                                       00139100
                C                                                                  00139200
ISN 0221          Q2(KOR,KNU) = Q2P + Q2P2 + Q2P3                                  00139300
ISN 0222          D2(KOR,KNU) = D2P + D2P2 + D2P3 + D1(KOR,KNU)                    00139400
ISN 0223          D (KOR,KNU) = D2(KOR,KNU)                                        00139500
ISN 0224        900  RETURN                                                       00139600
                C                                                                  00139700
ISN 0225          END                                                              00139800
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PNCT843-80-11

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*LEVEL 2.3.0 (JUNE 78)                    OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.35      PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

                 C                                                                                    00139900
   ISN 0002            SUBROUTINE GI                                                                 00140000
                 C                                                                                    00140100
                 C GI-TRACK MODEL                                                                     00140200
                 C                                                                                    00140300
                 C                                                                                    00140400
   ISN 0003            REAL*8 DIME,DAFT,DI,RAMDR,$                                                   00140500
                 C =============== C O M M O N ==========================================00140600
   ISN 0004            REAL*8 ORGNAM,DAY                                                             00140700
                 C                                                                                    00140800
                 C  INPUT...                                                                          00140900
                 C                                                                                    00141000
   ISN 0005            COMMON /INPUT/                                                                00141100
                      A    HEAD(18)          ,LABEL(18)          ,NORG                             00141200
                      B   ,KORG(30)          ,NON                ,NZ(30)                           00141300
                      C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                       00141400
                      D   ,ID(2,30)          ,NOPT               ,MOPT                             00141500
                      E   ,TIT(30)           ,TIMET(8)           ,DTIME                            00141600
                      F   ,D3T(30)           ,D4T(30)            ,D5T(30)                          00141700
                      G   ,P0T(30)           ,AMADT(30)          ,IUNIT                            00141800
                      H   ,UNIT                                                                      00141900
                 C                                                                                    00142000
                 C BIOLOGICAL LIBRARY RECORD ...                                                      00142100
                 C                                                                                    00142200
   ISN 0006            COMMON /BIOLIB/                                                               00142300
                      A    LZ    (3000)      ,LA    (3000)      ,META  (3000)                     00142400
                      B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                     00142500
                      C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                     00142600
                      D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                     00142700
                      E   ,EY    (3000)                                                           00142800
                 C                                                                                    00142900
                 C DATA TABLES...                                                                     00143000
                 C                                                                                    00143100
   ISN 0007            COMMON /TABLES/                                                               00143200
                      A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                           00143300
                      B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                          00143400
                      C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                          00143500
                      D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                          00143600
                      E   ,T5(4,3)           ,T6(1,3)                                              00143700
                 C                                                                                    00143800
                 C CONTROL PARAMETERS...                                                              00143900
                 C                                                                                    00144000
   ISN 0008            COMMON /CONTRL/                                                               00144100
                      A    DAY               ,TIME               ,INIT                             00144200
                      B   ,TAFT              ,IER                ,KNU                              00144300
                      C   ,KOR               ,IP                 ,IR                               00144400
                      D   ,NLIB              ,NPAGE              ,FAC                              00144500
                 C                                                                                    00144600
                 C OUTPUT STORAGE FOR CURRENT TIME STEP...                                            00144700
                 C                                                                                    00144800
   ISN 0009            COMMON /OUTPUT/                                                               00144900
                      A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                        00145000
                      B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                        00145100
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                C   ,HLF(30)          ,Q(30,30)          ,HLFOUT(30,30)        00145200
              C                                                                 00145300
              C CURRENT VARIABLES                                               00145400
              C                                                                 00145500
   ISN 0010         COMMON /NOW/                                                00145600
                   A    TI       ,D3       ,D4       ,D5       ,P0       ,AMAD  00145700
                   B   ,F1                                                      00145800
              C .....                                                           00145900
   ISN 0011         EXP($)=DEXP($)                                              00146000
   ISN 0012         ISKIP=0                                                     00146100
   ISN 0013         GO TO 100                                                   00146200
              C                                                                 00146300
   ISN 0014         ENTRY GI0(QG)                                               00146400
   ISN 0015         ISKIP=1                                                     00146500
   ISN 0016    100  CONTINUE                                                    00146600
              C                                                                 00146700
   ISN 0017         DIME=TIME                                                   00146800
   ISN 0018         DAFT=TAFT                                                   00146900
   ISN 0019         DI=TI                                                       00147000
   ISN 0020         IF (ABS(F1-1.0).LE.1.E-5) F1=0.95                           00147100
              C                                                                 00147200
   ISN 0022         AL2   = ALOG(2.0)                                           00147300
   ISN 0023         RAMDR = AL2/PHLF(IP)                                        00147400
              C                                                                 00147500
   ISN 0024         RAMDBB= AL2/T3(2,KLASS(KNU))                                00147600
   ISN 0025         RAMDBD= AL2/T4(2,KLASS(KNU))                                00147700
   ISN 0026         RAMDBF= AL2/T5(2,KLASS(KNU))                                00147800
   ISN 0027         RAMDBG= AL2/T5(3,KLASS(KNU))                                00147900
              C                                                                 00148000
   ISN 0028         IF (ISKIP.EQ.1) GO TO 200                                   00148100
   ISN 0030         RAMDB = RAMDBB + RAMDR                                      00148200
   ISN 0031         RAMDD = RAMDBD + RAMDR                                      00148300
   ISN 0032         RAMDF = RAMDBF + RAMDR                                      00148400
   ISN 0033         RAMDG = RAMDBG + RAMDR                                      00148500
              C                                                                 00148600
   ISN 0034         CB = RAMDBB*F3(2,KLASS(KNU))*D3/RAMDB                       00148700
   ISN 0035         CD = RAMDBD*F4(2,KLASS(KNU))*D4/RAMDD                       00148800
   ISN 0036         CF = RAMDBF*F5(2,KLASS(KNU))*D5/RAMDF                       00148900
   ISN 0037         CG = RAMDBG*F5(3,KLASS(KNU))*D5/RAMDG                       00149000
   ISN 0038         IF(DIME.GT.DI) GO TO 200                                    00149100
              C                                                                 00149200
   ISN 0040         Q1G =  CB*(DIME - (1.-EXP(-RAMDB*DIME))/RAMDB )             00149300
   ISN 0041         Q2G =    CD*(DIME - (1.-EXP(-RAMDD*DIME))/RAMDD )           00149400
   ISN 0042         Q3G =   CF*(DIME - (1.-EXP(-RAMDF*DIME))/RAMDF )            00149500
   ISN 0043         Q4G =      CG*(DIME - (1.-EXP(-RAMDG*DIME))/RAMDG )         00149600
   ISN 0044         IF(Q1G.LT.0) Q1G=CB*RAMDB*DIME**2.*0.5                      00149700
   ISN 0046         IF(Q2G.LT.0) Q2G=CD*RAMDD*DIME**2.*0.5                      00149800
   ISN 0048         IF(Q3G.LT.0) Q3G=CF*RAMDF*DIME**2.*0.5                      00149900
   ISN 0050         IF(Q4G.LT.0) Q4G=CG*RAMDG*DIME**2.*0.5                      00150000
   ISN 0052         Q1(KOR,KNU)= P0*(Q1G+Q2G+Q3G+Q4G)                           00150100
              C                                                                 00150200
   ISN 0053         QG  = Q1(KOR,KNU)                                           00150300
   ISN 0054         GO TO 220                                                   00150400
   ISN 0055    200  CONTINUE                                                    00150500
   ISN 0056         Q1G2=CB/RAMDB*(1.-EXP(-RAMDB*DI))*(1.-EXP(-RAMDB*DAFT))     00150600
   ISN 0057         Q2G2=CD/RAMDD*(1.-EXP(-RAMDD*DI))*(1.-EXP(-RAMDD*DAFT))     00150700
   ISN 0058         Q3G2=CF/RAMDF*(1.-EXP(-RAMDF*DI))*(1.-EXP(-RAMDF*DAFT))     00150800
   ISN 0059         Q4G2=CG/RAMDG*(1.-EXP(-RAMDG*DI))*(1.-EXP(-RAMDG*DAFT))     00150900
```

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                C                                                                       00151000
ISN 0060              IF(Q1G2.LT.0.) Q1G2=CB*(RAMDB*DI-0.5*RAMDB**2*DI**2)              00151100
                     A                    *(DAFT-0.5*RAMDB*DAFT**2)                    00151200
ISN 0062              IF(Q2G2.LT.0.) Q2G2=CD*(RAMDD*DI-0.5*RAMDD**2*DI**2)              00151300
                     A                    *(DAFT-0.5*RAMDD*DAFT**2)                    00151400
ISN 0064              IF(Q3G2.LT.0.) Q3G2=CF*(RAMDF*DI-0.5*RAMDF**2*DI**2)              00151500
                     A                    *(DAFT-0.5*RAMDF*DAFT**2)                    00151600
ISN 0066              IF(Q4G2.LT.0.) Q4G2=CG*(RAMDG*DI-0.5*RAMDG**2*DI**2)              00151700
                     A                    *(DAFT-0.5*RAMDG*DAFT**2)                    00151800
                C                                                                       00151900
ISN 0068              Q2(KOR,KNU)=P0*(Q1G2+Q2G2+Q3G2+Q4G2)                              00152000
                C                                                                       00152100
ISN 0069            210 CONTINUE                                                        00152200
ISN 0070              QG = Q1(KOR,KNU)+Q2(KOR,KNU)                                      00152300
ISN 0071              Q2(KOR,KNU) = QG                                                  00152400
ISN 0072              GO TO 220                                                         00152500
ISN 0073              ENTRY GI1(QG)                                                     00152600
ISN 0074              RAMDR=ALOG(2.0)/PHLF(IP)                                          00152700
ISN 0075              IF (ABS(F1-1.0).LE.1.E-5) F1=0.95                                 00152800
ISN 0077            220 Q (KOR,KNU)=QG                                                  00152900
                C                                                                       00153000
                C                                                                       00153100
                C DOSE                                                                  00153200
                C                                                                       00153300
ISN 0078              IF (KORG(KOR).EQ.21 .OR. KORG(KOR).EQ.22 .OR. KORG(KOR).EQ.23)    00153400
                     A GO TO 250                                                        00153500
                C  GI(S)                                                                00153600
                C                                                                       00153700
ISN 0080              IF (KLASS(KNU).EQ.1) EN(KOR,KNU)=ED(IP)                           00153800
ISN 0082              IF (KLASS(KNU).EQ.2) EN(KOR,KNU)=EW(IP)                           00153900
ISN 0084              IF (KLASS(KNU).EQ.3) EN(KOR,KNU)=EY(IP)                           00154000
                C                                                                       00154100
ISN 0086              EXDS=EXP(-RAMDR*GIS(1))                                           00154200
                C                                                                       00154300
ISN 0087              DS=25.57*EN(KOR,KNU)*QG/GIS(3)*(1.-EXDS)/RAMDR                    00154400
ISN 0088              IF(EXDS.GE.0.9998) DS=25.57*EN(KOR,KNU)*QG/GIS(3)                 00154500
                     A                    *(GIS(1)-0.5*RAMDR*GIS(1)**2)                00154600
ISN 0090              D(KOR,KNU) = DS                                                   00154700
ISN 0091            250  IF (KORG(KOR).EQ.20 .OR. KORG(KOR).EQ.22 .OR. KORG(KOR).EQ.23) 00154800
                     A GO TO 300                                                        00154900
                C                                                                       00155000
                C  GI(SI)                                                               00155100
                C                                                                       00155200
ISN 0093              RAMDA = ALOG(1./(1.-F1))/GISI(1)                                  00155300
ISN 0094              IF (KLASS(KNU).EQ.1) EN(KOR,KNU)=ED(IP)                           00155400
ISN 0096              IF (KLASS(KNU).EQ.2) EN(KOR,KNU)=EW(IP)                           00155500
ISN 0098              IF (KLASS(KNU).EQ.3) EN(KOR,KNU)=EY(IP)                           00155600
                C                                                                       00155700
ISN 0100              D(KOR,KNU) = 25.57*EN(KOR,KNU)/GISI(3)*EXP(-RAMDR*GIS (1))       00155800
                     A  *(1.-EXP(-(RAMDR+RAMDA)*GISI(1))/(RAMDR+RAMDA)) * QG            00155900
ISN 0101              IF(D(KOR,KNU).LT.0.) D(KOR,KNU)=25.57*EN(KOR,KNU)/GISI(3)*EXP(    00156000
                     1-RAMDR*GIS(1))*(GISI(1)-(RAMDR+RAMDA)*GISI(1)**2.*0.5)*QG          00156100
                C                                                                       00156200
                C  GI(ULI)                                                              00156300
                C                                                                       00156400
ISN 0103            300  IF (KORG(KOR).EQ.20 .OR. KORG(KOR).EQ.21 .OR. KORG(KOR).EQ.23) 00156500
                     A GO TO 350                                                        00156600
                C                                                                       00156700
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ISN 0105          IF (KLASS(KNU).EQ.1) EN(KOR,KNU)=ED(IP)                    00156800
ISN 0107          IF (KLASS(KNU).EQ.2) EN(KOR,KNU)=EW(IP)                    00156900
ISN 0109          IF (KLASS(KNU).EQ.3) EN(KOR,KNU)=EY(IP)                    00157000
                C                                                            00157100
ISN 0111          D(KOR,KNU)=25.57*GIUL(1)*EXP(-RAMDR*(GIS(1)+GISI(1)))      00157200
                 A *EN(KOR,KNU)/GIUL(3)*QG*(1.-F1)                           00157300
                C                                                            00157400
                C  GI(LLI)                                                   00157500
                C                                                            00157600
ISN 0112         350  IF (KORG(KOR).EQ.20 .OR. KORG(KOR).EQ.21 .OR. KORG(KOR).EQ.22)  00157700
                     A GO TO 400                                             00157800
ISN 0114          IF (KLASS(KNU).EQ.1)EN(KOR,KNU)=ED(IP)                     00157900
ISN 0116          IF (KLASS(KNU).EQ.2)EN(KOR,KNU)=EW(IP)                     00158000
ISN 0118          IF (KLASS(KNU).EQ.3)EN(KOR,KNU)=EY(IP)                     00158100
                C                                                            00158200
ISN 0120          D(KOR,KNU) = 25.57*GILL(1)*EXP(-RAMDR*(GIS(1)+GISI(1)+GIUL(1)))  00158300
                 A * EN(KOR,KNU)/GILL(3)*QG*(1.-F1)                          00158400
ISN 0121         400  CONTINUE                                               00158500
                C                                                            00158600
                C FOR CALL FROM INTAKE                                       00158700
                C                                                            00158800
ISN 0122          IF (DIME.GT.DI) D2(KOR,KNU)=D(KOR,KNU)                     00158900
ISN 0124          IF (DIME.LE.DI) D1(KOR,KNU)=D(KOR,KNU)                     00159000
ISN 0126          IF (KOR.LT.22) GO TO 500                                   00159100
ISN 0128            Q1(KOR,KNU) = Q1(KOR,KNU)*(1-F1)                         00159200
ISN 0129            Q2(KOR,KNU) = Q2(KOR,KNU)*(1-F1)                         00159300
ISN 0130            Q (KOR,KNU) = Q (KOR,KNU)*(1-F1)                         00159400
ISN 0131         500  RETURN                                                 00159500
ISN 0132          END                                                        00159600
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*LEVEL 2.3.0 (JUNE 78)                  OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.37      PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

                C                                                                                    00159700
   ISN 0002             SUBROUTINE INTAKE                                                            00159800
                C                                                                                    00159900
                C ACUTE INTAKE                                                                       00160000
                C                                                                                    00160100
                C                                                                                    00160200
                C =============== C O M M O N ==========================================            00160300
   ISN 0003             REAL*8 ORGNAM,DAY                                                            00160400
                C                                                                                    00160500
                C  INPUT...                                                                          00160600
                C                                                                                    00160700
   ISN 0004             COMMON /INPUT/                                                               00160800
                       A    HEAD(18)          ,LABEL(18)          ,NORG                            00160900
                       B   ,KORG(30)          ,NON                ,NZ(30)                          00161000
                       C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                      00161100
                       D   ,ID(2,30)          ,NOPT               ,MOPT                            00161200
                       E   ,TIT(30)           ,TIMET(8)           ,DTIME                           00161300
                       F   ,D3T(30)           ,D4T(30)            ,D5T(30)                         00161400
                       G   ,P0T(30)           ,AMADT(30)          ,IUNIT                           00161500
                       H   ,UNIT                                                                    00161600
                C                                                                                    00161700
                C BIOLOGICAL LIBRARY RECORD ...                                                      00161800
                C                                                                                    00161900
   ISN 0005             COMMON /BIOLIB/                                                              00162000
                       A    LZ    (3000)      ,LA    (3000)      ,META  (3000)                    00162100
                       B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                    00162200
                       C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                    00162300
                       D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                    00162400
                       E   ,EY    (3000)                                                            00162500
                C                                                                                    00162600
                C DATA TABLES...                                                                     00162700
                C                                                                                    00162800
   ISN 0006             COMMON /TABLES/                                                              00162900
                       A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                          00163000
                       B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                         00163100
                       C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                         00163200
                       D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                         00163300
                       E   ,T5(4,3)           ,T6(1,3)                                             00163400
                C                                                                                    00163500
                C CONTROL PARAMETERS...                                                              00163600
                C                                                                                    00163700
   ISN 0007             COMMON /CONTRL/                                                              00163800
                       A    DAY               ,TIME               ,INIT                            00163900
                       B   ,TAFT              ,IER                ,KNU                             00164000
                       C   ,KOR               ,IP                 ,IR                              00164100
                       D   ,NLIB              ,NPAGE              ,FAC                             00164200
                C                                                                                    00164300
                C OUTPUT STORAGE FOR CURRENT TIME STEP...                                            00164400
                C                                                                                    00164500
   ISN 0008             COMMON /OUTPUT/                                                              00164600
                       A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                       00164700
                       B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                       00164800
                       C   ,HLF(30)            ,Q(30,30)          ,HLFOUT(30,30)                   00164900
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*LEVEL 2.3.0 (JUNE 78)        INTAKE          OS/360  FORTRAN H EXTENDED            DATE 80.023/18.15.37       PAGE   2

                C                                                                                          00165000
                C CURRENT VARIABLES                                                                        00165100
                C                                                                                          00165200
  ISN 0009            COMMON /NOW/                                                                         00165300
                     A    TI        ,D3       ,D4       ,D5       ,P0       ,AMAD       ,                  00165400
                     B   ,F1                                                                               00165500
                C ..........................................................................               00165600
  ISN 0010            IF (NOPT.EQ.2) CALL ACUTE                                                            00165700
                C                                                                                          00165800
                C CHRONIC INTAKE                                                                           00165900
                C                                                                                          00166000
  ISN 0012            IF (NOPT.EQ.3) CALL CHRO                                                             00166100
  ISN 0014            RETURN                                                                               00166200
  ISN 0015            END                                                                                  00166300
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*LEVEL 2.3.0 (JUNE 78)                OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.38      PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

                 C                                                                                    00166400
   ISN 0002            SUBROUTINE ACUTE                                                             00166500
                 C                                                                                    00166600
                 C ACUTE INGESTION                                                                    00166700
                 C                                                                                    00166800
                 C                                                                                    00166900
                 C =============== C O M M O N ==========================================             00167000
   ISN 0003            REAL*8 ORGNAM,DAY                                                            00167100
                 C                                                                                    00167200
                 C  INPUT...                                                                          00167300
                 C                                                                                    00167400
   ISN 0004            COMMON /INPUT/                                                               00167500
                      A    HEAD(18)          ,LABEL(18)          ,NORG                             00167600
                      B   ,KORG(30)          ,NON                ,NZ(30)                           00167700
                      C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                       00167800
                      D   ,ID(2,30)          ,NOPT               ,MOPT                             00167900
                      E   ,TIT(30)           ,TIMET(8)           ,DTIME                            00168000
                      F   ,D3T(30)           ,D4T(30)            ,D5T(30)                          00168100
                      G   ,P0T(30)           ,AMADT(30)          ,IUNIT                            00168200
                      H   ,UNIT                                                                    00168300
                 C                                                                                    00168400
                 C BIOLOGICAL LIBRARY RECORD ...                                                      00168500
                 C                                                                                    00168600
   ISN 0005            COMMON /BIOLIB/                                                              00168700
                      A    LZ    (3000)      ,LA    (3000)      ,META  (3000)                     00168800
                      B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                     00168900
                      C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                     00169000
                      D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                     00169100
                      E   ,EY    (3000)                                                            00169200
                 C                                                                                    00169300
                 C DATA TABLES...                                                                     00169400
                 C                                                                                    00169500
   ISN 0006            COMMON /TABLES/                                                              00169600
                      A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                           00169700
                      B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                          00169800
                      C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                          00169900
                      D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                          00170000
                      E   ,T5(4,3)           ,T6(1,3)                                              00170100
                 C                                                                                    00170200
                 C CONTROL PARAMETERS...                                                              00170300
                 C                                                                                    00170400
   ISN 0007            COMMON /CONTRL/                                                              00170500
                      A    DAY               ,TIME               ,INIT                             00170600
                      B   ,TAFT              ,IER                ,KNU                              00170700
                      C   ,KOR               ,IP                 ,IR                               00170800
                      D   ,NLIB              ,NPAGE              ,FAC                              00170900
                 C                                                                                    00171000
                 C OUTPUT STORAGE FOR CURRENT TIME STEP...                                            00171100
                 C                                                                                    00171200
   ISN 0008            COMMON /OUTPUT/                                                              00171300
                      A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                        00171400
                      B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                        00171500
                      C   ,HLF(30)            ,Q(30,30)          ,HLFOUT(30,30)                    00171600
```

