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LOS ALAMOS SCIENTIFIC LABORATORY
of the
University of California
LOS ALAMOS, NEW MEXICO

Computer Reduction of Metabolic Data
Obtained from Scintillation Counters

RELEASED FOR ANNOUNCEMENT
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of the
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Computer Reduction of Metabolic Data
Obtained from Scintillation Counters

by
P. N. Dean

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ABSTRACT

This report describes in detail the RTW series of computer programs written to analyze metabolic data. The programs calculate elapsed time between radionuclide administration and time of measurement, correct all data for changes in counting efficiency relative to measurements made on standards at zero time and for physical decay, if desired, and express the observed counting information as effective or biological retention at time of measurement.

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CHAPTER 1

INTRODUCTION

Electronic computers provide efficient and accurate methods of data processing and analysis in the field of biomedical research.¹ The RTW series of computer codes were written to take metabolic data from radiobiological studies of uptake and retention, to apply the proper corrections to the data for counter instability, etc., and to put it in the proper form on IBM cards for further processing (curve fits, etc.). There are four programs: RTW-1, RTW-1A, RTW-2, and RTW-2A. The first two codes were written to analyze data taken with the Los Alamos Small Animal Counter (LASAC III),² and the second two were written for use with data taken with the Los Alamos Whole Body Counter (HUMCO II). The difference in the programs is primarily in data card format. The two A codes were written for dual-tracer experiments.

CHAPTER 2

RTW-1 PROGRAM

2.1 Mathematical Model

2.1.1 Retention

Four counting channels are provided for. Any channel or combination of channels can be selected for the computation. The program first averages the count rates when the subject is counted more than once and subtracts the background. It averages all cards with the same serial number. The program next computes both the effective and biological retention. The biological retention is computed by first correcting the data for counter fluctuation and physical decay of the radionuclide and then expressing it as a percentage of the initial count rate. This is accomplished by dividing the animal-to-standard ratio at any time t by the animal-to-standard ratio at time zero and multiplying by 100. The effective retention is merely the count rate at time t , summed for the selected channels and corrected for counter fluctuation. The latter is done by counting a standard each time the subject is counted. The count rate of the standard at time t is corrected for decay since time zero, and a ratio to the count rate of the standard at time zero is made. All counting data at time t are then corrected by this ratio.

2.1.2 Elapsed Time

Both the time of day and the day of the year (as month, day, and year) are punched on the data cards. From this, the program computes the day of the year in fractional days, accurate to the minute, correcting for leap years. This is done for both time zero and time t . The elapsed time is then computed taking into account whether time zero and time t are in the same year, in different years, or in intervening years, and accounting for leap years.

2.1.3 Weighting Factor

The weighting factors in the case of counting data are not the same for each data point (Y_i). This program computes a "statistical" weighting factor, the reciprocal of the variance of each Y_i . The count rate is computed as follows:

$$R = \frac{1}{j} \sum_{s=1}^j \frac{C_s}{t_{C_s}} - \frac{1}{k} \sum_{r=1}^k \frac{B_r}{t_{B_r}},$$

where R = net count rate in counts per second

C_s = total (gross) counts

B_r = total (gross) background counts

t_{C_s} = time for C counts

t_{B_r} = time for B counts

j = number of measurements of C_s

k = number of measurements of B_r

Since R is a linear combination of C_s and B_r , which are mutually independent events, we have

$$\sigma_R^2 = \frac{1}{j^2} \sum_{s=1}^j \frac{C_s}{t_{C_s}^2} + \frac{1}{k^2} \sum_{r=1}^k \frac{B_r}{t_{B_r}^2},$$

and

$$W_R = \frac{1}{\sigma_R^2},$$

where w_R = weighting factor.

2.2 Data Input

2.2.1 Card Format

The format of the data card is shown in Table 1. Although four counting channels are shown, the program will accept any one or all four. Two of the sub-class numbers are reserved for computer operation. The number 8 is re-

Table 1. LASAC III Data Card Format.