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                C                                                                00171700
                C CURRENT VARIABLES                                              00171800
                C                                                                00171900
   ISN 0009           COMMON /NOW/                                               00172000
                     A    TI       ,D3       ,D4       ,D5       ,P0       ,AMAD 00172100
                     B   ,F1                                                     00172200
                C ...............................................................00172300
                C                                                                00172400
   ISN 0010           Q0=P0T(KNU)                                                00172500
                C                                                                00172600
   ISN 0011           IF(KORG(KOR).EQ.20) BHLF(IP)=GIS(1)                        00172700
   ISN 0013           IF(KORG(KOR).EQ.21) BHLF(IP)=GISI(1)                       00172800
   ISN 0015           IF(KORG(KOR).EQ.22) BHLF(IP)=GIUL(1)                       00172900
   ISN 0017           IF(KORG(KOR).EQ.23) BHLF(IP)=GILL(1)                       00173000
                C                                                                00173100
   ISN 0019           IP1=IP                                                     00173200
   ISN 0020           IF(KORG(KOR).GE.20) CALL LOCATE(1,KNU,IP1,IR)              00173300
                C                                                                00173400
   ISN 0022           RAMDA = ALOG(2.0)*(1./PHLF(IP) + 1./AMAX1(1.E-30,BHLF(IP))) 00173500
   ISN 0023           Q1(KOR,KNU)= Q0*FW(IP1)    *EXP(-RAMDA*TIME)               00173600
   ISN 0024           IF (KORG(KNU).GE.20) CALL GI1(Q0)                          00173700
   ISN 0026           IF (KORG(KNU).GE.20) GO TO 100                             00173800
                C                                                                00173900
   ISN 0028           EN(KOR,KNU)=ED(IP)                                         00174000
   ISN 0029           D(KOR,KNU) = 51.15*EN(KOR,KNU)/ORGMAS(KORG(KOR),MOPT)*Q0*FW(IP) 00174100
                     A  *(1.-EXP(-RAMDA*TIME))/RAMDA                            00174200
   ISN 0030           Q2(KOR,KNU)=Q1(KOR,KNU)                                    00174300
   ISN 0031           D1(KOR,KNU)=      D(KOR,KNU)                               00174400
   ISN 0032           D2(KOR,KNU)=      D(KOR,KNU)                               00174500
                C                                                                00174600
   ISN 0033    100    RETURN                                                     00174700
   ISN 0034           END                                                        00174800
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*LEVEL 2.3.0 (JUNE 78)                    OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.39      PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

                 C                                                                                    00174900
   ISN 0002            SUBROUTINE CHRO                                                              00175000
                 C                                                                                    00175100
                 C                                                                                    00175200
                 C =============== C O M M O N ==========================================             00175300
   ISN 0003            REAL*8 ORGNAM,DAY                                                            00175400
                 C                                                                                    00175500
                 C  INPUT...                                                                          00175600
                 C                                                                                    00175700
   ISN 0004            COMMON /INPUT/                                                               00175800
                      A    HEAD(18)          ,LABEL(18)          ,NORG                             00175900
                      B   ,KORG(30)          ,NON                ,NZ(30)                           00176000
                      C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                       00176100
                      D   ,ID(2,30)          ,NOPT               ,MOPT                             00176200
                      E   ,TIT(30)           ,TIMET(8)           ,DTIME                            00176300
                      F   ,D3T(30)           ,D4T(30)            ,D5T(30)                          00176400
                      G   ,P0T(30)           ,AMADT(30)          ,IUNIT                            00176500
                      H   ,UNIT                                                                     00176600
                 C                                                                                    00176700
                 C BIOLOGICAL LIBRARY RECORD ...                                                      00176800
                 C                                                                                    00176900
   ISN 0005            COMMON /BIOLIB/                                                              00177000
                      A    LZ    (3000)      ,LA    (3000)      ,META  (3000)                     00177100
                      B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                     00177200
                      C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                     00177300
                      D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                     00177400
                      E   ,EY    (3000)                                                            00177500
                 C                                                                                    00177600
                 C DATA TABLES...                                                                     00177700
                 C                                                                                    00177800
   ISN 0006            COMMON /TABLES/                                                              00177900
                      A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                           00178000
                      B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                          00178100
                      C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                          00178200
                      D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                          00178300
                      E   ,T5(4,3)           ,T6(1,3)                                              00178400
                 C                                                                                    00178500
                 C CONTROL PARAMETERS...                                                              00178600
                 C                                                                                    00178700
   ISN 0007            COMMON /CONTRL/                                                              00178800
                      A    DAY               ,TIME               ,INIT                             00178900
                      B   ,TAFT              ,IER                ,KNU                              00179000
                      C   ,KOR               ,IP                 ,IR                               00179100
                      D   ,NLIB              ,NPAGE              ,FAC                              00179200
                 C                                                                                    00179300
                 C OUTPUT STORAGE FOR CURRENT TIME STEP...                                            00179400
                 C                                                                                    00179500
   ISN 0008            COMMON /OUTPUT/                                                              00179600
                      A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                        00179700
                      B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                        00179800
                      C   ,HLF(30)            ,Q(30,30)          ,HLFOUT(30,30)                    00179900
                 C                                                                                    00180000
                 C CURRENT VARIABLES                                                                  00180100
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                C                                                                00180200
                                                                                 00180300
   ISN 0009          COMMON /NOW/                                                00180400
                    A    TI       ,D3       ,D4       ,D5       ,P0       ,AMAD  00180500
                    B   ,F1                                                      00180600
                C ...............................................................00180700
   ISN 0010          EN(KOR,KNU)=ED(IP)                                          00180800
                C                                                                00180900
   ISN 0011          P0=P0T(KNU)                                                 00181000
                C                                                                00181100
   ISN 0012          IF(KORG(KOR).EQ.20) BHLF(IP)=GIS(1)                         00181200
   ISN 0014          IF(KORG(KOR).EQ.21) BHLF(IP)=GISI(1)                        00181300
   ISN 0016          IF(KORG(KOR).EQ.22) BHLF(IP)=GIUL(1)                        00181400
   ISN 0018          IF(KORG(KOR).EQ.23) BHLF(IP)=GILL(1)                        00181500
                C                                                                00181600
   ISN 0020          IP1=IP                                                      00181700
   ISN 0021          IF(KORG(KOR).GE.20) CALL LOCATE(1,KNU,IP1,IR)               00181800
                C                                                                00181900
   ISN 0023          RAMDA = ALOG(2.0)*(1./PHLF(IP) + 1./AMAX1(1.E-30,BHLF(IP)))  00182000
   ISN 0024          IF (TIME.GT.TI) GO TO 500                                   00182100
   ISN 0026          QG=P0  * TIME                                               00182200
   ISN 0027          Q1(KOR,KNU)=P0*FW(IP)*(1.-EXP(-RAMDA*TIME))/    RAMDA      00182300
   ISN 0028          IF (KORG(KOR).GE.20) CALL GI1(QG)                           00182400
   ISN 0030          IF (KORG(KOR).GE.20) GO TO 900                              00182500
   ISN 0032          D1(KOR,KNU)=51.15*EN(KOR,KNU)*FW(IP)*P0/(   ORGMAS(KORG(KOR),MOPT)
                    A * RAMDA)                                                   00182600
                    A  *(TIME-(1.-EXP(-RAMDA*TIME))/RAMDA)                       00182700
                C                                                                00182800
   ISN 0033          GO TO 900                                                   00182900
                C                                                                00183000
   ISN 0034    500   QG=P0  * TI                                                00183100
   ISN 0035          Q2(KOR,KNU)=Q1(KOR,KNU)*EXP(-RAMDA*TAFT)                    00183200
   ISN 0036          IF (KORG(KOR).GE.20) CALL GI1(QG)                           00183300
   ISN 0038          IF (KORG(KOR).GE.20) GO TO 900                              00183400
   ISN 0040          D2(KOR,KNU)=51.15*EN(KOR,KNU)*FW(IP)*P0/(ORGMAS(KORG(KOR),MOPT)  00183500
                    A * RAMDA)                                                   00183600
                    A *(1.-EXP(-RAMDA*TI))*(1.-EXP(-RAMDA*TAFT))/RAMDA           00183700
   ISN 0041    900   D (KOR,KNU)=D1(KOR,KNU)+D2(KOR,KNU)                         00183800
   ISN 0042          D2(KOR,KNU)=D(KOR,KNU)                                      00183900
                C                                                                00184000
   ISN 0043          RETURN                                                      00184100
   ISN 0044          END                                                         00184200
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*LEVEL 2.3.0 (JUNE 78)                    OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.40      PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

                 C                                                                                    00184300
ISN 0002               SUBROUTINE LOCATE(KOR$,KNU$,IP$,IR$)                                           00184400
                 C                                                                                    00184500
                 C =============== C O M M O N ==========================================             00184600
ISN 0003               REAL*8 ORGNAM,DAY                                                              00184700
                 C                                                                                    00184800
                 C  INPUT...                                                                          00184900
                 C                                                                                    00185000
ISN 0004               COMMON /INPUT/                                                                 00185100
                      A    HEAD(18)          ,LABEL(18)          ,NORG                              00185200
                      B   ,KORG(30)          ,NON                ,NZ(30)                            00185300
                      C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                        00185400
                      D   ,ID(2,30)          ,NOPT               ,MOPT                              00185500
                      E   ,TIT(30)           ,TIMET(8)           ,DTIME                             00185600
                      F   ,D3T(30)           ,D4T(30)            ,D5T(30)                           00185700
                      G   ,P0T(30)           ,AMADT(30)          ,IUNIT                             00185800
                      H   ,UNIT                                                                       00185900
                 C                                                                                    00186000
                 C BIOLOGICAL LIBRARY RECORD ...                                                      00186100
                 C                                                                                    00186200
ISN 0005               COMMON /BIOLIB/                                                                00186300
                      A    LZ    (3000)     ,LA    (3000)      ,META  (3000)                         00186400
                      B   ,IDZ   (3000)     ,KODE  (3000)      ,PHLF  (3000)                         00186500
                      C   ,BHLF  (3000)     ,FW    (3000)      ,FA    (3000)                         00186600
                      D   ,F2D   (3000)     ,ED    (3000)      ,EW    (3000)                         00186700
                      E   ,EY    (3000)                                                               00186800
                 C                                                                                    00186900
                 C DATA TABLES...                                                                     00187000
                 C                                                                                    00187100
ISN 0006               COMMON /TABLES/                                                                00187200
                      A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                            00187300
                      B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                           00187400
                      C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                           00187500
                      D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                           00187600
                      E   ,T5(4,3)           ,T6(1,3)                                               00187700
                 C                                                                                    00187800
                 C CONTROL PARAMETERS...                                                              00187900
                 C                                                                                    00188000
ISN 0007               COMMON /CONTRL/                                                                00188100
                      A    DAY               ,TIME               ,INIT                              00188200
                      B   ,TAFT              ,IER                ,KNU                               00188300
                      C   ,KOR               ,IP                 ,IR                                00188400
                      D   ,NLIB              ,NPAGE              ,FAC                               00188500
                 C                                                                                    00188600
                 C OUTPUT STORAGE FOR CURRENT TIME STEP...                                            00188700
                 C                                                                                    00188800
ISN 0008               COMMON /OUTPUT/                                                                00188900
                      A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                         00189000
                      B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                         00189100
                      C   ,HLF(30)            ,Q(30,30)          ,HLFOUT(30,30)                     00189200
                 C                                                                                    00189300
                 C CURRENT VARIABLES                                                                  00189400
                 C                                                                                    00189500
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*LEVEL 2.3.0 (JUNE 78)        LOCATE          OS/360  FORTRAN H EXTENDED            DATE 80.023/18.15.40       PAGE   2

   ISN 0009           COMMON /NOW/                                                                    00189600
                     A    TI        ,D3       ,D4       ,D5       ,P0       ,AMAD                   00189700
                     B   ,F1                                                                         00189800
                    C ..............................................,.....................................00189900
   ISN 0010          IR$=0                                                                           00190000
   ISN 0011          IP$=0                                                                           00190100
   ISN 0012          DO 100 N=1,NLIB                                                                 00190200
   ISN 0013          IF (LZ(N).EQ.NZ(KNU$) .AND. LA(N).EQ.MASS(KNU$) .AND.                           00190300
                     A KODE(N).EQ.KOR$ .AND. META(N).EQ.METAIN(KNU$))                                00190400
                     B GO TO 150                                                                     00190500
   ISN 0015              GO TO 100                                                                   00190600
                    C                                                                               00190700
   ISN 0016          150 IP$=N                                                                       00190800
   ISN 0017          IR$=IR$+1                                                                       00190900
   ISN 0018          100 CONTINUE                                                                    00191000
                    C                                                                               00191100
   ISN 0019          IF (IP$.EQ.0) WRITE(6,1000) NZ(KNU$),MASS(KNU$),KOR$                            00191200
   ISN 0021          IF (IR$.GT.1) WRITE(6,1010) IR$,NZ(KNU$),MASS(KNU$),KOR$,IDZ(IP$)               00191300
   ISN 0023          1000 FORMAT(' NOT FOUND IN LIBRARY,Z=',I2,',A=',I3,',ORGAN CODE=',I2)           00191400
   ISN 0024          1010 FORMAT(' DUPL.',I2,' REC. IN LIBRARY,Z=',I2,',A=',I3,',ORGAN CODE         00191500
                     A =',I2,1X,A2,' .')                                                             00191600
                    C                                                                               00191700
                    C SUBSTITUTED 158520 C REPLACE BLANKED EW & EY BY ED                            00191800
                    C                                                                               00191900
   ISN 0025          IF(EW(IP$).EQ.0.) EW(IP$) = ED(IP$)                                             00192000
   ISN 0027          IF(EY(IP$).EQ.0.) EY(IP$) = ED(IP$)                                             00192100
                    C                                                                               00192200
   ISN 0029          RETURN                                                                          00192300
   ISN 0030          END                                                                             00192400
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*LEVEL 2.3.0 (JUNE 78)                  OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.40       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

                 C                                                                                    00192500
   ISN 0002            SUBROUTINE ORGAN                                                             00192600
                 C                                                                                    00192700
                 C  INHALATION FOR ORGANS OTHER THAN LUNG AND GI                                      00192800
                 C                                                                                    00192900
                 C                                                                                    00193000
   ISN 0003            REAL*8 DIME,DAFT,ERT,TRM1,$,DI                                               00193100
   ISN 0004            REAL*8 RAMDN,RAMDA,RAMDB,RAMDC,RAMDD,RAMDE,RAMDF,RAMDG,RAMDH,RAMDI           00193200
   ISN 0005            REAL*8 EXPN,EXPH,EXPI                                                        00193300
                 C ================ C O M M O N ============================================       00193400
   ISN 0006            REAL*8 ORGNAM,DAY                                                            00193500
                 C                                                                                    00193600
                 C  INPUT...                                                                          00193700
                 C                                                                                    00193800
   ISN 0007            COMMON /INPUT/                                                               00193900
                      A    HEAD(18)          ,LABEL(18)          ,NORG                             00194000
                      B   ,KORG(30)          ,NON                ,NZ(30)                           00194100
                      C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                       00194200
                      D   ,ID(2,30)          ,NOPT               ,MOPT                             00194300
                      E   ,TIT(30)           ,TIMET(8)           ,DTIME                            00194400
                      F   ,D3T(30)           ,D4T(30)            ,D5T(30)                          00194500
                      G   ,P0T(30)           ,AMADT(30)          ,IUNIT                            00194600
                      H   ,UNIT                                                                     00194700
                 C                                                                                    00194800
                 C BIOLOGICAL LIBRARY RECORD ...                                                      00194900
                 C                                                                                    00195000
   ISN 0008            COMMON /BIOLIB/                                                              00195100
                      A    LZ    (3000)      ,LA    (3000)      ,META  (3000)                       00195200
                      B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                       00195300
                      C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                       00195400
                      D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                       00195500
                      E   ,EY    (3000)                                                            00195600
                 C                                                                                    00195700
                 C DATA TABLES...                                                                     00195800
                 C                                                                                    00195900
   ISN 0009            COMMON /TABLES/                                                              00196000
                      A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                           00196100
                      B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                          00196200
                      C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                          00196300
                      D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                          00196400
                      E   ,T5(4,3)           ,T6(1,3)                                              00196500
                 C                                                                                    00196600
                 C CONTROL PARAMETERS...                                                              00196700
                 C                                                                                    00196800
   ISN 0010            COMMON /CONTRL/                                                              00196900
                      A    DAY               ,TIME               ,INIT                             00197000
                      B   ,TAFT              ,IER                ,KNU                              00197100
                      C   ,KOR               ,IP                 ,IR                               00197200
                      D   ,NLIB              ,NPAGE              ,FAC                              00197300
                 C                                                                                    00197400
                 C OUTPUT STORAGE FOR CURRENT TIME STEP...                                            00197500
                 C                                                                                    00197600
   ISN 0011            COMMON /OUTPUT/                                                              00197700
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*LEVEL 2.3.0 (JUNE 78)        ORGAN          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.40      PAGE   2

                     A    Q1 (30,30)         ,Q2(30,30)          ,D1(30,30)          00197800
                     B   ,D2 (30,30)         ,D (30,30)          ,EN(30,30)          00197930
                     C   ,HLF(30)             ,Q(30,30)          ,HLFOUT(30,30)      00198000
                C                                                                    00198100
                C CURRENT VARIABLES                                                  00198200
                C                                                                    00198300
   ISN 0012          COMMON /NOW/                                                    00198400
                     A    TI        ,D3       ,D4       ,D5       ,P0       ,AMAD   00198500
                     B   ,F1                                                         00198600
                C ---------------------------------------------------------------- 00198700
   ISN 0013          ABS($)=DABS($)                                                  00198800
   ISN 0014          EXP($)=DEXP($)                                                  00198900
   ISN 0015          DIME=TIME                                                       00199000
   ISN 0016          DAFT=TAFT                                                       00199100
   ISN 0017          DI=TI                                                           00199200
   ISN 0018          AL2=ALOG(2.0)                                                   00199300
   ISN 0019          RAMDAB=AL2/T3(1,KLASS(KNU))                                     00199400
   ISN 0020          RAMDBB=AL2/T3(2,KLASS(KNU))                                     00199500
   ISN 0021          RAMDCB=AL2/T4(1,KLASS(KNU))                                     00199600
   ISN 0022          RAMDDB=AL2/T4(2,KLASS(KNU))                                     00199700
   ISN 0023          RAMDEB=AL2/T5(1,KLASS(KNU))                                     00199800
   ISN 0024          RAMDFB=AL2/T5(2,KLASS(KNU))                                     00199900
   ISN 0025          RAMDGB=AL2/T5(3,KLASS(KNU))                                     00200000
   ISN 0026          RAMDHB=AL2/T5(4,KLASS(KNU))                                     00200100
   ISN 0027          RAMDIB=AL2/T6(1,KLASS(KNU))                                     00200200
   ISN 0028          CALL LOCATE(8,KNU,IP8,IR)                                       00200300
   ISN 0029          RAMDR=AL2/PHLF(IP8)                                             00200400
   ISN 0030          RAMDN=AL2/PHLF(IP ) + AL2/AMAX1(1.E-30,BHLF(IP))                00200500
                C                                                                    00200600
   ISN 0031          RAMDA = RAMDAB + RAMDR                                          00200700
   ISN 0032          RAMDB = RAMDBB + RAMDR                                          00200800
   ISN 0033          RAMDC = RAMDCB + RAMDR                                          00200900
   ISN 0034          RAMDD = RAMDDB + RAMDR                                          00201000
   ISN 0035          RAMDE = RAMDEB + RAMDR                                          00201100
   ISN 0036          RAMDF = RAMDFB + RAMDR                                          00201200
   ISN 0037          RAMDG = RAMDGB + RAMDR                                          00201300
   ISN 0038          RAMDH = RAMDHB + RAMDR                                          00201400
   ISN 0039          RAMDI = RAMDIB + RAMDR                                          00201500
                C                                                                    00201600
   ISN 0040          CA=RAMDAB*F3(1,KLASS(KNU))*D3/RAMDA                             00201700
   ISN 0041          CB=RAMDBB*F3(2,KLASS(KNU))*D3/RAMDB * F1                        00201800
   ISN 0042          CC=RAMDCB*F4(1,KLASS(KNU))*D4/RAMDC                             00201900
   ISN 0043          CD=RAMDDB*F4(2,KLASS(KNU))*D4/RAMDD * F1                        00202000
   ISN 0044          CE=RAMDEB*F5(1,KLASS(KNU))*D5/RAMDE                             00202100
   ISN 0045          CF=RAMDFB*F5(2,KLASS(KNU))*D5/RAMDF * F1                        00202200
   ISN 0046          CG=RAMDGB*F5(3,KLASS(KNU))*D5/RAMDG * F1                        00202300
   ISN 0047          CH=RAMDIB*RAMDHB*F6(1,KLASS(KNU))*F5(4,KLASS(KNU))*D5/RAMDH     00202400
                C                                                                    00202500
   ISN 0048          COEFF=RAMDIB*RAMDHB*F6(1,KLASS(KNU))*F5(4,KLASS(KNU))           00202600
                     A     *F2D(IP)*D5/RAMDH                                         00202700
                C                                                                    00202800
   ISN 0049          IF (DIME.GT.DI) GO TO 500                                       00202900
                C                                                                    00203000
   ISN 0051          ERT=EXP(-RAMDN*DIME)                                            00203100
   ISN 0052          TRM1=(1-ERT)/RAMDN                                              00203200
   ISN 0053          IF((1.-ERT).LE.1.E-3) TRM1=DIME-0.5*RAMDN*DIME**2.              00203300
                C                                                                    00203400
   ISN 0055          Q1A = P0*F2D(IP)*(CA*(TRM1-(ERT-EXP(-RAMDA*DIME))/(RAMDA-RAMDN))) 00203500
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ISN 0056          Q1B = P0*F2D(IP)*(CB*(TRM1-(ERT-EXP(-RAMDB*DIME))/(RAMDB-RAMDN))) 00203600
ISN 0057          Q1C = P0*F2D(IP)*(CC*(TRM1-(ERT-EXP(-RAMDC*DIME))/(RAMDC-RAMDN))) 00203700
ISN 0058          Q1D = P0*F2D(IP)*(CD*(TRM1-(ERT-EXP(-RAMDD*DIME))/(RAMDD-RAMDN))) 00203800
ISN 0059          Q1E = P0*F2D(IP)*(CE*(TRM1-(ERT-EXP(-RAMDE*DIME))/(RAMDE-RAMDN))) 00203900
ISN 0060          Q1F = P0*F2D(IP)*(CF*(TRM1-(ERT-EXP(-RAMDF*DIME))/(RAMDF-RAMDN))) 00204000
ISN 0061          Q1G = P0*F2D(IP)*(CG*(TRM1-(ERT-EXP(-RAMDG*DIME))/(RAMDG-RAMDN))) 00204100
ISN 0062          IF (ABS(RAMDH-RAMDI)/RAMDH.LT.1.E-5)  GO TO 200                   00204200
                C                                                                   00204300
ISN 0064          QL  =P0*COEFF                                                     00204400
                 A * ((TRM1-(ERT-EXP(-RAMDI*DIME))/(RAMDI-RAMDN))/RAMDI           00204500
                 B - ((ERT-EXP(-RAMDI*DIME))/(RAMDI-RAMDN)                        00204600
                 C    -(ERT-EXP(-RAMDH*DIME))/(RAMDH-RAMDN))/(RAMDH-RAMDI) )      00204700
ISN 0065          IF(QL.LT.0.) QL=P0*COEFF*DIME**2                                  00204800
ISN 0067          GO TO 300                                                         00204900
                C                                                                   00205000
ISN 0068        200  CONTINUE                                                       00205100
ISN 0069          QL  =P0*COEFF                                                     00205200
                 A *((TRM1-(ERT-EXP(-RAMDI*DIME))/(RAMDI-RAMDN))/RAMDI            00205300
                 B   -(ERT-((RAMDI-RAMDN)*DIME+1.)*EXP(-RAMDI*DIME))/(RAMDI-RAMDN) 00205400
                 C **2)                                                           00205500
ISN 0070          IF(QL.LT.0.) QL=P0*COEFF*0.5*RAMDI**2*DIME**2/(RAMDI-RAMDN)      00205600
                C     IF(QL.LT.0.) QL=P0*COEFF*(RAMDN*1.5*RAMDI)*DIME**2          00205700
                C    A  /(2.*(RAMDN-RAMDI))                                       00205800
                C                                                                   00205900
ISN 0072        300 CONTINUE                                                      00206000
ISN 0073          IF(Q1A.LT.0.) Q1A=P0*F2D(IP)*CA*RAMDA*DIME**2*0.5                 00206100
ISN 0075          IF(Q1B.LT.0.) Q1B=P0*F2D(IP)*CB*RAMDB*DIME**2*0.5                 00206200
ISN 0077          IF(Q1C.LT.0.) Q1C=P0*F2D(IP)*CC*RAMDC*DIME**2*0.5                 00206300
ISN 0079          IF(Q1D.LT.0.) Q1D=P0*F2D(IP)*CD*RAMDD*DIME**2*0.5                 00206400
ISN 0081          IF(Q1E.LT.0.) Q1E=P0*F2D(IP)*CE*RAMDE*DIME**2*0.5                 00206500
ISN 0083          IF(Q1F.LT.0.) Q1F=P0*F2D(IP)*CF*RAMDF*DIME**2*0.5                 00206600
ISN 0085          IF(Q1G.LT.0.) Q1G=P0*F2D(IP)*CG*RAMDG*DIME**2*0.5                 00206700
                C                                                                   00206800
ISN 0087          Q1(KOR,KNU) = Q1A+Q1B+Q1C+Q1D+Q1E+Q1F+Q1G+QL                      00206900
ISN 0088          AN=TRM1                                                           00207000
ISN 0089          AI=(1.-EXP(-RAMDI*DIME))/RAMDI                                    00207100
ISN 0090          AH=(1.-EXP(-RAMDH*DIME))/RAMDH                                    00207200
                C                                                                   00207300
ISN 0091          IF(AN*RAMDN.LT.1.D-5) AN=DIME-RAMDN*DIME**2*0.5                   00207400
ISN 0093          IF(AH*RAMDH.LT.1.D-5) AH=DIME-RAMDH*DIME**2*0.5                   00207500
ISN 0095          IF(AI*RAMDI.LT.1.D-5) AI=DIME-RAMDI*DIME**2*0.5                   00207600
                C                                                                   00207700
                C                                                                   00207800
ISN 0097          IF (KLASS(KNU).EQ.1) EN(KOR,KNU)=ED(IP)                           00207900
ISN 0099          IF (KLASS(KNU).EQ.2) EN(KOR,KNU)=EW(IP)                           00208000
ISN 0101          IF (KLASS(KNU).EQ.3) EN(KOR,KNU)=EY(IP)                           00208100
ISN 0103          IF(ABS(RAMDH-RAMDI)/RAMDH.LE.1.E-5)  GO TO 400                    00208200
                C                                                                   00208300
ISN 0105          D1(KOR,KNU)=51.15*EN(KOR,KNU)*P0*F2D(IP)/ORGMAS(KORG(KOR),MOPT)*( 00208400
                 A CA*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDA*DIME))/RAMDA)/(RAMDA-RAMDN)00208500
                 A)                                                               00208600
                 B+CB*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDB*DIME))/RAMDB)/(RAMDB-RAMDN)00208700
                 B)                                                               00208800
                 C+CC*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDC*DIME))/RAMDC)/(RAMDC-RAMDN)00208900
                 C)                                                               00209000
                 D+CD*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDD*DIME))/RAMDD)/(RAMDD-RAMDN)00209100
                 D)                                                               00209200
                 E+CE*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDE*DIME))/RAMDE)/(RAMDE-RAMDN)00209300
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                E)                                                                00209400
                F+CF*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDF*DIME))/RAMDF)/(RAMDF-RAMDN)00209500
                F)                                                                00209600
                G+CG*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDG*DIME))/RAMDG)/(RAMDG-RAMDN)00209700
                G)                                                                00209800
                I +CH/RAMDI*((DIME-AN)/RAMDN-(AN-AI)/(RAMDI-RAMDN))               00209900
                J -CH/(RAMDH-RAMDI)*((AN-AI)/(RAMDI-RAMDN)-(AN-AH)/(RAMDH-RAMDN))) 00210000
ISN 0106         IF(D1(KOR,KNU).LT.0.) D1(KOR,KNU)=51.15*EN(KOR,KNU)*P0*F2D(IP)    00210100
                A/ORGMAS(KORG(KOR),MOPT)*(RAMDA+RAMDB+RAMDC+RAMDD+RAMDE+RAMDF+RAMDG00210200
                B)*DIME**3/6.                                                     00210300
ISN 0108         GO TO 450                                                        00210400
              C                                                                   00210500
ISN 0109      400 CONTINUE                                                        00210600
ISN 0110         D1(KOR,KNU)=51.15*EN(KOR,KNU)*P0*F2D(IP)/ORGMAS(KORG(KOR),MOPT) * 00210700
                A(CA*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDA*DIME))/RAMDA)/(RAMDA-RAMDN)00210800
                A)                                                                00210900
                B+CB*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDB*DIME))/RAMDB)/(RAMDB-RAMDN)00211000
                B)                                                                00211100
                C+CC*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDC*DIME))/RAMDC)/(RAMDC-RAMDN)00211200
                C)                                                                00211300
                D+CD*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDD*DIME))/RAMDD)/(RAMDD-RAMDN)00211400
                D)                                                                00211500
                E+CE*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDE*DIME))/RAMDE)/(RAMDE-RAMDN)00211600
                E)                                                                00211700
                F+CF*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDF*DIME))/RAMDF)/(RAMDF-RAMDN)00211800
                F)                                                                00211900
                G+CG*((DIME-AN)/RAMDN-(AN-(1-EXP(-RAMDG*DIME))/RAMDG)/(RAMDG-RAMDN)00212000
                G)                                                                00212100
              C                                                                   00212200
                H+CH/RAMDI*((DIME-AN)/RAMDN-(AN-AI)/(RAMDI-RAMDN))                00212300
                I+CH/(RAMDI-RAMDN)**2*((AI-AN)                                    00212400
                J+(RAMDI-RAMDN)/RAMDI**2*(1-(RAMDI*DIME+1)*EXP(-RAMDI*DIME))))    00212500
ISN 0111         IF(D1(KOR,KNU).LT.0.) D1(KOR,KNU)=51.15*EN(KOR,KNU)*P0*F2D(IP)   00212600
                A/ORGMAS(KORG(KOR),MOPT)*((RAMDA+RAMDB+RAMDC+RAMDD+RAMDE+RAMDF+RAMD00212700
                BG)*DIME**3/6.+CH*DIME**3/6.+CH*(RAMDI**2.*DIME+RAMDH-RAMDI)*DIME**00212800
                C3/6./(RAMDI-RAMDN))                                              00212900
ISN 0113      450 GO TO 900                                                       00213000
              C                                                                   00213100
ISN 0114      500 CONTINUE                                                        00213200
ISN 0115         RAMDH=AL2/T5(4,KLASS(KNU))                                       00213300
ISN 0116         RAMDI=AL2/T6(1,KLASS(KNU))                                       00213400
ISN 0117         Q1AL=F3(1,KLASS(KNU))*D3*P0*(1.-EXP(-RAMDA*DI))/RAMDA            00213500
ISN 0118         Q1BL=F3(2,KLASS(KNU))*D3*P0*(1.-EXP(-RAMDB*DI))/RAMDB            00213600
ISN 0119         Q1CL=F4(1,KLASS(KNU))*D4*P0*(1.-EXP(-RAMDC*DI))/RAMDC            00213700
ISN 0120         Q1DL=F4(2,KLASS(KNU))*D4*P0*(1.-EXP(-RAMDD*DI))/RAMDD            00213800
ISN 0121         Q1EL=F5(1,KLASS(KNU))*D5*P0*(1.-EXP(-RAMDE*DI))/RAMDE            00213900
ISN 0122         Q1FL=F5(2,KLASS(KNU))*D5*P0*(1.-EXP(-RAMDF*DI))/RAMDF            00214000
ISN 0123         Q1GL=F5(3,KLASS(KNU))*D5*P0*(1.-EXP(-RAMDG*DI))/RAMDG            00214100
ISN 0124         IF(Q1AL.LT.0) Q1AL=F3(1,KLASS(KNU))*D3*P0*(DI-0.5*RAMDA*DI**2)   00214200
ISN 0126         IF(Q1BL.LT.0) Q1BL=F3(2,KLASS(KNU))*D3*P0*(DI-0.5*RAMDB*DI**2)   00214300
ISN 0128         IF(Q1CL.LT.0) Q1CL=F4(1,KLASS(KNU))*D4*P0*(DI-0.5*RAMDC*DI**2)   00214400
ISN 0130         IF(Q1DL.LT.0) Q1DL=F4(2,KLASS(KNU))*D4*P0*(DI-0.5*RAMDD*DI**2)   00214500
ISN 0132         IF(Q1EL.LT.0) Q1EL=F5(1,KLASS(KNU))*D5*P0*(DI-0.5*RAMDE*DI**2)   00214600
ISN 0134         IF(Q1FL.LT.0) Q1FL=F5(2,KLASS(KNU))*D5*P0*(DI-0.5*RAMDF*DI**2)   00214700
ISN 0136         IF(Q1GL.LT.0) Q1GL=F5(3,KLASS(KNU))*D5*P0*(DI-0.5*RAMDG*DI**2)   00214800
              C                                                                   00214900
ISN 0138         QPH=F5(4,KLASS(KNU))*D5*P0*(1.-EXP(-RAMDH*DI))/RAMDH             00215000
ISN 0139         IF(QPH.LT.0.) QPH=F5(4,KLASS(KNU))*D5*P0*(DI-0.5*RAMDH*DI**2)    00215100
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                C                                                               00215200
  ISN 0141            CAD=RAMDAB*Q1AL                                           00215300
  ISN 0142            CBD=RAMDBB*Q1BL*F1                                        00215400
  ISN 0143            CCD=RAMDCB*Q1CL                                           00215500
  ISN 0144            CDD=RAMDDB*Q1DL*F1                                        00215600
  ISN 0145            CED=RAMDEB*Q1EL                                           00215700
  ISN 0146            CFD=RAMDFB*Q1FL*F1                                        00215800
  ISN 0147            CGD=RAMDGB*Q1GL*F1                                        00215900
  ISN 0148            CHD=F6(1,KLASS(KNU))*RAMDIB*RAMDHB*QPH                    00216000
                C                                                               00216100
  ISN 0149            IF(ABS(RAMDH-RAMDI)/RAMDH.LE.1.E-5) GO TO 520             00216200
                C                                                               00216300
  ISN 0151            QLM=RAMDHB*F6(1,KLASS(KNU))*F5(4,KLASS(KNU))*D5*P0/RAMDH  00216400
                     A *((1.-EXP(-RAMDI*DI  ))/RAMDI -                          00216500
                     B  (EXP(-RAMDI*DI  )-EXP(-RAMDH*DI  ))/(RAMDH-RAMDI))      00216600
  ISN 0152            IF(QLM.LT.0.) QLM=RAMDHB*F6(1,KLASS(KNU))*F5(4,KLASS(KNU)) 00216700
                     A *D5*P0* RAMDH*DI**2*0.5                                  00216800
  ISN 0154            GO TO 540                                                 00216900
                C                                                               00217000
  ISN 0155     520    QLM=RAMDHB*F6(1,KLASS(KNU))*F5(4,KLASS(KNU))*D5*P0/RAMDI  00217100
                     A*((1-EXP(-RAMDI*DI  ))/RAMDI-DI  *EXP(-RAMDI*DI  ))       00217200
                C                                                               00217300
  ISN 0156            IF(QLM.LT.0.) QLM=RAMDHB*F6(1,KLASS(KNU))*F5(4,KLASS(KNU))*D5*P0 00217400
                     A  /RAMDH *0.5*RAMDI*DI**2*(1+RAMDI)                       00217500
  ISN 0158     540    CONTINUE                                                  00217600
  ISN 0159            EXPN=EXP(-RAMDN*DAFT)                                     00217700
  ISN 0160            EXPH=EXP(-RAMDH*DAFT)                                     00217800
  ISN 0161            EXPI=EXP(-RAMDI*DAFT)                                     00217900
  ISN 0162            IF(EXPN.GT.0.998) EXPN=1.                                 00218000
  ISN 0164            IF (ABS(RAMDH-RAMDI)/RAMDH.LE.1.E-5) GO TO 600            00218100
  ISN 0166            Q2(KOR,KNU)=Q1(KOR,KNU)*EXPN                              00218200
                     A + F2D(IP)*RAMDIB*QLM*(EXPI-EXPN)/(RAMDN-RAMDI)           00218300
                     C + F2D(IP)*(                                              00218400
                     D  CAD/(RAMDA-RAMDN)*(EXPN-EXP(-RAMDA*DAFT))               00218500
                     E +CBD/(RAMDB-RAMDN)*(EXPN-EXP(-RAMDB*DAFT))               00218600
                     F +CCD/(RAMDC-RAMDN)*(EXPN-EXP(-RAMDC*DAFT))               00218700
                     G +CDD/(RAMDD-RAMDN)*(EXPN-EXP(-RAMDD*DAFT))               00218800
                     H +CED/(RAMDE-RAMDN)*(EXPN-EXP(-RAMDE*DAFT))               00218900
                     I +CFD/(RAMDF-RAMDN)*(EXPN-EXP(-RAMDF*DAFT))               00219000
                     J +CGD/(RAMDG-RAMDN)*(EXPN-EXP(-RAMDG*DAFT))               00219100
                     K+CHD/(RAMDH-RAMDI)*((EXPN-EXPI)/(RAMDI-RAMDN)-(EXPN-EXPH)/(RAMDH 00219200
                     L-RAMDN))                                                  00219300
                C                                                               00219400
  ISN 0167            IF(Q2(KOR,KNU).LT.0) Q2(KOR,KNU)=Q1(KOR,KNU)*EXPN         00219500
                     1+F2D(IP)*RAMDIB*QLM*(DAFT-0.5*(RAMDI+RAMDN)*DAFT**2.)     00219600
                     2+F2D(IP)*( CAD*(1.-0.5*(RAMDA+RAMDN)*DAFT)                00219700
                     3         + CBD*(1.-0.5*(RAMDB+RAMDN)*DAFT)                00219800
                     4         + CCD*(1.-0.5*(RAMDC+RAMDN)*DAFT)                00219900
                     5         + CDD*(1.-0.5*(RAMDD+RAMDN)*DAFT)                00220000
                     6         + CED*(1.-0.5*(RAMDE+RAMDN)*DAFT)                00220100
                     7         + CFD*(1.-0.5*(RAMDF+RAMDN)*DAFT)                00220200
                     8         + CGD*(1.-0.5*(RAMDG+RAMDN)*DAFT)                00220300
                     9         + 0.5*CHD*DAFT)*DAFT                             00220400
                C                                                               00220500
  ISN 0169            GO TO 650                                                 00220600
                C                                                               00220700
  ISN 0170     600    Q2(KOR,KNU) = Q1(KOR,KNU)*EXPN                            00220800
                     A+ F2D(IP)*RAMDIB*QLM*(EXPI-EXPN)/(RAMDN-RAMDI)            00220900
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                     B+ F2D(IP)*(                                                        00221000
                     C  CAD/(RAMDA-RAMDN) * (EXPN-EXP(-RAMDA*DAFT) )                     00221100
                     D +CBD/(RAMDB-RAMDN) * (EXPN-EXP(-RAMDB*DAFT) )                     00221200
                     E +CCD/(RAMDC-RAMDN) * (EXPN-EXP(-RAMDC*DAFT) )                     00221300
                     F +CDD/(RAMDD-RAMDN) * (EXPN-EXP(-RAMDD*DAFT) )                     00221400
                     G +CED/(RAMDE-RAMDN) * (EXPN-EXP(-RAMDE*DAFT) )                     00221500
                     H +CFD/(RAMDF-RAMDN) * (EXPN-EXP(-RAMDF*DAFT) )                     00221600
                     I +CGD/(RAMDG-RAMDN) * (EXPN-EXP(-RAMDG*DAFT) )                     00221700
                     J +CHD/(RAMDI-RAMDN)**2 *(EXPN-((RAMDI-RAMDN)*DAFT+1)*EXPI))        00221800
                   C                                                                     00221900
ISN 0171             IF(Q2(KOR,KNU).LT.0.) Q2(KOR,KNU)=Q1(KOR,KNU)*EXPN                  00222000
                    1+F2D(IP)*RAMDIB*QLM*(DAFT-0.5*(RAMDI+RAMDN)*DAFT**2)                00222100
                    2+F2D(IP)*(((CAD*(1.-0.5*(RAMDA+RAMDN)*DAFT)                         00222200
                    3          +CBD*(1.-0.5*(RAMDB+RAMDN)*DAFT)                         00222300
                    4          +CCD*(1.-0.5*(RAMDC+RAMDN)*DAFT)                         00222400
                    5          +CDD*(1.-0.5*(RAMDD+RAMDN)*DAFT)                         00222500
                    6          +CED*(1.-0.5*(RAMDE+RAMDN)*DAFT)                         00222600
                    7          +CFD*(1.-0.5*(RAMDF+RAMDN)*DAFT)                         00222700
                    8          +CGD*(1.-0.5*(RAMDG+RAMDN)*DAFT))*DAFT                   00222800
                    9   +CHD/(RAMDI-RAMDN)**2*(EXPN-((RAMDI-RAMDN)*DAFT+1)*EXPI)))     00222900
                   C                                                                     00223000
ISN 0173      650  CONTINUE                                                            00223100
                   C                                                                     00223200
ISN 0174             BA=(1-EXP(-RAMDA*DAFT))/RAMDA                                       00223300
ISN 0175             BB=(1-EXP(-RAMDB*DAFT))/RAMDB                                       00223400
ISN 0176             BC=(1-EXP(-RAMDC*DAFT))/RAMDC                                       00223500
ISN 0177             BD=(1-EXP(-RAMDD*DAFT))/RAMDD                                       00223600
ISN 0178             BE=(1-EXP(-RAMDE*DAFT))/RAMDE                                       00223700
ISN 0179             BF=(1-EXP(-RAMDF*DAFT))/RAMDF                                       00223800
ISN 0180             BG=(1-EXP(-RAMDG*DAFT))/RAMDG                                       00223900
                   C DOSE                                                                00224000
                   C                                                                     00224100
ISN 0181             BN=(1-EXP(-RAMDN*DAFT))/RAMDN                                       00224200
ISN 0182             BH=(1-EXP(-RAMDH*DAFT))/RAMDH                                       00224300
ISN 0183             BI=(1-EXP(-RAMDI*DAFT))/RAMDI                                       00224400
ISN 0184             IF(BA.LT.0.) BA=DAFT-0.5*RAMDA*DAFT**2.                             00224500
ISN 0186             IF(BB.LT.0.) BB=DAFT-0.5*RAMDB*DAFT**2.                             00224600
ISN 0188             IF(BC.LT.0.) BC=DAFT-0.5*RAMDC*DAFT**2.                             00224700
ISN 0190             IF(BD.LT.0.) BD=DAFT-0.5*RAMDD*DAFT**2.                             00224800
ISN 0192             IF(BE.LT.0.) BE=DAFT-0.5*RAMDE*DAFT**2.                             00224900
ISN 0194             IF(BF.LT.0.) BF=DAFT-0.5*RAMDF*DAFT**2.                             00225000
ISN 0196             IF(BG.LT.0.) BG=DAFT-0.5*RAMDG*DAFT**2.                             00225100
ISN 0198             IF(BH.LT.0.) BH=DAFT-0.5*RAMDH*DAFT**2.                             00225200
ISN 0200             IF(BI.LT.0.) BI=DAFT-0.5*RAMDI*DAFT**2.                             00225300
ISN 0202             IF(BN.LT.0.) BN=DAFT-0.5*RAMDN*DAFT**2.                             00225400
ISN 0204             IF(ABS(RAMDH-RAMDI)/RAMDH.LE.1.E-5) GO TO 660                       00225500
                   C                                                                     00225600
ISN 0206             Z =(BN-BH)/(RAMDH-RAMDN)                                            00225700
ISN 0207             IF(Z.LT.0.) Z=0.5*DAFT**2                                           00225800
ISN 0209             G =CHD/(RAMDH-RAMDI)                                                00225900
ISN 0210             GO TO 670                                                           00226000
                   C                                                                     00226100
ISN 0211      660    Z =(1-(RAMDI*DAFT+1)*EXPI)/RAMDI**2                                 00226200
ISN 0212             IF(Z.LT.0.) Z=0.5*(1.-RAMDI*DAFT)*DAFT**2                           00226300
ISN 0214             G =CHD/(RAMDI-RAMDN)                                                00226400
                   C                                                                     00226500
ISN 0215      670    IF (KLASS(KNU).EQ.1) EN(KOR,KNU)=ED(IP)                             00226600
ISN 0217             IF (KLASS(KNU).EQ.2) EN(KOR,KNU)=EW(IP)                             00226700
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ISN 0219          IF (KLASS(KNU).EQ.3) EN(KOR,KNU)=EY(IP)                          00226800
                  C                                                                00226900
ISN 0221          D2(KOR,KNU) = 51.15*(EN(KOR,KNU)/ORGMAS(KORG(KOR),MOPT))*( Q1(KOR,00227000
                 A KNU) * BN+F2D(IP)*( RAMDIB*QLM/(RAMDN-RAMDI)*(BI-BN) +          00227100
                 C G*((BN-BI)/(RAMDI-RAMDN) -Z) +.                                00227200
                 D CAD/(RAMDA-RAMDN)*(BN-BA) + CBD/(RAMDB-RAMDN)*(BN-BB)+         00227300
                 E CCD/(RAMDC-RAMDN)*(BN-BC) + CDD/(RAMDD-RAMDN)*(BN-BD)+         00227400
                 F CED/(RAMDE-RAMDN)*(BN-BE) + CFD/(RAMDF-RAMDN)*(BN-BF)+         00227500
                 G CGD/(RAMDG-RAMDN)*(BN-BG) ))                                   00227600
                  C                                                               00227700
ISN 0222          IF(D2(KOR,KNU).LT.0.) D2(KOR,KNU)=51.15*EN(KOR,KNU)/ORGMAS(KORG(KO00227800
                 1R),MOPT)*(Q1(KOR,KNU)*BN+F2D(IP)*(0.5*RAMDIB*QLM*DAFT**2        00227900
                 2+G*(0.5*DAFT**2-Z) +                                            00228000
                 30.5*DAFT**2*(CAD+CBD+CCD+CDD+CED+CFD+CGD)))                     00228100
                  C                                                               00228200
ISN 0224           900  D(KOR,KNU)=D1(KOR,KNU)+D2(KOR,KNU)                        00228300
ISN 0225          D2(KOR,KNU)=D(KOR,KNU)                                           00228400
                  C                                                               00228500
ISN 0226          RETURN                                                          00228600
ISN 0227          END                                                             00228700
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*LEVEL 2.3.0 (JUNE 78)                OS/360  FORTRAN H EXTENDED          DATE 60.023/18.15.46       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