Column(s)	Information
1	Blank
2	Class — code indicating experimenter
3	Class — type of measurement
	0 whole body
	1 urine
	2 feces
	3 urine and feces
	4 tissue distribution
4-9	Serial number
10-11	Atomic number
12-13	Animal number
14-17	Time of count (24-hour clock time, e.g., 1500 is 3:00 p.m.)
18-21	Isotope identification — code
22-27	Time zero date — month, day, year
28-30	Weight of animal
31-33	Counting time in seconds
34	Route of administration — code
	1 IG, acute
	2 IG, chronic
	3 IP, acute
	4 IP, chronic
	5 IV, acute
	6 IV, chronic
35	Tissue identification
	0 entire animal
	1 carcass
	2 muscle
	3 bone
	4 gonads
	5 liver
	6 gastrointestinal tract
	7 pelt
	8 kidneys
	9 other
36-41	Date of count — month, day, year
42-48	Channel 1 counts
49	Blank
50-56	Channel 2 counts
57	Blank
58-64	Channel 3 counts
65	Blank
66-72	Channel 4 counts
73	Blank
74-80	Date of count — day, month, year [16APR64] (can be added for convenience during tape-to-card conversion)

quired for all standards, and the number 9 for backgrounds. A different serial number is given to each sample counted. If a sample is counted more than once consecutively and at the same time, the cards should all have the same serial number. The program will then average the count rates in each channel selected. The counting data for each animal are "tagged" with the animal number for future reference. Time zero date is the month, day, and year of the beginning of the experiment, in that order. Weight is the sample weight in grams. The day of count is the month, day, and year on which the sample is counted. Channels 1 through 4 are the gross counts in each channel.

The format of the CONTROL, LABEL CARD is shown in Table 2 and that of CONTROL CARD NO. 2 in Table 3. The CV = 1 option (Table 3) is usually used to separate blocks of output listings which are to be filed separately. The CV = 2 option (Table 3) is used to separate animal and excreta output listings for time zero.

Table 2. RTW-1 and RTW-2 CONTROL, LABEL CARD Format.

Column(s)	Information
1-6	Isotope name in alpha-numeric form, e.g., CS-137.
7-66	Sixty columns in which anything can be punched to identify the experimental data being analyzed.
67-72	Half-life of the isotope in days. The decimal is understood to be to the right of the fourth numeral or can be punched anywhere in these columns, e.g., 102464 is understood to be 1024.64 days.
73	The number of channels to be summed (1 to 4).
74-77	The numbers of the channels that are to be summed, e.g., 1234, 1000, 1400.

Table 3. RTW-1 and RTW-1A CONTROL CARD NO. 2 Format.

Column	Information
2	Control variable CV For CV = 0, the program will punch output cards for all data analyzed up to this time, and restart. CV = 1, the program will print the next block of data on a new page, regardless of whether or not the present page is full. CV = 2, the program will treat the next block of data as time zero data and print the output on a new page.

2.2.2 Card Order

- (1) CONTROL, LABEL CARD.
- (2) Beginning of data in the following order:
 - (a) Backgrounds are always entered first. There is no limit to the number of cards that can be entered. They will all be averaged together, if they have a 9 in column 3.
 - (b) Standard cards for time zero are entered next. All cards with an 8 in column 3 will be averaged, regardless of serial number.
 - (c) Sample cards for time zero are now entered. Again there is no limit to the number of cards per sample. All consecutive cards with the same serial number will be averaged. There is a limit of 25 samples or animals per experiment.
 - (d) A blank card to signify the end of time zero data.
 - (e) CONTROL CARD NO. 2 is optional at this point.

The above order is repeated for each successive day's data, beginning with CARD NO. 2. The current background is always used and can be changed at any time. The program can be re-started for data from another experiment by setting $CV = 0$ on CONTROL CARD NO. 2 and starting with CARD NO. 1. The data from an entire completed experiment do not have to be run at one time. The time zero data must, however, be entered each time. An example of card order for a typical computer run is shown in Table A-1 of the Appendix.

2.3 Output

2.3.1 Printed Listing

Table A-2 shows the output listing from the analysis of the data of Table A-1. The output from each day's counting is printed as a single block of data. The program will print as many blocks of output per page as possible without continuation to a new page. CONTROL CARD NO. 2, option $CV = 2$, is also illustrated. The output for the excreta (sub-class 1 or 2) is listed separately. The last line of a block of printing shows the average biological and effective retention values for that day.