                C                                                                                    00228800
ISN 0002            SUBROUTINE SOLOUT                                                                00228900
                C                                                                                    00229000
                C PRINT SOLUTION FOR EACH TIME STEP                                                  00229100
                C                                                                                    00229200
                C                                                                                    00229300
                C =============== C O M M O N ==========================================             00229400
ISN 0003            REAL*8 ORGNAM,DAY                                                                00229500
ISN 0004            DIMENSION MET(2)                                                                 00229600
ISN 0005            DATA MET/' ','M'/                                                                00229700
                C                                                                                    00229800
                C  INPUT...                                                                          00229900
                C                                                                                    00230000
ISN 0006            COMMON /INPUT/                                                                   00230100
                   A    HEAD(18)          ,LABEL(18)          ,NORG                                 00230200
                   B   ,KORG(30)          ,NON                ,NZ(30)                               00230300
                   C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                           00230400
                   D   ,ID(2,30)          ,NOPT               ,MOPT                                 00230500
                   E   ,TIT(30)           ,TIMET(8)           ,DTIME                                00230600
                   F   ,D3T(30)           ,D4T(30)            ,D5T(30)                              00230700
                   G   ,P0T(30)           ,AMADT(30)          ,IUNIT                                00230800
                   H   ,UNIT                                                                         00230900
                C                                                                                    00231000
                C BIOLOGICAL LIBRARY RECORD ...                                                      00231100
                C                                                                                    00231200
ISN 0007            COMMON /BIOLIB/                                                                  00231300
                   A    LZ    (3000)      ,LA    (3000)      ,META  (3000)                         00231400
                   B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                         00231500
                   C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                         00231600
                   D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                         00231700
                   E   ,EY    (3000)                                                                00231800
                C                                                                                    00231900
                C DATA TABLES...                                                                     00232000
                C                                                                                    00232100
ISN 0008            COMMON /TABLES/                                                                  00232200
                   A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                               00232300
                   B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                              00232400
                   C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                              00232500
                   D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                              00232600
                   E   ,T5(4,3)           ,T6(1,3)                                                  00232700
                C                                                                                    00232800
                C CONTROL PARAMETERS...                                                              00232900
                C                                                                                    00233000
ISN 0009            COMMON /CONTRL/                                                                  00233100
                   A    DAY               ,TIME               ,INIT                                 00233200
                   B   ,TAFT              ,IER                ,KNU                                  00233300
                   C   ,KOR               ,IP                 ,IR                                   00233400
                   D   ,NLIB              ,NPAGE              ,FAC                                  00233500
                C                                                                                    00233600
                C OUTPUT STORAGE FOR CURRENT TIME STEP...                                            00233700
                C                                                                                    00233800
ISN 0010            COMMON /OUTPUT/                                                                  00233900
                   A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                            00234000
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*LEVEL 2.3.0 (JUNE 78)        SOLOUT          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.46       PAGE   2

                     B   ,D2 (30,30)          ,D (30,30)          ,EN(30,30)              00234100
                     C   ,HLF(30)             ,Q(30,30)           ,HLFOUT(30,30)          00234200
                     C                                                                    00234300
                     C CURRENT VARIABLES                                                  00234400
                     C                                                                    00234500
ISN 0011                  COMMON /NOW/                                                    00234600
                     A    TI        ,D3        ,D4        ,D5        ,P0        ,AMAD     00234700
                     B   ,F1                                                              00234800
                     C ...................................................................00234900
ISN 0012                  LOGICAL*1 MID(2)/' ','M'/                                      00235000
ISN 0013                  DIMENSION CLASS(3)                                             00235100
ISN 0014                  DATA CLASS/'D','W','Y'/                                        00235200
                     C                                                                    00235300
ISN 0015                   LS=1                                                          00235400
ISN 0016                  NPAGE=NPAGE+1                                                  00235500
                     C                                                                    00235600
ISN 0017                  IWARN=0                                                        00235610
ISN 0018                  DO 120 N=1,NORG                                                00235620
ISN 0019                  IF(KORG(N).EQ.8) IWARN=1                                       00235630
ISN 0021           120    CONTINUE                                                       00235640
                     C                                                                    00235650
ISN 0022                  DO 100 NTYP=1,2                                                00235700
ISN 0023                  KORS=1                                                         00235800
ISN 0024                   LS7=LS+7                                                      00235900
ISN 0025                   LS8=LS+8                                                      00236000
ISN 0026                   LS15=LS+15                                                    00236100
ISN 0027                   LS16=LS+16                                                    00236200
ISN 0028                   KORS7=KORS+7                                                  00236300
ISN 0029                   KORS8=KORS+8                                                  00236400
ISN 0030                   KORS15=KORS+15                                                00236500
ISN 0031                   KORS16=KORS+16                                                00236600
ISN 0032                  MAXL=60                                                        00236700
ISN 0033                  LINE=0                                                         00236800
                     C                                                                    00236900
ISN 0034           50     WRITE(6,1000) DAY,NPAGE                                        00237000
ISN 0035           1000   FORMAT('1',T20,'ACRO -- A COMPUTER PROGRAM FOR CALCULATING ',  00237100
                         A 'ORGAN DOSE FROM ACUTE OR CHRONIC',T105,'DATE',T115,'PAGE' /  00237200
                         B T103,A8,T115,I3,/                                            00237300
                         B T28,'INHALATION AND INGESTION OF RADIONUCLIDE'/)              00237400
                     C                                                                    00237500
ISN 0036                  WRITE(6,1010) HEAD,LABEL                                       00237600
ISN 0037           1010   FORMAT(T20,18A4,/T22,18A4)                                     00237700
ISN 0038                  LIN=6                                                          00237800
                     C                                                                    00237900
ISN 0039                  IF(INIT.EQ.0 ) GO TO 200                                       00238000
ISN 0041                  INIT=0                                                         00238100
                     C                                                                    00238200
                     C INPUT EDITED (ONLY INITIAL STEP)                                   00238300
                     C                                                                    00238400
ISN 0042                  WRITE(6,1020) UNIT                                             00238500
ISN 0043           1020   FORMAT(/T10,'NUCLIDE',T20,'INTAKE RATE',T35,'INTAKE TIME',     00238600
                         A T52,'AMAD',T61,'TRANS.',T71,'FRACTION OF DEPOSITION',         00238700
                         B T100,'HALF LIFE'/                                            00238800
                         C T19,'(MICRO CI/SEC)',T37,'(',A4,')',T50,'(MICRON)',T61,'CLASS',00238900
                         D T72,'D3',T81,'D4',T90,'D5',T103,'(DAYS)')                     00239000
                     C                                                                    00239100
ISN 0044                  DO 110 N=1,NON                                                 00239200
ISN 0045                  TIO=TIT(N)*FAC                                                 00239300
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ISN 0046          P00=P0T(N)                                                    00239400
ISN 0047          IF (NOPT.NE.2)  P00=P00/(24.*3600.)                           00239500
                C                                                               00239600
ISN 0049          IF(METAIN(N).EQ.0) MEF=MET(1)                                 00239700
ISN 0051          IF(METAIN(N).EQ.1) MEF=MET(2)                                 00239800
ISN 0053          WRITE(6,1030) ID(1,N),ID(2,N),MEF           ,P00,TI0,         00239900
                 A AMADT(N),CLASS(KLASS(N)),D3T(N),D4T(N),D5T(N),HLF(N)         00240000
ISN 0054       1030 FORMAT(/T10,A2,I3,A1,4X,T20,1PE11.4,T35,E11.4,T51,0PF7.3,T63,A1,  00240100
                 A T70,F6.4,T79,F6.4,T88,F6.4,T102,1PE11.4,T117,1PE11.4 )       00240200
ISN 0055       110  CONTINUE                                                    00240300
ISN 0056          NPAGE=NPAGE+1                                                 00240400
ISN 0057          WRITE(6,1000) DAY,NPAGE                                       00240500
                C                                                               00240600
ISN 0058          WRITE(6,1040)                                                 00240700
ISN 0059       1040 FORMAT(//T10,'EFFECTIVE ENERGY(MEV)',/                      00240800
                 A         T10,'======================')                       00240900
                C                                                               00241000
ISN 0060          LE=NORG                                                       00241100
ISN 0061          IF(LE.GT.LS+7) GO TO 400                                      00241200
ISN 0063          WRITE(6,2020) (ORGNAM(KORG(K)),K=LS,LE)                       00241300
                C                                                               00241400
ISN 0064          DO 210 K=1,NON                                                00241500
ISN 0065          IF(METAIN(K).EQ.0) MEF=MET(1)                                 00241600
ISN 0067          IF(METAIN(K).EQ.1) MEF=MET(2)                                 00241700
ISN 0069       210   WRITE(6,2030) ID(1,K),ID(2,K),MEF,CLASS(KLASS(K)),(EN(M,K),  00241800
                 A M=LS,LE)                                                     00241900
ISN 0070          GO TO 600                                                     00242000
ISN 0071       400   IF(LE.GT.LS+16) GO TO 500                                 00242100
ISN 0073          WRITE(6,2020) (ORGNAM(KORG(K)),K=LS,LS7)                      00242200
ISN 0074          DO 230 K=1,NON                                                00242300
ISN 0075          IF(METAIN(K).EQ.0) MEF=MET(1)                                 00242400
ISN 0077          IF(METAIN(K).EQ.1) MEF=MET(2)                                 00242500
ISN 0079       230   WRITE(6,2030) ID(1,K),ID(2,K),MEF,CLASS(KLASS(K)),(EN(M,K),  00242600
                 A M=LS,LS7)                                                    00242700
ISN 0080          WRITE(6,2020) (ORGNAM(KORG(K)),K=LS8,LE)                      00242800
ISN 0081          DO 240 K=1,NON                                                00242900
ISN 0082          IF(METAIN(K).EQ.0) MEF=MET(1)                                 00243000
ISN 0084          IF(METAIN(K).EQ.1) MEF=MET(2)                                 00243100
ISN 0086       240   WRITE(6,2030) ID(1,K),ID(2,K),MEF,CLASS(KLASS(K)),(EN(M,K),  00243200
                 A M=LS8,LE)                                                    00243300
ISN 0087          GO TO 600                                                     00243400
ISN 0088       500   WRITE(6,2020) (ORGNAM(KORG(K)),K=LS,LS7)                  00243500
ISN 0089          DO 260 K=1,NON                                                00243600
ISN 0090          IF(METAIN(K).EQ.0) MEF=MET(1)                                 00243700
ISN 0092          IF(METAIN(K).EQ.0) MEF=MET(2)                                 00243800
ISN 0094       260   WRITE(6,2030) ID(1,K),ID(2,K),MEF,CLASS(KLASS(K)),(EN(M,K),  00243900
                 A M=LS,LS7)                                                    00244000
ISN 0095          WRITE(6,2020) (ORGNAM(KORG(K)),K=LS8,LS15)                    00244100
ISN 0096          DO 270 K=1,NON                                                00244200
ISN 0097          IF(METAIN(K).EQ.0) MEF=MET(1)                                 00244300
ISN 0099          IF(METAIN(K).EQ.1) MEF=MET(2)                                 00244400
ISN 0101       270   WRITE(6,2030) ID(1,K),ID(2,K),MEF,CLASS(KLASS(K)),(EN(M,K),  00244500
                 A M=LS8,LS15)                                                  00244600
ISN 0102          WRITE(6,2020) (ORGNAM(KORG(K)),K=LS16,LE)                     00244700
ISN 0103          DO 280 K=1,NON                                                00244800
ISN 0104          IF(METAIN(K).EQ.0) MEF=MET(1)                                 00244900
ISN 0106          IF(METAIN(K).EQ.1) MEF=MET(2)                                 00245000
ISN 0108       280   WRITE(6,2030) ID(1,K),ID(2,K),MEF,CLASS(KLASS(K)),(EN(M,K),  00245100
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*LEVEL 2.3.0 (JUNE 78)        SOLOUT          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.46       PAGE   4

                     A M=LS16,LE)                                                                          00245200
  ISN 0109       600   NPAGE=NPAGE+1                                                                       00245300
                 C                                                                                         00245400
  ISN 0110             WRITE(6,1000) DAY,NPAGE                                                           00245500
                 C                                                                                         00245600
  ISN 0111            WRITE(6,2040)                                                                      00245700
  ISN 0112       2040  FORMAT(/T10,'ORGAN MASS (G)',/T10,'===============')                               00245800
  ISN 0113             DO 290 I=LS,LE                                                                     00245900
  ISN 0114       290   WRITE(6,2050) ORGNAM(KORG(I)),ORGMAS(KORG(I),MOPT)                                 00246000
  ISN 0115       2050  FORMAT(1X,T10,A8,T25,F8.2)                                                         00246100
                 C                                                                                         00246200
  ISN 0116             NPAGE=NPAGE+1                                                                      00246300
                 C                                                                                         00246400
  ISN 0117             WRITE(6,1000) DAY,NPAGE                                                           00246500
                 C                                                                                         00246600
  ISN 0118             WRITE(6,2060)                                                                      00246700
  ISN 0119       2060  FORMAT(/T10,'BIOLOGICAL HALF-LIFE (DAYS)',                                         00246800
                     A        /T10,'==========================')                                          00246900
  ISN 0120            IF(IWARN.EQ.1) WRITE(6,2090)                                                       00246910
  ISN 0122       2090 FORMAT(T12,'(VALUES FOR LUNGS ARE NOT USED WHEN INTAKE MODE',                       00246920
                     A ' IS ''INHALATION'')')                                                           00246930
                 C                                                                                         00246940
  ISN 0123             IF(LE.GT.LS+7) GO TO 700                                                           00247000
  ISN 0125             WRITE(6,2020) (ORGNAM(KORG(K)),K=LS,LE)                                            00247100
  ISN 0126             DO 510 K=1,NON                                                                     00247200
  ISN 0127             IF(METAIN(K).EQ.0) MEF=MET(1)                                                      00247300
  ISN 0129             IF(METAIN(K).EQ.1) MEF=MET(2)                                                      00247400
  ISN 0131        510  WRITE(6,2030) ID(1,K),ID(2,K),MEF,CLASS(KLASS(K)),(HLFOUT(M,K),                    00247500
                     A M=LS,LE)                                                                         00247600
  ISN 0132             GO TO 900                                                                          00247700
  ISN 0133       700   IF(LE.GT.LS+15) GO TO 800                                                          00247800
  ISN 0135             WRITE(6,2020) (ORGNAM(KORG(K)),K=LS,LS7)                                           00247900
  ISN 0136             DO 520 K=1,NON                                                                     00248000
  ISN 0137             IF(METAIN(K).EQ.0) MEF=MET(1)                                                      00248100
  ISN 0139             IF(METAIN(K).EQ.1) MEF=MET(2)                                                      00248200
  ISN 0141       520   WRITE(6,2030) ID(1,K),ID(2,K),MEF,CLASS(KLASS(K)),(HLFOUT(M,K),                   00248300
                     A M=LS,LS7)                                                                        00248400
  ISN 0142             WRITE(6,2020) (ORGNAM(KORG(K)),K=LS8,LE)                                           00248500
  ISN 0143             DO 530 K=1,NON                                                                     00248600
  ISN 0144             IF(METAIN(K).EQ.0) MEF=MET(1)                                                      00248700
  ISN 0146             IF(METAIN(K).EQ.1) MEF=MET(2)                                                      00248800
  ISN 0148       530   WRITE(6,2030) ID(1,K),ID(2,K),MEF,CLASS(KLASS(K)),(HLFOUT(M,K),                   00248900
                     A M=LS8,LE)                                                                        00249000
  ISN 0149             GO TO 900                                                                          00249100
  ISN 0150       800   WRITE(6,2020) (ORGNAM(KORG(K)),K=LS,LS7)                                           00249200
  ISN 0151             DO 540 K=1,NON                                                                     00249300
  ISN 0152             IF(METAIN(K).EQ.0) MEF=MET(1)                                                      00249400
  ISN 0154             IF(METAIN(K).EQ.0) MEF=MET(2)                                                      00249500
  ISN 0156       540   WRITE(6,2030) ID(1,K),ID(2,K),MEF,CLASS(KLASS(K)),(HLFOUT(M,K),                   00249600
                     A M=LS,LS7)                                                                        00249700
  ISN 0157             WRITE(6,2020) (ORGNAM(KORG(K)),K=LS8,LS15)                                         00249800
  ISN 0158             DO 560 K=1,NON                                                                     00249900
  ISN 0159             IF(METAIN(K).EQ.0) MEF=MET(1)                                                      00250000
  ISN 0161             IF(METAIN(K).EQ.1) MEF=MET(2)                                                      00250100
  ISN 0163       560   WRITE(6,2030) ID(1,K),ID(2,K),MEF,CLASS(KLASS(K)),(HLFOUT(M,K),                   00250200
                     A M=LS8,LS15)                                                                      00250300
  ISN 0164             WRITE(6,2020) (ORGNAM(KORG(K)),K=LS16,LE)                                          00250400
  ISN 0165             DO 570 K=1,NON                                                                     00250500
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*LEVEL 2.3.0 (JUNE 78)        SOLOUT          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.15.46       PAGE   5

   ISN 0166            IF(METAIN(K).EQ.0) MEF=MET(1)                                                    00250600
   ISN 0168            IF(METAIN(K).EQ.1) MEF=MET(2)                                                    00250700
   ISN 0170       570  WRITE(6,2030) ID(1,K),ID(2,K),MEF,CLASS(KLASS(K)),(HLFOUT(M,K),                 00250800
                  A M=LS16,LE)                                                                          00250900
   ISN 0171       900  NPAGE=NPAGE+1                                                                    00251000
                  C                                                                                     00251100
   ISN 0172            WRITE(6,1000) DAY,NPAGE                                                          00251200
                  C                                                                                     00251300
   ISN 0173       200  TSEC=TIME*24*60*60                                                              00251400
   ISN 0174            WRITE(6,2000) TSEC,TIME                                                          00251500
   ISN 0175            IF (NTYP.EQ.2) GO TO 300                                                         00251600
   ISN 0177       2000 FORMAT(T10,'.....TIME INTERVAL FOLLOWING THE START OF INTAKE =',                 00251700
                  A 1PE11.4,' (SEC),OR ',0PF8.0,' (DAYS) .....')                                        00251800
   ISN 0178            WRITE (6,2010)                                                                   00251900
   ISN 0179       2010 FORMAT(/T10,'ORGAN BURDEN (MICRO CI OR *3.7E+4 BQ.)',                            00252000
                  A       /T10,'====================================' )                                 00252100
                  C                                                                                     00252200
   ISN 0180            KORE=MIN0(KORS+7,NORG)                                                           00252300
   ISN 0181            IF(KORE.GT.KORS+7) GO TO 450                                                     00252400
   ISN 0183            WRITE (6,2020) (ORGNAM(KORG(K)),K=KORS,KORE)                                     00252500
   ISN 0184       2020 FORMAT(/T14,'--- ORGAN ---', /1X ,'NUCLIDE',T13,'TR.CLASS',T24,                  00252600
                  A8(4X,A8,1X))                                                                         00252700
   ISN 0185            DO 250 L=1,NON                                                                   00252800
   ISN 0186            DO 251 K=KORS,KORE                                                               00252900
   ISN 0187            Q1(K,L)=Q1(K,L)                                                                  00253000
   ISN 0188       251  Q2(K,L)=Q2(K,L)                                                                  00253100
   ISN 0189            IF(METAIN(L).EQ.0) MEF=MET(1)                                                    00253200
   ISN 0191            IF(METAIN(L).EQ.1) MEF=MET(2)                                                    00253300
   ISN 0193            IF(TIME.LE.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),                00253400
                      A(Q1(K,L),K=KORS,KORE)                                                            00253500
   ISN 0195            IF(TIME.GT.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),                00253600
                      A(Q2(K,L),K=KORS,KORE)                                                            00253700
   ISN 0197       2030 FORMAT(2X,A2,I3,A1,7X,A1,T24,1P6E13.4)                                           00253800
   ISN 0198       250  CONTINUE                                                                        00253900
   ISN 0199             GO TO 650                                                                      00254000
   ISN 0200       450  IF(KORE.GT.KORS+15) GO TO 550                                                   00254100
   ISN 0202            WRITE(6,2020) (ORGNAM(KORG(K)),K=KORS,KORS7)                                     00254200
   ISN 0203            DO 410 L=1,NON                                                                   00254300
   ISN 0204            DO 411 K=KORS,KORS7                                                              00254400
   ISN 0205            Q1(K,1)=Q1(K,1)                                                                  00254500
   ISN 0206       411  Q2(K,L)=Q2(K,L)                                                                  00254600
   ISN 0207            IF(METAIN(L).EQ.0) MEF=MET(1)                                                    00254700
   ISN 0209            IF(METAIN(2).EQ.1) MEF=MET(2)                                                    00254800
   ISN 0211            IF(TIME.LE.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),                00254900
                      A(Q1(K,L),K=KORS,KORS7)                                                           00255000
   ISN 0213            IF(TIME.GT.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),                00255100
                      A(Q2(K,L),K=KORS,KORS7)                                                           00255200
   ISN 0215       410  CONTINUE                                                                        00255300
   ISN 0216            WRITE(6,2020) (ORGNAM(KORG(K)),K=KORS8,KORE)                                     00255400
   ISN 0217            DO 420 L=1,NON                                                                   00255500
   ISN 0218            DO 421 K=KORS8,KORE                                                              00255600
   ISN 0219            Q1(K,1)=Q1(K,1)                                                                  00255700
   ISN 0220       421  Q2(K,L)=Q2(K,L)                                                                  00255800
   ISN 0221            IF(METAIN(L).EQ.0) MEF=MET(1)                                                    00255900
   ISN 0223            IF(METAIN(2).EQ.1) MEF=MET(2)                                                    00256000
   ISN 0225            IF(TIME.LE.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),                00256100
                      A(Q1(K,L),K=KORS8,KORE)                                                           00256200
   ISN 0227            IF(TIME.GT.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),                00256300
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                     A(Q2(K,L),K=KORS8,KORE)                                    00256400
ISN 0229        420  CONTINUE                                                   00256500
ISN 0230             GO TO 650                                                  00256600
ISN 0231        550  WRITE(6,2020) (ORGNAM(KORG(K)),K=KORS,KORS7)               00256700
ISN 0232             DO 430 L=1,NON                                             00256800
ISN 0233             DO 431 K=KORS,KORS7                                        00256900
ISN 0234             Q1(K,1)=Q1(K,1)                                            00257000
ISN 0235        431  Q2(K,L)=Q2(K,L)                                           00257100
ISN 0236             IF(METAIN(L).EQ.0) MEF=MET(1)                              00257200
ISN 0238             IF(METAIN(2).EQ.1) MEF=MET(2)                              00257300
ISN 0240             IF(TIME.LE.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)), 00257400
                     A(Q1(K,L),K=KORS,KORS7)                                    00257500
ISN 0242             IF(TIME.GT.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)), 00257600
                     A(Q2(K,L),K=KORS,KORS7)                                    00257700
ISN 0244        430  CONTINUE                                                   00257800
ISN 0245             WRITE(6,2020) (ORGNAM(KORG(K)),K=KORS8,KORS15)             00257900
ISN 0246             DO 440 L=1,NON                                             00258000
ISN 0247             DO 441 K=KORS8,KORS15                                      00258100
ISN 0248             Q1(K,1)=Q1(K,1)                                            00258200
ISN 0249        441  Q2(K,L)=Q2(K,L)                                           00258300
ISN 0250             IF(METAIN(L).EQ.0) MEF=MET(1)                              00258400
ISN 0252             IF(METAIN(2).EQ.1) MEF=MET(2)                              00258500
ISN 0254             IF(TIME.LE.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)), 00258600
                     A(Q1(K,L),K=KORS8,KORS15)                                  00258700
ISN 0256             IF(TIME.GT.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)), 00258800
                     A(Q2(K,L),K=KORS8,KORS15)                                  00258900
ISN 0258        440  CONTINUE                                                   00259000
ISN 0259             WRITE(6,2020) (ORGNAM(KORG(K)),K=KORS16,KORE)              00259100
ISN 0260             DO 460 L=1,NON                                             00259200
ISN 0261             DO 461 K=KORS16,KORE                                       00259300
ISN 0262             Q1(K,1)=Q1(K,1)                                            00259400
ISN 0263        461  Q2(K,L)=Q2(K,L)                                           00259500
ISN 0264             IF(METAIN(L).EQ.0) MEF=MET(1)                              00259600
ISN 0266             IF(METAIN(2).EQ.1) MEF=MET(2)                              00259700
ISN 0268             IF(TIME.LE.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)), 00259800
                     A(Q1(K,L),K=KORS16,KORE)                                   00259900
ISN 0270             IF(TIME.GT.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)), 00260000
                     A(Q2(K,L),K=KORS16,KORE)                                   00260100
ISN 0272        460  CONTINUE                                                   00260200
ISN 0273        650  NPAGE=NPAGE+1                                             00260300
                C                                                               00260400
ISN 0274             IF (KORE.GE.NORG) GO TO 100                                00260500
                C                                                               00260600
ISN 0276               KORS = KORE+1                                            00260700
ISN 0277               GO TO 50                                                 00260800
                C                                                               00260900
ISN 0278        300  WRITE(6,3010)                                             00261000
ISN 0279        3010 FORMAT(/T10,'ORGAN DOSE EQUIVALENT(REM OR 1.E-2 SV)',      00261100
                     A       /T10,'====================================' )     00261200
                C                                                               00261300
ISN 0280             KORE=MIN0(KORS+7,NORG)                                     00261400
ISN 0281             IF(KORE.GT.KORS+7) GO TO 750                               00261500
ISN 0283             WRITE(6,2020) (ORGNAM(KORG(K)),K=KORS,KORE)                00261600
                C                                                               00261700
ISN 0284             DO 350 L=1,NON                                             00261800
ISN 0285             DO 351 K=KORS,KORE                                         00261900
ISN 0286             D1(K,L)=D1(K,L)                                            00262000
ISN 0287             D2(K,L)=D2(K,L)                                            00262100
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ISN 0288      351  D(K,L)=D(K,L)                                                          00262200
ISN 0289           IF(METAIN(L).EQ.0) MEF=MET(1)                                        00262300
ISN 0291           IF(METAIN(L).EQ.1) MEF=MET(2)                                        00262400
ISN 0293           IF(TIME.LE.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),    00262500
                  A (D1(K,L),K=KORS,KORE)                                               00262600
ISN 0295           IF(TIME.GT.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),    00262700
                  A (D2(K,L),K=KORS,KORE)                                               00262800
                                                                                        00262900
ISN 0297      350  CONTINUE                                                            00263000
ISN 0298           GO TO 950                                                            00263100
ISN 0299      750  IF(KORE.GT.KORS+15) GO TO 850                                        00263200
ISN 0301           WRITE(6,2020) (ORGNAM(KORG(K)),K=KORS,KORS7)                         00263300
                C                                                                       00263400
ISN 0302           DO 710 L=1,NON                                                       00263500
ISN 0303           DO 711 K=KORS,KORS7                                                  00263600
ISN 0304           D1(K,L)=D1(K,L)                                                      00263700
ISN 0305           D2(K,L)=D2(K,L)                                                      00263800
ISN 0306      711  D(K,L)=D(K,L)                                                        00263900
ISN 0307           IF(METAIN(L).EQ.0) MEF=MET(1)                                        00264000
ISN 0309           IF(METAIN(L).EQ.1) MEF=MET(2)                                        00264100
ISN 0311           IF(TIME.LE.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),    00264200
                  A (D1(K,L),K=KORS,KORS7)                                              00264300
ISN 0313           IF(TIME.GT.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),    00264400
                  A (D2(K,L),K=KORS,KORS7)                                              00264500
ISN 0315      710  CONTINUE                                                            00264600
ISN 0316           WRITE(6,2020) (ORGNAM(KORG(K)),K=KORS8,KORE)                         00264700
                C                                                                       00264800
ISN 0317           DO 720 L=1,NON                                                       00264900
ISN 0318           DO 721 K=KORS8,KORE                                                  00265000
ISN 0319           D1(K,L)=D1(K,L)                                                      00265100
ISN 0320           D2(K,L)=D2(K,L)                                                      00265200
ISN 0321      721  D(K,L)=D(K,L)                                                        00265300
ISN 0322           IF(METAIN(L).EQ.0) MEF=MET(1)                                        00265400
ISN 0324           IF(METAIN(L).EQ.1) MEF=MET(2)                                        00265500
ISN 0326           IF(TIME.LE.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),    00265600
                  A (D1(K,L),K=KORS8,KORE)                                              00265700
ISN 0328           IF(TIME.GT.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),    00265800
                  A (D2(K,L),K=KORS8,KORE)                                              00265900
ISN 0330      720  CONTINUE                                                            00266000
ISN 0331           GO TO 950                                                            00266100
ISN 0332      850  WRITE(6,2020) (ORGNAM(KORG(K)),K=KORS,KORS7)                        00266200
                C                                                                       00266300
ISN 0333           DO 730 L=1,NON                                                       00266400
ISN 0334           DO 731 K=KORS,KORS7                                                  00266500
ISN 0335           D1(K,L)=D1(K,L)                                                      00266600
ISN 0336           D2(K,L)=D2(K,L)                                                      00266700
ISN 0337      731  D(K,L)=D(K,L)                                                        00266800
ISN 0338           IF(METAIN(L).EQ.0) MEF=MET(1)                                        00266900
ISN 0340           IF(METAIN(L).EQ.1) MEF=MET(2)                                        00267000
ISN 0342           IF(TIME.LE.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),    00267100
                  A (D1(K,L),K=KORS,KORS7)                                              00267200
ISN 0344           IF(TIME.GT.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)),    00267300
                  A (D2(K,L),K=KORS,KORS7)                                              00267400
ISN 0346      730  CONTINUE                                                            00267500
ISN 0347           WRITE(6,2020) (ORGNAM(KORG(K)),K=KORS8,KORS15)                       00267600
                C                                                                       00267700
ISN 0348           DO 740 L=1,NON                                                       00267800
ISN 0349           DO 741 K=KORS8,KORS15                                                00267900
ISN 0350           D1(K,L)=D1(K,L)
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ISN 0351          D2(K,L)=D2(K,L)                                                    00268000
ISN 0352       741  D(K,L)=D(K,L)                                                    00268100
ISN 0353          IF(METAIN(L).EQ.0) MEF=MET(1)                                   00268200
ISN 0355          IF(METAIN(L).EQ.1) MEF=MET(2)                                   00268300
ISN 0357          IF(TIME.LE.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)), 00268400
                 A (D1(K,L),K=KORS8,KORS15)                                       00268500
ISN 0359          IF(TIME.GT.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)), 00268600
                 A (D2(K,L),K=KORS8,KORS15)                                       00268700
ISN 0361       740  CONTINUE                                                      00268800
                C                                                                 00268900
ISN 0362          WRITE(6,2020) (ORGNAM(KORG(K)),K=KORS16,KORE)                   00269000
                C                                                                 00269100
ISN 0363          DO 760 L=1,NON                                                  00269200
ISN 0364          DO 761 K=KORS16,KORE                                            00269300
ISN 0365          D1(K,L)=D1(K,L)                                                 00269400
ISN 0366          D2(K,L)=D2(K,L)                                                 00269500
ISN 0367       761  D(K,L)=D(K,L)                                                 00269600
ISN 0368          IF(METAIN(L).EQ.0) MEF=MET(1)                                   00269700
ISN 0370          IF(METAIN(L).EQ.1) MEF=MET(2)                                   00269800
ISN 0372          IF(TIME.LE.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)), 00269900
                 A (D1(K,L),K=KORS16,KORE)                                        00270000
ISN 0374          IF(TIME.GT.TI) WRITE(6,2030) ID(1,L),ID(2,L),MEF,CLASS(KLASS(L)), 00270100
                 A (D2(K,L),K=KORS16,KORE)                                        00270200
ISN 0376       760  CONTINUE                                                      00270300
ISN 0377       950  NPAGE=NPAGE+1                                                 00270600
ISN 0378          IF (KORE.GE.NORG) GO TO 100                                     00270700
ISN 0380            KORS =KORE+1                                                  00270800
ISN 0381            GO TO 50                                                      00270900
                C                                                                 00271000
ISN 0382       100  CONTINUE                                                      00271100
ISN 0383          NPAGE=NPAGE-1                                                   00271200
                C                                                                 00271300
ISN 0384          RETURN                                                          00271400
ISN 0385          END                                                             00271500
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*LEVEL 2.3.0 (JUNE 78)                  OS/360  FORTRAN H EXTENDED          DATE 80.023/18.16.23       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