2.3.2 Answer Cards

Table 4 shows the answer card format. The retention, elapsed time, and weighting factor are punched in floating points with the format 1PE12.5. The number 22345 would be punched as +2.2345OE+04. The notation E+04 means the decimal point should be moved four places to the right.

Table 4. ANSWER CARD Format.

Columns	Information
1-12*	Retention
13-24*	Elapsed time
25-36*	Weighting factor
39-44	Serial number
46-48	Animal number
49-54	Isotope name
78-80	EFF**

*Floating point form.

**EFF is punched on the card to indicate that the effective retention is punched in columns 1-12.

2.4 Program

The FORTRAN listing is shown in Table A-3. The program is written in FORTRAN II for use under the MONITOR System.

CHAPTER 3

RTW-1A PROGRAM

3.1 Mathematical Model

3.1.1 Retention

The RTW-1A program was written for use with dual-tracer experiments. The data are first converted to count rate, and the background is subtracted. The count rate in each channel is a linear combination of the count rates in that channel from each component. Therefore, one can write a set of n equations, where n is the number of channels, of the form

$$Y_i = \sum_j f_j E_{ij} ,$$

where Y_i is the count rate in channel i , f_j is the fraction of radionuclide j present in the sample, and E_{ij} is the count rate in channel i due to a known amount of the radionuclide j . The E_{ij} are obtained by counting the radionuclide j alone. For two isotopes, the equations are

$$Y_i = f_1 E_{i1} + f_2 E_{i2} .$$

This set of equations is then solved for f_1 and f_2 by least squares. This program computes only effective retention (the total count rates from each isotope), i.e.,

$$\sum_i f_1 E_{i1}$$

and

$$\sum_i f_2 E_{i2} .$$

These count rates are then corrected for changes in counter efficiency as described in Section 2.1.1.

3.1.2 Elapsed Time

The elapsed time calculation is described in Section 2.1.2.

3.1.3 Weighting Factor

The weighting factors for the count rate from each isotope are computed as described in Section 2.1.3, assuming only a single measurement of each sample.

3.2 Data Input

3.2.1 Card Format

The format of the data card is shown in Table 1 and is described in Section 2.2.1. The format of the CONTROL, LABEL CARD is shown in Table 5. The format of CONTROL CARD NO. 2 is shown in Table 3 and is described in Section 2.2.1.

Table 5. RTW-1A and RTW-2A CONTROL, LABEL CARD Format.

Column(s)	Information
1-6	Isotope No. 1 name in alpha-numeric form, e.g., CS-137.
7-12	Isotope No. 2 name in alpha-numeric form, e.g., CO-60.
13-60	Forty-eight columns in which anything can be punched to identify the experimental data being analyzed.
61-66	Half-life of Isotope No. 1 in days. The decimal is understood to be to the right of the fourth numeral or can be punched anywhere in these columns, e.g., 102464 is understood to be 1024.64 days.
67-72	Half-life of Isotope No. 2 punched as above.
73	The number of channels to be used (1 to 4).
74-77	The numbers of the channels that are to be used, e.g., 1234, 1230, 2300.

3.2.2 Card Order

The card order is the same as that for RTW-1 and is described in Section 2.2.2, with one exception: the data cards for the two standards should always be in the same order. The two standards are distinguished by their different atomic numbers, punched in columns 10 and 11. An example of card order for a typical computer run is shown in Table A-4.

3.3 Output

3.3.1 Printed Listing

Table A-5 shows the output listing from the analysis of the data in Table A-4. The labeling is self-explanatory.

3.3.2 Answer Cards

Table 4 shows the answer card format. The numbers are punched in the form described for RTW-1, Section 2.3.2. Two sets of cards are punched, one for each isotope.

3.4 Program

The FORTRAN listing is shown in Table A-6. The program is written in FORTRAN II for use under the MONITOR System.

CHAPTER 4

RTW-2 PROGRAM

4.1 Mathematical Model

4.1.1 Retention

Six counting channels are provided for. Any channel or combination of channels can be selected for the computation. The data are corrected, and the retention is computed as described for RTW-1 in Section 2.1.1. There is one additional correction of the data. This program is used with data taken with the large whole-body counter (HUMCO II) and, therefore, applies to large animals. With these animals, the natural radioactivity is large enough to be significant; therefore, the count rates of the animals are measured before administration of an isotope. The program then corrects later data for this "natural" background of the experimental animals.

4.1.2 Elapsed Time

The elapsed time calculation is described in Section 2.1.2.

4.1.3 Weighting Factor

The weighting factor is described in Section 2.1.3.

4.2 Data Input

4.2.1 Card Format

The format of the data card is shown in Table 6. There are six counting channels. The ancillary information punched onto the card is the same as described in Section 2.2.1. The format of the CONTROL, LABEL CARD is the same as for RTW-1 and is shown in Table 2. The date is entered on the DATE CARD in columns 24 through 29 in the order of month, day, and year. Thus MARCH 13, 1965, would be 031365. CONTROL CARD NO. 2 has the same options for CV that are defined in Table 3. However, the control variable is punched in column 29.

4.2.2 Card Order

- (1) CONTROL, LABEL CARD.
- (2) Beginning of background data on ex-

Column(s)	Information
1	Blank
2	Class — code indicating type of subject
	0 clinical 6 experimental people
	1 control subjects 9 calibrations
	5 large animals
3	Sub-class — code indicating specific subject
	1 dogs ("tagged" with radionuclide)
	2 monkeys ("tagged" with radionuclide)
	3 "cold" dogs (untagged)
	4 "cold" monkeys (untagged)
	5 standards
	6 feces
	7 urine
	8 standards
	9 background
4-9	Serial number
10-11	Animal number
12-13	Atomic number
14-17	Time of count (24-hour clock time)
18-23	Isotope identification — code
24-29	Time zero date — month, day, year
30-32	Sample weight in kilograms
33-35	Counting time in seconds
36-41	Channel 1 counts
42-47	Channel 2 counts
48-53	Channel 3 counts
54-59	Channel 4 counts
60-65	Channel 5 counts
66-71	Channel 6 counts

- (a) Backgrounds are always entered first. There is no limit to the number of cards that can be entered. They will all be averaged together, if they have a 9 in column 3.
- (b) Data cards from pre-experiment measurement of natural background of experimental animals.

(3) DATE CARD.

This card has the time zero date punched as described in Section 4.2.1. This card signals the end of animal background data and the beginning of time zero data.

(4) Beginning of time zero data, in the following order:

- (a) Backgrounds as above.
- (b) Standard cards for time zero. All cards with an 8 in column 3 will be averaged.
- (c) Animal data cards for time zero are now entered. There is no limit to the number of cards per animal. All consecutive cards with the same serial number will be averaged. There is a limit of 25 animals per experiment.

If data for additional days are to be entered, the date card with date of count is used. It is then followed by the data in the order 4a, 4b, and 4c above.

CONTROL CARD NO. 2 can be used as described in Table 3. For CV = 1 and CV = 2 options, the next card would be the DATE CARD followed by data in the order a, b, and c. For CV = 0 option, all accumulated data will be punched, and the program will restart with CARD NO. 1.

An example of card order for a typical computer run is shown in Table A-7.

4.3 Output

4.3.1 Printed Listing

Table A-8 shows the output listing from the analysis of the data in Table A-7. The labeling is self-explanatory. The method of block printing is described in Section 2.3.1.

4.3.2 Answer Cards

Table 4 shows the answer card format. The numbers are punched as described for RTW-1 in Section 2.3.2.

4.4 Program

The flow diagram for the computer program is shown in Figs. A-1 through A-5. The flow diagram is essentially the same for all four programs, with the exception that RTW-1 and RTW-1A do not have the routine to read in cold counts. The FORTRAN listing is shown in Table A-9. The program is written in FORTRAN II for use under the MONITOR System.

CHAPTER 5

RTW-2A PROGRAM

5.1 Mathematical Model.

5.1.1 Retention

The RTW-2A program was written for use with dual-tracer experiments. It is essentially the same as the RTW-1A program. The difference is in the card formats and card order. The technique of calculation is described in Section 3.1.1.

5.1.2 Elapsed Time

The elapsed time calculation is described in Section 2.1.2.

5.1.3 Weighting Factor

The weighting factor is described in Section 2.1.3.

5.2 Data Input

5.2.1 Card Format

The format of the data card is shown in Table 6 and is described in Section 4.2.1. The format of the CONTROL, LABEL CARD is shown in Table 5. The format of the DATE CARD is described in Section 4.2.1. CONTROL CARD NO. 2 has the same options for CV that are defined in Table 3; however, the control variable is punched in column 29.