ISN 0002            BLOCK DATA                                                                    00271600
                    C                                                                             00271700
                    C =============== C O M M O N ==========================================      00271800
ISN 0003            REAL*8 ORGNAM,DAY                                                             00271900
                    C                                                                             00272000
                    C  INPUT...                                                                   00272100
                    C                                                                             00272200
ISN 0004            COMMON /INPUT/                                                                00272300
                    A    HEAD(18)          ,LABEL(18)          ,NORG                            00272400
                    B   ,KORG(30)          ,NON                ,NZ(30)                          00272500
                    C   ,MASS(30)          ,KLASS(30)          ,METAIN(30)                      00272600
                    D   ,ID(2,30)          ,NOPT               ,MOPT                            00272700
                    E   ,TIT(30)           ,TIMET(8)           ,DTIME                           00272800
                    F   ,D3T(30)           ,D4T(30)            ,D5T(30)                         00272900
                    G   ,P0T(30)           ,AMADT(30)          ,IUNIT                           00273000
                    H   ,UNIT                                                                     00273100
                    C                                                                             00273200
                    C BIOLOGICAL LIBRARY RECORD ...                                               00273300
                    C                                                                             00273400
ISN 0005            COMMON /BIOLIB/                                                               00273500
                    A    LZ    (3000)      ,LA    (3000)      ,META  (3000)                    00273600
                    B   ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                    00273700
                    C   ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                    00273800
                    D   ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                    00273900
                    E   ,EY    (3000)                                                             00274000
                    C                                                                             00274100
                    C DATA TABLES...                                                              00274200
                    C                                                                             00274300
ISN 0006            COMMON /TABLES/                                                               00274400
                    A    ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                          00274500
                    B   ,GISI(3)           ,GIUL(3)            ,GILL(3)                         00274600
                    C   ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                         00274700
                    D   ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                         00274800
                    E   ,T5(4,3)           ,T6(1,3)                                             00274900
                    C                                                                             00275000
                    C CONTROL PARAMETERS...                                                       00275100
                    C                                                                             00275200
ISN 0007            COMMON /CONTRL/                                                               00275300
                    A    DAY               ,TIME               ,INIT                            00275400
                    B   ,TAFT              ,IER                ,KNU                             00275500
                    C   ,KOR               ,IP                 ,IR                              00275600
                    D   ,NLIB              ,NPAGE              ,FAC                             00275700
                    C                                                                             00275800
                    C OUTPUT STORAGE FOR CURRENT TIME STEP...                                     00275900
                    C                                                                             00276000
ISN 0008            COMMON /OUTPUT/                                                               00276100
                    A    Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                       00276200
                    B   ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                       00276300
                    C   ,HLF(30)           ,Q(30,30)           ,HLFOUT(30,30)                   00276400
                    C                                                                             00276500
                    C CURRENT VARIABLES                                                           00276600
                    C                                                                             00276700
ISN 0009            COMMON /NOW/                                                                  00276800
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*LEVEL 2.3.0 (JUNE 78)        INPUT          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.16.23      PAGE   2

                     A    TI       ,D3       ,D4       ,D5       ,P0       ,AMAD       00276900
                     B   ,FI                                                            00277000
                C ..........................................................................00277100
                C                                                                       00277200
                C ORGAN NAME                                                            00277300
                C                                                                       00277400
   ISN 0010           DATA ORGNAM                                                       00277500
                     A  /'T.BODY  ' ,'BD.WATER' ,'KIDNEYS ' ,'LIVER   ' ,'SPLEEN  '    00277600
                     B              ,'BONE    ' ,'FAT     ' ,'LUNGS   ' ,'ADRENALS'    00277700
                     C  ,'TESTES  ' ,'OVARIES ' ,'SKIN    ' ,'BRAIN   ' ,'MUSCLE  '    00277800
                     D  ,'PROSTATE' ,'THYROID ' ,'PANCREAS' ,'HEART   ' ,'GI-TRACT'    00277900
                     E  ,'STOMACH ' ,'GI-SI   ' ,'GI-ULI  ' ,'GI-LLI  '   /           00278000
                C                                                                       00278100
                C ORGAN MASS (GRAM)                                                     00278200
                C                                                                       00278300
   ISN 0011           DATA ORGMAS                                                       00278400
                     A   / 70000.  ,43000.   ,300.     ,1700.    ,150.                 00278500
                     B   ,7000.    ,10000.   ,1000.    ,20.      ,40.                  00278600
                     C   ,8.       ,2000.    ,1500.    ,30000.   ,20.                  00278700
                     D   ,20.      ,70.      ,300.     ,1635.    ,250.                 00278800
                     D   ,1100.    ,135.     ,150.                                     00278900
                     E   ,70000.   ,42000.   ,310.     ,1800.    ,180.                 00279000
                     F   ,5000.    ,13500.   ,1000.    ,14.      ,35.                  00279100
                     G   ,11.      ,2600.    ,1400.    ,28000.   ,16.                  00279200
                     H   ,20.      ,100.     ,330.     ,1205.    ,250.                 00279300
                     I   ,400.     ,220.     ,135.     /                               00279400
                C                                                                       00279500
                C GI   PARAMETERS                                                       00279600
                C    1. RESIDENCE TIME(DAY)  2. TIME TO REACH(DAY)  3. MASS(GRAM)       00279700
                C                                                                       00279800
   ISN 0012           DATA GIS     /0.041667 ,0.       ,250.  /                       00279900
   ISN 0013           DATA GISI    /0.166667 ,0.041667 ,1100. /                       00280000
   ISN 0014           DATA GIUL    /0.541667 ,0.208333 ,135.  /                       00280100
   ISN 0015           DATA GILL    /1.0      ,0.75     ,150.  /                       00280200
                C                                                                       00280300
                C TGLM PARAMETERS                                                       00280400
                C                                                                       00280500
   ISN 0016           DATA F3 /0.5,0.5, 0.1,0.9, 0.01,0.99/                            00280600
   ISN 0017           DATA F4/0.95,0.05, 0.5,0.5, 0.01,0.99/                           00280700
   ISN 0018           DATA F5/0.8,0.,0.,0.2, 0.15,0.4,0.4,0.05, 0.05,0.4,0.4,0.15/     00280800
   ISN 0019           DATA F6/1., 1., 0.9/                                             00280900
                C                                                                       00281000
   ISN 0020           DATA T3/0.01,0.01, 0.01,0.4, 0.01,0.4/                           00281100
   ISN 0021           DATA T4/0.01,0.2, 0.01,0.2, 0.01,0.2/                            00281200
   ISN 0022           DATA T5/0.5,1.E-03,1.E-03,0.5, 50.,1.,50.,50., 500.,1.,500.,500./00281300
   ISN 0023           DATA T6/0.5, 50., 1000./                                         00281400
                C                                                                       00281500
                C                                                                       00281600
   ISN 0024           END                                                              00281700
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*LEVEL 2.3.0 (JUNE 78)                OS/360  FORTRAN H EXTENDED          DATE 80.023/18.16.23      PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

   ISN 0002          SUBROUTINE SET                                                                00281800
                     C                                                                             00281900
                     C INITIAL SET                                                                 00282000
                     C                                                                             00282100
                     C                                                                             00282200
                     C ================ C O M M O N ==========================================     00282300
   ISN 0003          REAL*8 ORGNAM,DAY                                                             00282400
                     C                                                                             00282500
                     C  INPUT...                                                                   00282600
                     C                                                                             00282700
   ISN 0004          COMMON /INPUT/                                                                00282800
                    A     HEAD(18)          ,LABEL(18)          ,NORG                            00282900
                    B    ,KORG(30)          ,NON                ,NZ(30)                          00283000
                    C    ,MASS(30)          ,KLASS(30)          ,METAIN(30)                      00283100
                    D    ,ID(2,30)          ,NOPT               ,MOPT                            00283200
                    E    ,TIT(30)           ,TIMET(8)           ,DTIME                           00283300
                    F    ,D3T(30)           ,D4T(30)            ,D5T(30)                         00283400
                    G    ,P0T(30)           ,AMADT(30)          ,IUNIT                           00283500
                    H    ,UNIT                                                                    00283600
                     C                                                                             00283700
                     C BIOLOGICAL LIBRARY RECORD ...                                               00283800
                     C                                                                             00283900
   ISN 0005          COMMON /BIOLIB/                                                               00284000
                    A     LZ     (3000)     ,LA     (3000)      ,META   (3000)                   00284100
                    B    ,IDZ    (3000)     ,KODE   (3000)      ,PHLF   (3000)                   00284200
                    C    ,BHLF   (3000)     ,FW     (3000)      ,FA     (3000)                   00284300
                    D    ,F2D    (3000)     ,ED     (3000)      ,EW     (3000)                   00284400
                    E    ,EY     (3000)                                                          00284500
                     C                                                                             00284600
                     C DATA TABLES...                                                              00284700
                     C                                                                             00284800
   ISN 0006          COMMON /TABLES/                                                               00284900
                    A     ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                          00285000
                    B    ,GISI(3)           ,GIUL(3)            ,GILL(3)                         00285100
                    C    ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                         00285200
                    D    ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                         00285300
                    E    ,T5(4,3)           ,T6(1,3)                                             00285400
                     C                                                                             00285500
                     C CONTROL PARAMETERS...                                                       00285600
                     C                                                                             00285700
   ISN 0007          COMMON /CONTRL/                                                               00285800
                    A     DAY               ,TIME               ,INIT                            00285900
                    B    ,TAFT              ,IER                ,KNU                             00286000
                    C    ,KOR               ,IP                 ,IR                              00286100
                    D    ,NLIB              ,NPAGE              ,FAC                             00286200
                     C                                                                             00286300
                     C OUTPUT STORAGE FOR CURRENT TIME STEP...                                     00286400
                     C                                                                             00286500
   ISN 0008          COMMON /OUTPUT/                                                               00286600
                    A     Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                       00286700
                    B    ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                       00286800
                    C    ,HLF(30)            ,Q(30,30)          ,HLFOUT(30,30)                   00286900
                     C                                                                             00287000
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*LEVEL 2.3.0 (JUNE 78)          SET          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.16.23      PAGE   2

                C CURRENT VARIABLES                                                                    00287100
                C                                                                                      00287200
   ISN 0009           COMMON /NOW/                                                                     00287300
                     A    TI        ,D3        ,D4        ,D5        ,P0        ,AMAD                 00287400
                     B   ,FI                                                                           00287500
                C ..................................................................................   00287600
   ISN 0010          GIS (3) = ORGMAS(20,MOPT)                                                        00287700
   ISN 0011          GISI(3) = ORGMAS(21,MOPT)                                                        00287800
   ISN 0012          GIUL(3) = ORGMAS(22,MOPT)                                                        00287900
   ISN 0013          GILL(3) = ORGMAS(23,MOPT)                                                        00288000
                C                                                                                      00288100
   ISN 0014          IF (IUNIT.EQ.0) FAC=24.*3600                                                     00288200
   ISN 0016          IF (IUNIT.EQ.1) FAC=24.                                                          00288300
   ISN 0018          IF (IUNIT.EQ.2) FAC=1.                                                           00288400
   ISN 0020          IF (IUNIT.EQ.3) FAC=1./365.                                                      00288500
   ISN 0022          DO 50 N=1,8                                                                      00288600
   ISN 0023    50     TIMET(N)=TIMET(N)/FAC                                                          00288700
   ISN 0024          DTIME=DTIME/FAC                                                                  00288800
   ISN 0025          DO 100 N=1,NON                                                                   00288900
   ISN 0026           TIT(N)=TIT(N)/FAC                                                               00289000
   ISN 0027          IF (NOPT.EQ.1) POT(N)=POT(N)/TIT(N)                                              00289100
   ISN 0029          IF (NOPT.EQ.3) POT(N)=POT(N)/TIT(N)                                              00289200
   ISN 0031    100   CONTINUE                                                                        00289300
                C                                                                                      00289400
   ISN 0032          DO 200 N=1,NON                                                                   00289500
   ISN 0033          HLF(N)=0.                                                                        00289600
   ISN 0034          DO 200 M=1,NORG                                                                  00289700
   ISN 0035            Q1(M,N) = 0.                                                                   00289800
   ISN 0036            Q2(M,N) = 0.                                                                   00289900
   ISN 0037            D1(M,N) = 0.                                                                   00290000
   ISN 0038            D2(M,N) = 0.                                                                   00290100
   ISN 0039            D(M,N) = 0.                                                                    00290200
   ISN 0040            EN(M,N) = 0.                                                                   00290300
   ISN 0041    200   CONTINUE                                                                        00290400
                C                                                                                      00290500
   ISN 0042          RETURN                                                                           00290600
   ISN 0043          END                                                                              00290700
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*LEVEL 2.3.0 (JUNE 78)                OS/360  FORTRAN H EXTENDED          DATE 80.023/18.16.24       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

   ISN 0002            SUBROUTINE ACRO                                                    00290800
                  C                                                                       00290900
                  C GENERATE HEAD COVER                                                   00291000
                  C                                                                       00291100
   ISN 0003            INTEGER VERSNO/' 7  '/,DATE(2)/'80/0','1/04'/                      00291200
   ISN 0004            LOGICAL*1 A/' '/,PAGE(132,42)/5544*'*'/                            00291300
   ISN 0005            DIMENSION NC(14,11)                                                00291400
                  C                                                                       00291500
   ISN 0006            DATA NC/40,41,56,65,74,72,99,102,                    6*0,          00291600
                      A 39,42,55,66,72,84,94,106,                          6*0,          00291700
                      B 38,43,53,67,72,85,92,107,                          6*0,          00291800
                      C 36,44,53,63,66,67,72,77,82,85,90,98,102,108,                     00291900
                      D 35,45,52,62,72,76,80,84,90,96,103,108,             2*0,          00292000
                      E 34,46,52,63,73,81,82,84,90,96,103,108,             2*0,          00292100
                      F 33,46,52,64,66,67,73,83,91,97,102,108,             2*0,          00292200
                      G 32,47,53,67,73,82,91,108,                          6*0,          00292300
                      H 31,48,53,67,73,83,92,107,                          6*0,          00292400
                      I 30,37,40,49,53,65,73,77,80,86,93,106,               2*0,          00292500
                      J 30,36,41,50,55,63,73,76,81,87,95,103,              2*0 /          00292600
                  C                                                                       00292700
   ISN 0007            DO 100 NR=1,11                                                     00292800
   ISN 0008             DO 100 N=1,7                                                      00292900
   ISN 0009               NS =NC(2*N-1,NR)                                                00293000
   ISN 0010               NE =NC(2*N,NR)                                                  00293100
   ISN 0011               IF (NS.EQ.0) GO TO 100                                          00293200
   ISN 0013               DO 150 M=NS,NE                                                  00293300
   ISN 0014    150          PAGE(M,NR+15) = A                                            00293400
   ISN 0015    100     CONTINUE                                                          00293500
                  C                                                                       00293600
   ISN 0016            DO 200 M=1,1                                                       00293700
   ISN 0017             WRITE(6,1000) PAGE                                                00293800
   ISN 0018    200      WRITE(6,1100) VERSNO,DATE                                        00293900
   ISN 0019    1000 FORMAT('1',(T2,132A1))                                               00294000
   ISN 0020    1100 FORMAT(////T75,'VERSION ',3A4,////T45,                               00294100
                      A 'ENVIRONMENTAL PROTECTION SECTION',                            00294200
                      B /T48,'HEALTH AND SAFETY DIVISION',                             00294300
                      A/T42,'POWER REACTOR & NUCLEAR FUEL DEVELOPMENT',                00294400
                      B' CORP.')                                                       00294500
                  C                                                                       00294600
   ISN 0021            RETURN                                                             00294700
   ISN 0022            END                                                                00294800
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*LEVEL 2.3.0 (JUNE 78)                OS/360  FORTRAN H EXTENDED          DATE 80.023/18.16.25       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

  ISN 0002            SUBROUTINE UPDATE                                                          00294900
                    C                                                                            00295000
                    C UPDATE BIOLOGICAL LIBRARY                                                  00295100
                    C                                                                            00295200
  ISN 0003            REAL*8 PHLFI,GHLFI,FWI,FAI,F2DI,FDI,EWI,EYI                                00295300
                    C =============== C O M M O N ==========================================00295400
  ISN 0004            REAL*8 ORGNAM,DAY                                                          00295500
                    C                                                                            00295600
                    C  INPUT...                                                                  00295700
                    C                                                                            00295800
  ISN 0005            COMMON /INPUT/                                                             00295900
                     A     HEAD(18)          ,LABEL(18)          ,NORG                         00296000
                     B    ,KORG(30)          ,NON                ,NZ(30)                       00296100
                     C    ,MASS(30)          ,KLASS(30)          ,METAIN(30)                   00296200
                     D    ,ID(2,30)          ,NOPT               ,MOPT                         00296300
                     E    ,TIT(30)           ,TIMET(8)           ,DTIME                        00296400
                     F    ,D3T(30)           ,D4T(30)            ,D5T(30)                      00296500
                     G    ,P0T(30)           ,AMADT(30)          ,IUNIT                        00296600
                     H    ,UNIT                                                                 00296700
                    C                                                                            00296800
                    C BIOLOGICAL LIBRARY RECORD ...                                              00296900
                    C                                                                            00297000
  ISN 0006            COMMON /BIOLIB/                                                            00297100
                     A     LZ    (3000)      ,LA    (3000)      ,META  (3000)                   00297200
                     B    ,IDZ   (3000)      ,KODE  (3000)      ,PHLF  (3000)                   00297300
                     C    ,BHLF  (3000)      ,FW    (3000)      ,FA    (3000)                   00297400
                     D    ,F2D   (3000)      ,ED    (3000)      ,EW    (3000)                   00297500
                     E    ,EY    (3000)                                                         00297600
                    C                                                                            00297700
                    C DATA TABLES...                                                             00297800
                    C                                                                            00297900
  ISN 0007            COMMON /TABLES/                                                            00298000
                     A     ORGNAM(23)        ,ORGMAS(23,2)       ,GIS(3)                       00298100
                     B    ,GISI(3)           ,GIUL(3)            ,GILL(3)                      00298200
                     C    ,F3(2,3)           ,F4(2,3)            ,F5(4,3)                      00298300
                     D    ,F6(1,3)           ,T3(2,3)            ,T4(2,3)                      00298400
                     E    ,T5(4,3)           ,T6(1,3)                                          00298500
                    C                                                                            00298600
                    C CONTROL PARAMETERS...                                                      00298700
                    C                                                                            00298800
  ISN 0008            COMMON /CONTRL/                                                            00298900
                     A     DAY               ,TIME               ,INIT                         00299000
                     B    ,TAFT              ,IER                ,KNU                          00299100
                     C    ,KOR               ,IP                 ,IR                           00299200
                     D    ,NLIB              ,NPAGE              ,FAC                          00299300
                    C                                                                            00299400
                    C OUTPUT STORAGE FOR CURRENT TIME STEP...                                    00299500
                    C                                                                            00299600
  ISN 0009            COMMON /OUTPUT/                                                            00299700
                     A     Q1 (30,30)        ,Q2(30,30)          ,D1(30,30)                    00299800
                     B    ,D2 (30,30)        ,D (30,30)          ,EN(30,30)                    00299900
                     C    ,HLF(30)           ,Q(30,30)           ,HLFOUT(30,30)                00300000
                    C                                                                            00300100
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*LEVEL 2.3.0 (JUNE 78)        UPDATE          OS/360  FORTRAN H EXTENDED          DATE 80.023/18.16.25       PAGE   2

                C CURRENT VARIABLES                                                                    00300200
                C                                                                                      00300300
   ISN 0010           COMMON /NOW/                                                                     00300400
                     A    TI        ,D3       ,D4       ,D5       ,P0       ,AMAD                    00300500
                     B   ,F1                                                                           00300600
                C.....................................................................................00300700
                C                                                                                      00300800
   ISN 0011           REWIND 10                                                                        00300900
   ISN 0012           REWIND 20                                                                        00301000
                C                                                                                      00301100
   ISN 0013           DO 100 N=1,NLIB                                                                  00301200
   ISN 0014      100  WRITE(20,1000) LZ(N),LA(N),META(N),IDZ(N),KODE(N),                              00301300
                     A PHLF(N),BHLF(N),FW(N),FA(N),F2D(N),ED(N),EW(N),EY(N)                           00301400
   ISN 0015     1000 FORMAT(2I3,I1,A2,I2,6E10.3,2E9.2)                                                00301500
                C                                                                                      00301600
   ISN 0016           REWIND 20                                                                        00301700
                C                                                                                      00301800
   ISN 0017           DO 200 N=1,NLIB                                                                  00301900
   ISN 0018           READ(20,1100) LZI,LAI,METAI,IDZI,KODEI,PHLFI,IPHLF,                              00302000
                     A GHLFI,IGHLF,FWI,IFW,FAI,IFA,F2DI,IF2D,EDI,IED,EWI,IEW,EYI,IEY                  00302100
                C                                                                                      00302200
   ISN 0019     1100 FORMAT(2I3,I1,A2,I2,6(2X,A4,1X,A3),2(2X,A3,1X,A3))                               00302300
                C                                                                                      00302400
   ISN 0020      200  WRITE(10,1200) LZI,LAI,METAI,IDZI,KODEI,PHLFI,IPHLF,                            00302500
                     A GHLFI,IGHLF,FWI,IFW,FAI,IFA,F2DI,IF2D,EDI,IED,EWI,IEW,EYI,IEY                  00302600
                C                                                                                      00302700
   ISN 0021     1200 FORMAT(2I3,I1,A2,I2,6(1X,A4,A3),2(A3,A3))                                        00302800
                C                                                                                      00302900
   ISN 0022           RETURN                                                                           00303000
   ISN 0023           END                                                                              00303100
```

```
*LEVEL 2.3.0 (JUNE 78)                OS/360  FORTRAN H EXTENDED          DATE 80.023/18.16.26       PAGE   1

REQUESTED OPTIONS:

OPTIONS IN EFFECT: NAME(MAIN) NOOPTIMIZE LINECOUNT(60) SIZE(MAX) AUTODBL(NONE)
                   SOURCE EBCDIC NOLIST NODECK OBJECT MAP NOFORMAT NOGOSTMT NOXREF NOALC NOANSF TERM IBM FLAG(I)

                C                                                                                00303200
                C ..............................................................................00303300
                C     SUBROUTINE QG10                                                            00303400
                C                                                                                00303500
   ISN 0002           SUBROUTINE QG10(XL,XU,FCT,Y)                                               00303600
                C                                                                                00303700
   ISN 0003           A=.5*(XL+XU)                                                               00303800
   ISN 0004           B=XU-XL                                                                    00303900
   ISN 0005           C=.4869533*B                                                               00304000
   ISN 0006           Y=.03333567*(FCT(A+C)+FCT(A-C))                                            00304100
   ISN 0007           C=.4325317*B                                                               00304200
   ISN 0008           Y=Y+.07472567*(FCT(A+C)+FCT(A-C))                                          00304300
   ISN 0009           C=.3397048*B                                                               00304400
   ISN 0010           Y=Y+.1095432*(FCT(A+C)+FCT(A-C))                                           00304500
   ISN 0011           C=.2166977*B                                                               00304600
   ISN 0012           Y=Y+.1346334*(FCT(A+C)+FCT(A-C))                                           00304700
   ISN 0013           C=.07443717*B                                                              00304800
   ISN 0014           Y=B*(Y+.1477621*(FCT(A+C)+FCT(A-C)))                                       00304900
   ISN 0015           RETURN                                                                     00305000
   ISN 0016           END                                                                        00305100
```

Appendix 3. Sample Output

VERSION 7 80/01/04

ENVIRONMENTAL PROTECTION SECTION
HEALTH AND SAFETY DIVISION
POWER REACTOR & NUCLEAR FUEL DEVELOPMENT CORP.