5.2.2 Card Order

The card order is the same as for RTW-1 and is described in Section 4.2.2, with one exception: the data cards for the two standards should always be in the same order. The two standards are distinguished by their different atomic numbers, punched in columns 12 and 13. An example

of card order for a typical computer run is shown in Table A-10.

5.3 Output

5.3.1 Printed Listing

Table A-11 shows the output listing from the analysis of the data in Table A-10. The labeling is self-explanatory.

5.3.2 Answer Cards

Table 4 shows the answer card format. The numbers are punched in the form described for RTW-1, Section 2.3.2. Two sets of cards are punched, one for each isotope.

5.4 Program

The FORTRAN listing is shown in Table A-12. The program is written in FORTRAN II for use under the MONITOR System.

REFERENCES

1. C. R. Richmond, J. E. Furchner, P. N. Dean and P. McWilliams, Health Phys. 10, 3-13 (1964).
2. R. L. Schuch, Los Alamos Scientific Laboratory Report LAMS-2455 (1960), p. 105.

APPENDIX

Table A-1. Example of Card Order for Operation of RTW-1 Program.

```
CO 60          IV MICE BORN APRIL 22 1964          1923553123
19011693270013200020080364000100500803640006307 0001515 0000754 0000818 03AUG64
19011767270013500020080364000100500803640006083 0001485 0000763 0000841 03AUG64
180116942700132200200803640001005008036400443784 0440594 0226309 0098456 03AUG64
180117062700134800200803640001005008036400443249 0436508 0230153 0100831 03AUG64
10011709270113460020080364026100500803640383262 0369537 0197518 0083632 03AUG64
10011695270113750020080364024100500803640370163 0359284 0184262 0078877 03AUG64
10011696270113270020080364027100500803640385578 0366815 0197327 0082888 03AUG64
10011697270413240020080364024100500803640369446 0393131 0206710 0086491 03AUG64
100116982705133000200803640231005008036403971 0391705 0200925 0083475 03AUG64
10011699270613420020080364026100500803640332107 0318432 0169661 0072209 03AUG64
10011700270713340020080364026100500803640387276 0371421 0194317 0081304 03AUG64
10011701270813360020080364024100500803640404207 0301411 0202296 0085375 03AUG64
10011702270913380020080364028100500803640365141 0352385 0176736 0074429 03AUG64
10011703271013400020080364024100500803640420653 0406102 0212914 0089328 03AUG64
10011704271113420020080364025100500803640387248 0372605 0195950 0082642 03AUG64
10011705271213440020080364026100500803640381838 0369122 0192610 0081151 03AUG64

2
11 1170627131346002008036400010000080364 476295 476295 03AUG64
12 1170727141348002008036400010000080364 476295 476295 03AUG64

1
19011753270013200020080364000100500803640006297 0001600 0000743 0000786 03AUG64
19011779270013360020080364000100500803640006345 0001551 0000801 0000822 03AUG64
180117562700124000200803640001005008036400449053 0447599 0214058 0092054 03AUG64
180117782700133400200803640001005008036400443374 0434880 0236558 0101136 03AUG64
10011757270112420020080364027100500803640166673 0151768 0086611 0052898 03AUG64
10011758270212440020080364024100500803640120170 0109043 0060739 0024318 03AUG64
10011759270312460020080364025100500803640126174 0116168 0064515 0025627 03AUG64
10011760270412480020080364023100500803640134026 0122240 0067416 0027011 03AUG64
10011761270512500020080364023100500803640139450 0121534 0067735 0026983 03AUG64
100117627061250020080364026100500803640148897 0139923 0074577 0029477 03AUG64
10011763270712560020080364026100500803640148897 0139923 0074577 0029477 03AUG64
10011764270812580020080364024100500803640137730 0125699 0069280 0027440 03AUG64
10011765270913010020080364027100500803640127041 0115209 0064214 0028229 03AUG64
10011766271013010020080364024100500803640141436 0128516 0070740 0028293 03AUG64
10011767271113030020080364025100500803640138865 0127523 0068408 0027150 03AUG64
10011768271213050020080364025100500803640136010 0125197 0066969 0026887 03AUG64

1
11011769271313120020080364000100500803640471914 0512276 0236594 0102391 03AUG64
11011770271313160020080364000100500803640455159 0477498 0245583 0104531 03AUG64
11011771271313180020080364000100500803640473684 0469789 0077708 0030126 03AUG64
11011772271313220020080364000100500803640234514 0246648 0108980 0045425 03AUG64
11011773271313230020080364000100500803640372747 0386088 0200765 0084692 03AUG64
11011774271313250020080364000100500803640333877 0361582 0159253 0069822 03AUG64
11011775271313270020080364000100500803640276916 0290323 0143030 0060016 03AUG64
12011776271413310020080364000100500803640265476 0256266 0152784 0061639 03AUG64
12011777271413320020080364000100500803640201350 0149358 0106916 0043243 03AUG64

1
19013037270008460020080364000100501006640005882 0001299 0000691 0000827 06OCT64
19013054270009340020080364000100501006640006850 0001383 0000818 0000828 06OCT64
18013038270008490020080364000100501006640026136 0405975 0242444 0105062 06OCT64
18013053270009320020080364000100501006640422479 0400859 0253508 0108970 06OCT64
10013039270108510020080364030100501006640013032 0007788 0004737 0002316 06OCT64
10013040270208590020080364027100501006640011759 0006638 0004107 0002078 06OCT64
1001304127030900020080364030100501006640011702 0006508 0003992 0002087 06OCT64
10013042270409020020080364027100501006640011702 0006732 0004114 0002154 06OCT64
10013043270509040020080364027100501006640011626 0006747 0004089 0002122 06OCT64
10013044270609060020080364030100501006640010860 0005897 0003568 0001942 06OCT64
```

Table A-2. Output Listing from Analysis of Data of Table A-1.

IV MICE BORN APRIL 22 1964

DAY OF COUNT 8/3/64

INITIAL DATE 8/3/64

ISOTOPE	HALF-LIFE	COUNT	CORR.	RATIO TO	ROUTE	TISSUE	ATOMIC	CHANNELS
CO-60	(DAYS)	RATE	RATE	INI. DAY	OF ADM.	TYPE	NUMBER	SUMMED
	1923.55	11028.45	11028.45	1.0000	5	0	27	123
SERIAL	ANIMAL	WEIGHT	TIME OF	ELAPSED	PERCENT	CORRECTED	TOTAL COUNT	
CL NUMBER	NUMBER	(GM)	COUNT	TIME (Days)	BIOL. RET.	RATE (CPS)	TIME (SEC)	
10	11709	1	26	1346	0.	100.00	9418.63	100
10	11695	2	24	1325	0.	100.00	9052.55	100
10	11696	3	27	1327	0.	100.00	9442.66	100
10	11697	4	24	1329	0.	100.00	10008.53	100
10	11698	5	23	1330	0.	100.00	9881.47	100
10	11699	6	26	1332	0.	100.00	8117.46	100
10	11700	7	26	1334	0.	100.00	9445.60	100
10	11701	8	24	1336	0.	100.00	9894.62	100
10	11702	9	28	1338	0.	100.00	8878.08	100
10	11703	10	24	1340	0.	100.00	10332.15	100
10	11704	11	25	1342	0.	100.00	9473.49	100
10	11705	12	26	1344	0.	100.00	9351.16	100
0	0	0	0	0	0.	100.00	9441.37	0

IV MICE BORN APRIL 22 1964

DAY OF COUNT 8/3/64

INITIAL DATE 8/3/64

ISOTOPE	HALF-LIFE	COUNT	CORR.	RATIO TO	ROUTE	TISSUE	ATOMIC	CHANNELS
CO-60	(DAYS)	RATE	RATE	INI. DAY	OF ADM.	TYPE	NUMBER	SUMMED
	1923.55	11028.45	11028.45	1.0000	0	0	27	123
SERIAL	ANIMAL	WEIGHT	TIME OF	ELAPSED	PERCENT	CORRECTED	TOTAL COUNT	
CL NUMBER	NUMBER	(GM)	COUNT	TIME (Days)	BIOL. RET.	RATE (CPS)	TIME (SEC)	
11	11706	13	0	1346	0.	100.00	9441.36	100
12	11707	14	0	1348	0.	100.00	9441.36	100
0	0	0	0	0	0.	100.00	9441.36	0