```
* ECHC LINES

HEAD     ACRG SAMPLE RUN
LABEL     PLUTONIUM INHALATION
ORGAN      1   3    4    6    8   10   23
NUCLIDE   94 238 1 0
          1.0      1.0      0.2
NUCLIDE   94 239 1 0
          1.0      1.0      0.2
NUCLIDE   94 240 1 0
          1.0      1.0      0.2
NUCLIDE   94 241 1 0
          1.0      1.0      0.2
NUCLIDE   94 242 1 0
          1.0      1.0      0.2
NUCLIDE   94 238 1 0
          1.0      1.0      1.0
NUCLIDE   94 239 1 0
          1.0      1.0      1.0
NUCLIDE   94 240 1 0
          1.0      1.0      1.0
NUCLIDE   94 241 1 0
          1.0      1.0      1.0
NUCLIDE   94 242 1 0
          1.0      1.0      1.0
NUCLIDE   94 238 2 0
          1.0      1.0      0.2
NUCLIDE   94 239 2 0
          1.0      1.0      0.2
NUCLIDE   94 240 2 0
          1.0      1.0      0.2
NUCLIDE   94 241 2 0
          1.0      1.0      0.2
NUCLIDE   94 242 2 0
          1.0      1.0      0.2
NUCLIDE   94 238 2 0
          1.0      1.0      1.0
NUCLIDE   94 239 2 0
          1.0      1.0      1.0
NUCLIDE   94 240 2 0
          1.0      1.0      1.0
NUCLIDE   94 241 2 0
          1.0      1.0      1.0
NUCLIDE   94 242 2 0
          1.0      1.0      1.0
NUCLIDE   94 238 3 0
          1.0      1.0      0.2
NUCLIDE   94 239 3 0
          1.0      1.0      0.2
NUCLIDE   94 240 3 0
          1.0      1.0      0.2
NUCLIDE   94 241 3 0
          1.0      1.0      0.2
NUCLIDE   94 242 3 0
          1.0      1.0      0.2
NUCLIDE   94 238 3 0
          1.0      1.0      1.0
NUCLIDE   94 239 3 0
          1.0      1.0      1.0
NUCLIDE   94 240 3 0
          1.0      1.0      1.0
```

```
NUCLIDE    94 241 3 0
          1.0       1.0       1.0
NUCLIDE    94 242 3 0
          1.0       1.0       1.0
TIME      50.
UNIT     YEAR
INHALATION        1
```

----- END OF ECHO

NOT UPDATED

```
HEADING ...     ACRC SAMPLE RUN
LABEL ...        PLUTONIUM INHALATION

ORGAN CODE ...    1   T.BODY
                  3   KIDNEYS
                  4   LIVER
                  6   BONE
                  8   LUNGS
                 10   TESTES
                 23   GI-LLI

NUCLIDE (Z,A,KLASS,META,ID) ....   94  238  1  0
              INTAKE TIME  .... 1.000E 00
              D3,D4,D5     .... 4.685E-02 8.000E-02 5.000E-01
        TOTAL INTAKE(MIC. CI.) .... 1.000E 00
              AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  239  1  0
              INTAKE TIME  .... 1.000E 00
              D3,D4,D5     .... 4.685E-02 8.000E-02 5.000E-01
        TOTAL INTAKE(MIC. CI.) .... 1.000E 00
              AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  240  1  0
              INTAKE TIME  .... 1.000E 00
              D3,D4,D5     .... 4.685E-02 8.000E-02 5.000E-01
        TOTAL INTAKE(MIC. CI.) .... 1.000E 00
              AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  241  1  0
              INTAKE TIME  .... 1.000E 00
              D3,D4,D5     .... 4.685E-02 8.000E-02 5.000E-01
        TOTAL INTAKE(MIC. CI.) .... 1.000E 00
              AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  242  1  0
              INTAKE TIME  .... 1.000E 00
              D3,D4,D5     .... 4.685E-02 8.000E-02 5.000E-01
        TOTAL INTAKE(MIC. CI.) .... 1.000E 00
              AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  238  1  0
              INTAKE TIME  .... 1.000E 00
              D3,D4,D5     .... 3.069E-01 8.000E-02 2.502E-01
        TOTAL INTAKE(MIC. CI.) .... 1.000E 00
              AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  239  1  0
              INTAKE TIME  .... 1.000E 00
              D3,D4,D5     .... 3.069E-01 8.000E-02 2.502E-01
        TOTAL INTAKE(MIC. CI.) .... 1.000E 00
              AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  240  1  0
              INTAKE TIME  .... 1.000E 00
              D3,D4,D5     .... 3.069E-01 8.000E-02 2.502E-01
        TOTAL INTAKE(MIC. CI.) .... 1.000E 00
              AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  241  1  0
              INTAKE TIME  .... 1.000E 00
```

```
          D3,D4,D5     .... 3.069E-01 8.000E-02 2.502E-01
     TOTAL INTAKE(MIC. CI.)  .... 1.000E 00
          AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  242  1  0
          INTAKE TIME  .... 1.000E 00
          D3,D4,D5     .... 3.069E-01 8.000E-02 2.502E-01
     TOTAL INTAKE(MIC. CI.)  .... 1.000E 00
          AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  238  2  0
          INTAKE TIME  .... 1.000E 00
          D3,D4,D5     .... 4.685E-02 8.000E-02 5.000E-01
     TOTAL INTAKE(MIC. CI.)  .... 1.000E 00
          AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  239  2  0
          INTAKE TIME  .... 1.000E 00
          D3,D4,D5     .... 4.685E-02 8.000E-02 5.000E-01
     TOTAL INTAKE(MIC. CI.)  .... 1.000E 00
          AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  240  2  0
          INTAKE TIME  .... 1.000E 00
          D3,D4,D5     .... 4.685E-02 8.000E-02 5.000E-01
     TOTAL INTAKE(MIC. CI.)  .... 1.000E 00
          AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  241  2  0
          INTAKE TIME  .... 1.000E 00
          D3,D4,D5     .... 4.685E-02 8.000E-02 5.000E-01
     TOTAL INTAKE(MIC. CI.)  .... 1.000E 00
          AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  242  2  0
          INTAKE TIME  .... 1.000E 00
          D3,D4,D5     .... 4.685E-02 8.000E-02 5.000E-01
     TOTAL INTAKE(MIC. CI.)  .... 1.000E 00
          AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  238  2  0
          INTAKE TIME  .... 1.000E 00
          D3,D4,D5     .... 3.069E-01 8.000E-02 2.502E-01
     TOTAL INTAKE(MIC. CI.)  .... 1.000E 00
          AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  239  2  0
          INTAKE TIME  .... 1.000E 00
          D3,D4,D5     .... 3.069E-01 8.000E-02 2.502E-01
     TOTAL INTAKE(MIC. CI.)  .... 1.000E 00
          AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  240  2  0
          INTAKE TIME  .... 1.000E 00
          D3,D4,D5     .... 3.069E-01 8.000E-02 2.502E-01
     TOTAL INTAKE(MIC. CI.)  .... 1.000E 00
          AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  241  2  0
          INTAKE TIME  .... 1.000E 00
          D3,D4,D5     .... 3.069E-01 8.000E-02 2.502E-01
     TOTAL INTAKE(MIC. CI.)  .... 1.000E 00
          AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  242  2  0
          INTAKE TIME  .... 1.000E 00
```

```
              D3,D4,D5      .... 3.069E-01 8.000E-02 2.502E-01
         TOTAL INTAKE(MIC. CI.) .... 1.000E 00
               AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  238  3  0
               INTAKE TIME  .... 1.000E 00
               D3,D4,D5      .... 4.685E-02 8.000E-02 5.000E-01
         TOTAL INTAKE(MIC. CI.) .... 1.000E 00
               AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  239  3  0
               INTAKE TIME  .... 1.000E 00
               D3,D4,D5      .... 4.685E-02 8.000E-02 5.000E-01
         TOTAL INTAKE(MIC. CI.) .... 1.000E 00
               AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  240  3  0
               INTAKE TIME  .... 1.000E 00
               D3,D4,D5      .... 4.685E-02 8.000E-02 5.000E-01
         TOTAL INTAKE(MIC. CI.) .... 1.000E 00
               AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  241  3  0
               INTAKE TIME  .... 1.000E 00
               D3,D4,D5      .... 4.685E-02 8.000E-02 5.000E-01
         TOTAL INTAKE(MIC. CI.) .... 1.000E 00
               AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  242  3  0
               INTAKE TIME  .... 1.000E 00
               D3,D4,D5      .... 4.685E-02 8.000E-02 5.000E-01
         TOTAL INTAKE(MIC. CI.) .... 1.000E 00
               AMAD(MICRON) .... 2.000E-01

NUCLIDE (Z,A,KLASS,META,ID) ....   94  238  3  0
               INTAKE TIME  .... 1.000E 00
               D3,D4,D5      .... 3.069E-01 8.000E-02 2.502E-01
         TOTAL INTAKE(MIC. CI.) .... 1.000E 00
               AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  239  3  0
               INTAKE TIME  .... 1.000E 00
               D3,D4,D5      .... 3.069E-01 8.000E-02 2.502E-01
         TOTAL INTAKE(MIC. CI.) .... 1.000E 00
               AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  240  3  0
               INTAKE TIME  .... 1.000E 00
               D3,D4,D5      .... 3.069E-01 8.000E-02 2.502E-01
         TOTAL INTAKE(MIC. CI.) .... 1.000E 00
               AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  241  3  0
               INTAKE TIME  .... 1.000E 00
               D3,D4,D5      .... 3.069E-01 8.000E-02 2.502E-01
         TOTAL INTAKE(MIC. CI.) .... 1.000E 00
               AMAD(MICRON) .... 1.000E 00

NUCLIDE (Z,A,KLASS,META,ID) ....   94  242  3  0
               INTAKE TIME  .... 1.000E 00
               D3,D4,D5      .... 3.069E-01 8.000E-02 2.502E-01
         TOTAL INTAKE(MIC. CI.) .... 1.000E 00
               AMAD(MICRON) .... 1.000E 00

      EVALUATION TIME       .. 5.000E 01 0.0       0.0       0.0       0.0       0.0       0.0       0.0
```

TIME UNIT ---- YEAR
REFERENCE MAN ADAPTED
* INHALATION OPTION ACCEPTED

ACRO -- A COMPUTER PROGRAM FOR CALCULATING ORGAN DOSE FROM ACUTE OR CHRONIC DATE PAGE 4

INHALATION AND INGESTION OF RADIONUCLIDE

ACRO SAMPLE RUN
PLUTONIUM INHALATION

NUCLIDE	INTAKE RATE (MICRO CI/SEC)	INTAKE TIME (YEAR)	AMAD (MICRON)	TRANS. CLASS	FRACTION OF DEPOSITION D3	D4	D5	HALF LIFE (DAYS)
PU238	3.1710E-08	1.0000E 00	0.200	D	0.0469	0.0800	0.5000	3.3000E 04
PU239	3.1710E-08	1.0000E 00	0.200	D	0.0469	0.0800	0.5000	8.9000E 06
PU240	3.1710E-08	1.0000E 00	0.200	D	0.0469	0.0800	0.5000	2.4000E 06
PU241	3.1710E-08	1.0000E 00	0.200	D	0.0469	0.0800	0.5000	4.8000E 03
PU242	3.1710E-08	1.0000E 00	0.200	D	0.0469	0.0800	0.5000	1.4000E 08
PU238	3.1710E-08	1.0000E 00	1.000	D	0.3069	0.0800	0.2502	3.3000E 04
PU239	3.1710E-08	1.0000E 00	1.000	D	0.3069	0.0800	0.2502	8.9000E 06
PU240	3.1710E-08	1.0000E 00	1.000	D	0.3069	0.0800	0.2502	2.4000E 06
PU241	3.1710E-08	1.0000E 00	1.000	D	0.3069	0.0800	0.2502	4.8000E 03
PU242	3.1710E-08	1.0000E 00	1.000	D	0.3069	0.0800	0.2502	1.4000E 08
PU238	3.1710E-08	1.0000E 00	0.200	W	0.0469	0.0800	0.5000	3.3000E 04
PU239	3.1710E-08	1.0000E 00	0.200	W	0.0469	0.0800	0.5000	8.9000E 06
PU240	3.1710E-08	1.0000E 00	0.200	W	0.0469	0.0800	0.5000	2.4000E 06
PU241	3.1710E-08	1.0000E 00	0.200	W	0.0469	0.0800	0.5000	4.8000E 03
PU242	3.1710E-08	1.0000E 00	0.200	W	0.0469	0.0800	0.5000	1.4000E 08
PU238	3.1710E-08	1.0000E 00	1.000	W	0.3069	0.0800	0.2502	3.3000E 04
PU239	3.1710E-08	1.0000E 00	1.000	W	0.3069	0.0800	0.2502	8.9000E 06
PU240	3.1710E-08	1.0000E 00	1.000	W	0.3069	0.0800	0.2502	2.4000E 06
PU241	3.1710E-08	1.0000E 00	1.000	W	0.3069	0.0800	0.2502	4.8000E 03
PU242	3.1710E-08	1.0000E 00	1.000	W	0.3069	0.0800	0.2502	1.4000E 08
PU238	3.1710E-08	1.0000E 00	0.200	Y	0.0469	0.0800	0.5000	3.3000E 04
PU239	3.1710E-08	1.0000E 00	0.200	Y	0.0469	0.0800	0.5000	8.9000E 06
PU240	3.1710E-08	1.0000E 00	0.200	Y	0.0469	0.0800	0.5000	2.4000E 06
PU241	3.1710E-08	1.0000E 00	0.200	Y	0.0469	0.0800	0.5000	4.8000E 03
PU242	3.1710E-08	1.0000E 00	0.200	Y	0.0469	0.0800	0.5000	1.4000E 08
PU238	3.1710E-08	1.0000E 00	1.000	Y	0.3069	0.0800	0.2502	3.3000E 04
PU239	3.1710E-08	1.0000E 00	1.000	Y	0.3069	0.0800	0.2502	8.9000E 06

PU240	3.1710E-08	1.0000E 00	1.000	Y	0.3069	0.0800	0.2502	2.4000E 06
PU241	3.1710E-08	1.0000E 00	1.000	Y	0.3069	0.0800	0.2502	4.8000E 03
PU242	3.1710E-08	1.0000E 00	1.000	Y	0.3069	0.0800	0.2502	1.4000E 08

EFFECTIVE ENERGY(MEV)

NUCLIDE	--- ORGAN --- TR.CLASS	T.BODY	KIDNEYS	LIVER	BONE	LUNGS	TESTES	GI-LLI
PU238	D	5.7000E 01	5.7000E 01	5.7000E 01	2.8000E 02	5.7000E 01	5.7000E 01	5.5000E-01
PU239	D	5.3000E 01	5.3000E 01	5.3000E 01	2.7000E 02	5.3000E 01	5.3000E 01	5.2000E-01
PU240	D	5.3000E 01	5.3000E 01	5.3000E 01	2.7000E 02	5.3000E 01	5.3000E 01	5.2000E-01
PU241	D	2.3000E 00	2.5000E 00	2.2000E 00	1.3000E 01	1.3300E-02	2.9000E 00	1.0000E-02
PU242	D	5.1000E 01	5.1000E 01	5.1000E 01	2.5000E 02	5.1000E 01	5.1000E 01	4.9000E-01
PU238	W	5.7000E 01	5.7000E 01	5.7000E 01	2.8000E 02	5.7000E 01	5.7000E 01	5.5000E-01
PU239	W	5.3000E 01	5.3000E 01	5.3000E 01	2.7000E 02	5.3000E 01	5.3000E 01	5.2000E-01
PU240	W	5.3000E 01	5.3000E 01	5.3000E 01	2.7000E 02	5.3000E 01	5.3000E 01	5.2000E-01
PU241	W	2.3000E 00	2.5000E 00	2.2000E 00	1.3000E 01	3.0000E-02	2.9000E 00	1.0000E-02
PU242	W	5.1000E 01	5.1000E 01	5.1000E 01	2.5000E 02	5.1000E 01	5.1000E 01	4.9000E-01
PU238	Y	5.7000E 01	5.7000E 01	5.7000E 01	2.8000E 02	5.7000E 01	5.7000E 01	5.5000E-01
PU239	Y	5.3000E 01	5.3000E 01	5.3000E 01	2.7000E 02	5.3000E 01	5.3000E 01	5.2000E-01
PU240	Y	5.3000E 01	5.3000E 01	5.3000E 01	2.7000E 02	5.3000E 01	5.3000E 01	5.2000E-01
PU241	Y	2.3000E 00	2.5000E 00	2.2000E 00	1.3000E 01	1.8000E-01	2.9000E 00	1.0000E-02
PU242	Y	5.1000E 01	5.1000E 01	5.1000E 01	2.5000E 02	5.1000E 01	5.1000E 01	4.9000E-01
PU238	Y	5.7000E 01	5.7000E 01	5.7000E 01	2.8000E 02	5.7000E 01	5.7000E 01	5.5000E-01
PU239	Y	5.3000E 01	5.3000E 01	5.3000E 01	2.7000E 02	5.3000E 01	5.3000E 01	5.2000E-01
PU240	Y	5.3000E 01	5.3000E 01	5.3000E 01	2.7000E 02	5.3000E 01	5.3000E 01	5.2000E-01
PU241	Y	2.3000E 00	2.5000E 00	2.2000E 00	1.3000E 01	1.8000E-01	2.9000E 00	1.0000E-02
PU242	Y	5.1000E 01	5.1000E 01	5.1000E 01	2.5000E 02	5.1000E 01	5.1000E 01	4.9000E-01

ORGAN MASS (G)	
T.BODY	70000.00
KIDNEYS	310.00
LIVER	1800.00
BONE	5000.00
LUNGS	1000.00
TESTES	35.00
GI-LLI	135.00

BIOLOGICAL HALF-LIFE (DAYS)

(VALUES FOR LUNGS ARE NOT USED WHEN INTAKE MODE IS 'INHALATION')

NUCLIDE	--- ORGAN --- TR.CLASS	T.BODY	KIDNEYS	LIVER	BONE	LUNGS	TESTES
PU238	D	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU239	D	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU240	D	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU241	D	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU242	D	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU238	D	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU239	D	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU240	D	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU241	D	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU242	D	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU238	W	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU239	W	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU240	W	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU241	W	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU242	W	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU238	W	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		INFINITE
PU239	W	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU240	W	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU241	W	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU242	W	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU238	Y	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU239	Y	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU240	Y	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU241	Y	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU242	Y	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU238	Y	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU239	Y	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU240	Y	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU241	Y	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		
PU242	Y	6.5000E 04	3.2000E 04	1.4600E 04	3.6500E 04		

PNCT843—80—11

ACRO -- A COMPUTER PROGRAM FOR CALCULATING ORGAN DOSE FROM ACUTE OR CHRONIC DATE PAGE 8

INHALATION AND INGESTION OF RADIONUCLIDE

.....TIME INTERVAL FOLLOWING THE START OF INTAKE = 3.1536E 07 (SEC),OR 365. (DAYS) .....

ORGAN BURDEN (MICRO CI OR *3.7E+4 BQ.)

NUCLIDE	--- ORGAN --- TR.CLASS	T.BODY	KIDNEYS	LIVER	BONE	LUNGS	TESTES	GI-LLI
PU238	D	5.9479E-01	1.1872E-02	2.6587E-01	2.6725E-01	1.1919E-03	2.0858E-04	2.7422E-02
PU239	D	5.9707E-01	1.1918E-02	2.6689E-01	2.6828E-01	1.1919E-03	2.0938E-04	2.7422E-02
PU240	D	5.9705E-01	1.1917E-02	2.6688E-01	2.6826E-01	1.1919E-03	2.0937E-04	2.7422E-02
PU241	D	5.8159E-01	1.1609E-02	2.5999E-01	2.6132E-01	1.1918E-03	2.0395E-04	2.7422E-02
PU242	D	5.9709E-01	1.1918E-02	2.6689E-01	2.6828E-01	1.1919E-03	2.0938E-04	2.7422E-02
PU238	C	4.7634E-01	9.5078E-03	2.1292E-01	2.1403E-01	5.9960E-04	1.6704E-04	1.5745E-01
PU239	D	4.7816E-01	9.5442E-03	2.1374E-01	2.1485E-01	5.9961E-04	1.6768E-04	1.5745E-01
PU240	D	4.7815E-01	9.5438E-03	2.1373E-01	2.1484E-01	5.9961E-04	1.6768E-04	1.5745E-01
PU241	D	4.6578E-01	9.2971E-03	2.0821E-01	2.0929E-01	5.9954E-04	1.6334E-04	1.5745E-01
PU242	D	4.7818E-01	9.5443E-03	2.1374E-01	2.1485E-01	5.9961E-04	1.6768E-04	1.5745E-01
PU238	W	1.1955E-01	2.3876E-03	5.3497E-02	5.3743E-02	6.4388E-02	4.1929E-05	4.4181E-01
PU239	W	1.2010E-01	2.3977E-03	5.3724E-02	5.3972E-02	6.4487E-02	4.2107E-05	4.4200E-01
PU240	W	1.2009E-01	2.3976E-03	5.3721E-02	5.3969E-02	6.4486E-02	4.2105E-05	4.4200E-01
PU241	W	1.1665E-01	2.3288E-03	5.2181E-02	5.2421E-02	6.3809E-02	4.0896E-05	4.4069E-01
PU242	W	1.2010E-01	2.3978E-03	5.3724E-02	5.3973E-02	6.4487E-02	4.2108E-05	4.4200E-01
PU238	W	1.0791E-01	2.1541E-03	4.8255E-02	4.8490E-02	3.2241E-02	3.7837E-05	4.9580E-01
PU239	W	1.0835E-01	2.1629E-03	4.8450E-02	4.8687E-02	3.2290E-02	3.7990E-05	4.9590E-01
PU240	W	1.0834E-01	2.1628E-03	4.8448E-02	4.8685E-02	3.2290E-02	3.7989E-05	4.9590E-01
PU241	W	1.0537E-01	2.1035E-03	4.7122E-02	4.7350E-02	3.1951E-02	3.6947E-05	4.9522E-01
PU242	W	1.0835E-01	2.1629E-03	4.8451E-02	4.8687E-02	3.2290E-02	3.7991E-05	4.9590E-01
PU238	Y	7.8071E-03	1.5592E-04	3.4964E-03	3.5095E-03	2.5033E-01	2.7363E-06	3.6759E-01
PU239	Y	7.8455E-03	1.5669E-04	3.5136E-03	3.5269E-03	2.5123E-01	2.7497E-06	3.6770E-01
PU240	Y	7.8457E-03	1.5668E-04	3.5134E-03	3.5264E-03	2.5122E-01	2.7496E-06	3.6770E-01
PU241	Y	7.5854E-03	1.5149E-04	3.3972E-03	3.4097E-03	2.4514E-01	2.6586E-06	3.6697E-01
PU242	Y	7.8469E-03	1.5670E-04	3.5137E-03	3.5267E-03	2.5123E-01	2.7498E-06	3.6770E-01
PU238	Y	7.1324E-03	1.4241E-04	3.1915E-03	3.2055E-03	1.2532E-01	2.5005E-06	5.0370E-01
PU239	Y	7.1640E-03	1.4304E-04	3.2056E-03	3.2198E-03	1.2576E-01	2.5115E-06	5.0375E-01
PU240	Y	7.1640E-03	1.4303E-04	3.2054E-03	3.2195E-03	1.2576E-01	2.5114E-06	5.0375E-01
PU241	Y	6.9500E-03	1.3877E-04	3.1100E-03	3.1235E-03	1.2272E-01	2.4365E-06	5.0336E-01
PU242	Y	7.1648E-03	1.4304E-04	3.2056E-03	3.2197E-03	1.2576E-01	2.5115E-06	5.0375E-01

ACRO -- A COMPUTER PROGRAM FOR CALCULATING ORGAN DOSE FROM ACUTE OR CHRONIC INHALATION AND INGESTION OF RADIONUCLIDE

DATE

ACRO SAMPLE RUN
PLUTONIUM INHALATION
.....TIME INTERVAL FOLLOWING THE START OF INTAKE = 3.1536E 07 (SEC),OR 365. (DAYS) .....

ORGAN DOSE EQUIVALENT(REM OR 1.E-2 SV)

NUCLIDE	--- ORGAN --- TR.CLASS	T.BODY	KIDNEYS	LIVER	BONE	LUNGS	TESTES	GI-LLI
PU238	D	4.5207E 00	2.0390E 01	7.8752E 01	1.3974E 02	1.2655E 00	3.1680E 00	2.8565E-03
PU239	D	4.2115E 00	1.8983E 01	7.3400E 01	1.3487E 02	1.1767E 00	3.0586E 00	2.7007E-03
PU240	D	4.1981E 00	1.8998E 01	7.3410E 01	1.3509E 02	1.1767E 00	2.9614E 00	2.7007E-03
PU241	D	1.7971E-01	8.8100E-01	2.9949E 00	6.3928E 00	2.9525E-04	1.5881E-01	5.1931E-05
PU242	D	4.0258E 00	1.8266E 01	7.0640E 01	1.2507E 02	1.1323E 00	4.2137E 00	2.5449E-03
PU238	D	3.6231E 00	1.6341E 01	6.3115E 01	1.1199E 02	6.3662E-01	2.5389E 00	1.6402E-02
PU239	D	3.3753E 00	1.5213E 01	5.8825E 01	1.0809E 02	5.9196E-01	2.4512E 00	1.5507E-02
PU240	D	3.3645E 00	1.5225E 01	5.8833E 01	1.0827E 02	5.9196E-01	2.3734E 00	1.5507E-02
PU241	D	1.4403E-01	7.0608E-01	2.4003E 00	5.1236E 00	1.4853E-04	1.2728E-01	2.9819E-04
PU242	D	3.2264E 00	1.4639E 01	5.6613E 01	1.0023E 02	5.6962E-01	3.3754E 00	1.4613E-02
PU238	W	8.0890E-01	3.6489E 00	1.4096E 01	2.5004E 01	5.4737E 01	5.6675E-01	4.6023E-02
PU239	W	7.5372E-01	3.3969E 00	1.3143E 01	2.4129E 01	5.0957E 01	5.5400E-01	4.3532E-02
PU240	W	7.5049E-01	3.4005E 00	1.3145E 01	2.4184E 01	5.0956E 01	5.3054E-01	4.3532E-02
PU241	W	3.2075E-02	1.5726E-01	5.3474E-01	1.1411E 00	2.8608E-02	2.8342E-02	8.3458E-04
PU242	W	7.1880E-01	3.2686E 00	1.2649E 01	2.2388E 01	4.9034E 01	8.3980E-01	4.1021E-02
PU238	W	7.7080E-01	3.4768E 00	1.3430E 01	2.3826E 01	2.7412E 01	5.4010E-01	5.1647E-02
PU239	W	7.1815E-01	3.2368E 00	1.2519E 01	2.2994E 01	2.5519E 01	5.2484E-01	4.8841E-02
PU240	W	7.1545E-01	3.2398E 00	1.2522E 01	2.3039E 01	2.5518E 01	5.0525E-01	4.8841E-02
PU241	W	3.0602E-02	1.5003E-01	5.1008E-01	1.0886E 00	1.4327E-02	2.7041E-02	9.3786E-04
PU242	W	6.8565E-01	3.1145E 00	1.2049E 01	2.1329E 01	2.4556E 01	7.6098E-01	4.6023E-02
PU238	Y	4.2589E-02	1.9231E-01	7.4108E-01	1.3126E 00	1.4198E 02	2.9746E-02	3.8292E-02
PU239	Y	3.9313E-02	1.7541E-01	6.8957E-01	1.2347E 00	1.3234E 02	4.4258E-02	3.6214E-02
PU240	Y	3.7194E-02	1.7791E-01	6.9157E-01	1.2715E 00	1.3233E 02	2.9057E-02	3.6214E-02
PU241	Y	1.6843E-03	8.2599E-03	2.8094E-02	5.9935E-02	4.4217E-01	1.4873E-03	6.9497E-04
PU242	Y	3.3547E-02	1.6866E-01	6.6504E-01	1.1737E 00	1.2734E 02	2.4137E-01	3.4125E-02
PU238	Y	4.5875E-02	2.0702E-01	7.9874E-01	1.4161E 00	7.1092E 01	3.2098E-02	5.2470E-02
PU239	Y	4.2556E-02	1.9092E-01	7.4388E-01	1.3507E 00	6.6261E 01	3.8765E-02	4.9614E-02
PU240	Y	4.1423E-02	1.9225E-01	7.4494E-01	1.3703E 00	6.6259E 01	3.0631E-02	4.9614E-02
PU241	Y	1.8194E-03	8.9205E-03	3.0332E-02	6.4729E-02	2.2140E-01	1.6072E-03	9.5327E-04
PU242	Y	3.8661E-02	1.8364E-01	7.1661E-01	1.2669E 00	6.3761E 01	1.4366E-01	4.6752E-02

ACRO -- A COMPUTER PROGRAM FOR CALCULATING ORGAN DOSE FROM ACUTE OR CHRONIC INHALATION AND INGESTION OF RADIONUCLIDE

DATE

ACRC SAMPLE RUN
PLUTONIUM INHALATION
.....TIME INTERVAL FOLLOWING THE START OF INTAKE = 1.5768E 09 (SEC),OR 18250. (DAYS) .....

ORGAN BURDEN (MICRO CI OR *3.7E+4 BQ.)

NUCLIDE	--- ORGAN --- TR.CLASS	T.BODY	KIDNEYS	LIVER	BONE	LUNGS	TESTES	GI-LLI
PU238	D	3.3826E-01	5.5462E-03	7.8278E-02	1.3096E-01	0.0	1.4355E-04	2.7426E-02
PU239	D	4.9369E-01	8.0947E-03	1.1424E-01	1.9113E-01	0.0	2.0980E-04	2.7426E-02
PU240	D	4.9182E-01	8.0639E-03	1.1381E-01	1.9041E-01	0.0	2.0871E-04	2.7426E-02
PU241	D	3.6394E-02	5.9673E-04	8.4223E-03	1.4090E-02	0.0	1.5444E-05	2.7426E-02
PU242	D	4.9435E-01	8.1054E-03	1.1439E-01	1.9138E-01	0.0	2.0980E-04	2.7426E-02
PU238	C	2.7070E-01	4.4385E-03	6.2642E-02	1.0480E-01	0.0	1.1488E-04	1.5746E-01
PU239	D	3.9508E-01	6.4779E-03	9.1425E-02	1.5296E-01	0.0	1.6789E-04	1.5746E-01
PU240	D	3.9358E-01	6.4532E-03	9.1077E-02	1.5237E-01	0.0	1.6702E-04	1.5746E-01
PU241	D	2.9125E-02	4.7754E-04	6.7400E-03	1.1276E-02	0.0	1.2359E-05	1.5746E-01
PU242	D	3.9561E-01	6.4864E-03	9.1545E-02	1.5316E-01	0.0	1.6790E-04	1.5746E-01
PU238	W	8.1733E-02	1.3410E-03	1.8957E-02	3.1660E-02	0.0	3.4662E-05	4.8186E-01
PU239	W	1.1925E-01	1.9567E-03	2.7659E-02	4.6193E-02	0.0	5.0644E-05	4.8217E-01
PU240	W	1.1880E-01	1.9492E-03	2.7554E-02	4.6017E-02	0.0	5.0381E-05	4.8216E-01
PU241	W	8.8094E-03	1.4454E-04	2.0434E-03	3.4124E-03	0.0	3.7359E-06	4.8006E-01
PU242	W	1.1941E-01	1.9592E-03	2.7696E-02	4.6254E-02	0.0	5.0645E-05	4.8217E-01
PU238	W	6.8182E-02	1.1184E-03	1.5799E-02	2.6405E-02	0.0	2.8923E-05	5.1626E-01
PU239	W	9.9493E-02	1.6320E-03	2.3055E-02	3.8531E-02	0.0	4.2264E-05	5.1642E-01
PU240	W	9.9116E-02	1.6258E-03	2.2967E-02	3.8384E-02	0.0	4.2044E-05	5.1642E-01
PU241	W	7.3436E-03	1.2046E-04	1.7018E-03	2.8440E-03	0.0	3.1151E-06	5.1534E-01
PU242	W	9.9626E-02	1.6341E-03	2.3085E-02	3.8582E-02	0.0	4.2264E-05	5.1642E-01
PU238	Y	5.5786E-02	9.3345E-04	1.3836E-02	2.1932E-02	5.1319E-03	2.3219E-05	5.2259E-01
PU239	Y	7.8716E-02	1.3163E-03	1.9481E-02	3.0932E-02	7.4978E-03	3.2828E-05	5.2557E-01
PU240	Y	7.8443E-02	1.3117E-03	1.9413E-02	3.0824E-02	7.4906E-03	3.2668E-05	5.2554E-01
PU241	Y	7.5493E-03	1.2691E-04	1.9031E-03	2.9784E-03	5.5213E-04	3.1284E-06	5.0667E-01
PU242	Y	7.8812E-02	1.3179E-03	1.9504E-02	3.0969E-02	7.5003E-03	3.2825E-05	5.2558E-01
PU238	Y	2.9750E-02	4.9718E-04	7.3482E-03	1.1685E-02	2.5684E-03	1.2397E-05	5.8174E-01
PU239	Y	4.2067E-02	7.0258E-04	1.0368E-02	1.6515E-02	3.7524E-03	1.7565E-05	5.8324E-01
PU240	Y	4.1920E-02	7.0013E-04	1.0332E-02	1.6457E-02	3.7489E-03	1.7479E-05	5.8322E-01
PU241	Y	3.9751E-03	6.6744E-05	9.9803E-04	1.5668E-03	2.7633E-04	1.6493E-06	5.7375E-01
PU242	Y	4.2116E-02	7.0343E-04	1.0380E-02	1.6535E-02	3.7537E-03	1.7563E-05	5.8324E-01

ACRO SAMPLE RUN
PLUTONIUM INHALATION
.....TIME INTERVAL FOLLOWING THE START OF INTAKE = 1.5768E 09 (SEC),OR 18250. (DAYS) .....

ORGAN DOSE EQUIVALENT(REM OR 1.E-2 SV)

NUCLIDE	--- ORGAN --- TR.CLASS	T.BODY	KIDNEYS	LIVER	BONE	LUNGS	TESTES	GI-LLI
PU238	C	3.4348E 02	1.4201E 03	4.5286E 03	9.9393E 03	1.2684E 00	2.6274E 02	2.8569E-03
PU239	D	3.8122E 02	1.5664E 03	4.9248E 03	1.1387E 04	1.1794E 00	2.9349E 02	2.7011E-03
PU240	D	3.8051E 02	1.5636E 03	4.9168E 03	1.1366E 04	1.1794E 00	2.9283E 02	2.7011E-03
PU241	D	6.1015E 00	2.8294E 01	8.5131E 01	2.0806E 02	2.9593E-04	5.7035E 00	5.1939E-05
PU242	D	3.6705E 02	1.5082E 03	4.7416E 03	1.0550E 04	1.1349E 00	2.8395E 02	2.5453E-03
PU238	D	2.7488E 02	1.1365E 03	3.6241E 03	7.9542E 03	6.3808E-01	2.1027E 02	1.6403E-02
PU239	D	3.0508E 02	1.2536E 03	3.9412E 03	9.1125E 03	5.9331E-01	2.3487E 02	1.5508E-02
PU240	D	3.0451E 02	1.2513E 03	3.9348E 03	9.0963E 03	5.9331E-01	2.3435E 02	1.5508E-02
PU241	D	4.8830E 00	2.2643E 01	6.8130E 01	1.6651E 02	1.4887E-04	4.5645E 00	2.9820E-04
PU242	D	2.9374E 02	1.2070E 03	3.7946E 03	8.4429E 03	5.7092E-01	2.2724E 02	1.4614E-02
PU238	W	8.2622E 01	3.4168E 02	1.0902E 03	2.3913E 03	6.9117E 01	6.3183E 01	5.0195E-02
PU239	W	9.1740E 01	3.7707E 02	1.1863E 03	2.7408E 03	6.4370E 01	7.0605E 01	4.7488E-02
PU240	W	9.1569E 01	3.7640E 02	1.1843E 03	2.7359E 03	6.4369E 01	7.0447E 01	4.7488E-02
PU241	W	1.4619E 00	6.7798E 00	2.0403E 01	4.9854E 01	3.6037E-02	1.3665E 00	9.0914E-04
PU242	W	8.8330E 01	3.6306E 02	1.1421E 03	2.5394E 03	6.1941E 01	6.8313E 01	4.4748E-02
PU238	W	6.9045E 01	2.8552E 02	9.1080E 02	1.9983E 03	3.4608E 01	5.2809E 01	5.3779E-02
PU239	W	7.6656E 01	3.1503E 02	9.9083E 02	2.2899E 03	3.2231E 01	5.9003E 01	5.0862E-02
PU240	W	7.6512E 01	3.1447E 02	9.8921E 02	2.2859E 03	3.2231E 01	5.8871E 01	5.0862E-02
PU241	W	1.2237E 00	5.6749E 00	1.7077E 01	4.1730E 01	1.8045E-02	1.1438E 00	9.7596E-04
PU242	W	7.3806E 01	3.0333E 02	9.5398E 02	2.1217E 03	3.1015E 01	5.7087E 01	4.7927E-02
PU238	Y	4.9479E 01	2.0604E 02	6.6693E 02	1.4396E 03	1.2071E 03	3.7569E 01	5.4438E-02
PU239	Y	5.4321E 01	2.2501E 02	7.1962E 02	1.6326E 03	1.2041E 03	4.1476E 01	5.1763E-02
PU240	Y	5.4226E 01	2.2464E 02	7.1850E 02	1.6298E 03	1.2038E 03	4.1387E 01	5.1760E-02
PU241	Y	9.0872E-01	4.2252E 00	1.2780E 01	3.1050E 01	2.8772E 00	8.4700E-01	9.5953E-04
PU242	Y	5.2299E 01	2.1665E 02	6.9283E 02	1.5125E 03	1.1587E 03	4.0147E 01	4.8778E-02
PU238	Y	2.6622E 01	1.1080E 02	3.5829E 02	7.7428E 02	6.0415E 02	2.0224E 01	6.0600E-02
PU239	Y	2.9249E 01	1.2109E 02	3.8680E 02	8.7867E 02	6.0264E 02	2.2346E 01	5.7443E-02
PU240	Y	2.9198E 01	1.2089E 02	3.8620E 02	8.7719E 02	6.0251E 02	2.2298E 01	5.7441E-02
PU241	Y	4.8781E-01	2.2677E 00	6.8566E 00	1.6666E 01	1.4401E 00	4.5477E-01	1.0866E-03
PU242	Y	2.8161E 01	1.1659E 02	3.7240E 02	8.1407E 02	5.7994E 02	2.1629E 01	5.4129E-02

PNCT843-80-11

```
.... A C R O  TERMINATED DUE TO END OF DATA.....
     COMPLETED ALL THE PROCESS              .....
```