IV MICE BORN APRIL 22 1964

DAY OF COUNT 8/4/64

INITIAL DATE 8/3/64

ISOTOPE	HALF-LIFE	COUNT	CORR.	RATIO TO	ROUTE	TISSUE	ATOMIC	CHANNELS
CO-60	(DAYS)	RATE	RATE	INI. DAY	OF ADM.	TYPE	NUMBER	SUMMED
	1923.55	11041.37	11045.32	0.9985	5	0	27	123
SERIAL	ANIMAL	WEIGHT	TIME OF	ELAPSED	PERCENT	CORRECTED	TOTAL COUNT	
CL NUMBER	NUMBER	(GM)	COUNT	TIME (Days)	BIOL. RET.	RATE (CPS)	TIME (SEC)	
10	11757	1	27	1242	1.0	41.66	3928.28	100
10	11758	2	24	1244	1.0	30.99	2808.99	100
10	11759	3	25	1246	1.0	31.71	2997.75	100
10	11760	4	23	1248	1.0	31.39	3145.77	100
10	11761	5	23	1250	1.0	31.70	3136.16	100
10	11762	6	25	1251	1.0	35.15	2856.96	100
10	11763	7	26	1256	1.0	37.04	3502.38	100
10	11764	8	24	1258	1.0	32.67	3235.91	100
10	11765	9	27	1301	1.0	33.35	2964.09	100
10	11766	10	24	1301	1.0	32.05	3315.61	100
10	11767	11	25	1303	1.0	34.34	3256.74	100
10	11768	12	25	1305	1.0	34.08	3190.45	100
0	0	0	0	0	0.	33.84	3194.92	0

Table A-2. (Continued).

IV MICE BORN APRIL 22 1964

DAY OF COUNT 10/6/64

INITIAL DATE 8/3/64

ISOTOPE	HALF-LIFE	COUNT	CORR.	RATIO TO	ROUTE	TISSUE	ATOMIC	CHANNELS
CO-60	(DAYS)	RATE	RATE	INI. DAY	OF ADM.	TYPE	NUMBER	SUMMED
	1923.55	10695.89	10944.73	1.0076	5	0	27	123
SERIAL	ANIMAL	WEIGHT	TIME OF	ELAPSED	PERCENT	CORRECTED	TOTAL COUNT	
CL	NUMBER	NUMBER	(GM)	COUNT	TIME (Days)	BIOL. RET.	RATE (CPS)	TIME (SEC)
10	13039	1	30	851	63.8	1.93	176.29	100
10	13040	2	27	859	63.8	1.66	145.53	100
10	13041	3	30	900	63.8	1.56	142.49	100
10	13042	4	27	902	63.8	1.50	145.97	100
10	13043	5	27	904	63.8	1.51	145.11	100
10	13044	6	30	906	63.8	1.57	123.57	100
10	13045	7	29	908	63.8	1.75	160.35	100
10	13046	8	28	910	63.8	1.44	138.41	100
10	13047	9	31	911	63.8	1.65	141.90	100
10	13048	10	27	913	63.8	1.65	165.72	100
10	13049	11	28	915	63.8	1.67	153.11	100
10	13050	12	28	917	63.8	1.56	141.10	100
0	0	0	0	0	0.	1.62	148.30	0

IV MICE BORN APRIL 22 1964

DAY OF COUNT 10/6/64

INITIAL DATE 8/3/64

ISOTOPE	HALF-LIFE	COUNT	CORR.	RATIO TO	ROUTE	TISSUE	ATOMIC	CHANNELS
CO-60	(DAYS)	RATE	RATE	INI. DAY	OF ADM.	TYPE	NUMBER	SUMMED
	1923.55	10695.89	10944.73	1.0076	5	0	27	123
SERIAL	ANIMAL	WEIGHT	TIME OF	ELAPSED	PERCENT	CORRECTED	TOTAL COUNT	
CL	NUMBER	NUMBER	(GM)	COUNT	TIME (Days)	BIOL. RET.	RATE (CPS)	TIME (SEC)
11	13051	13	0	919	63.8	0.37	34.32	200
12	13052	14	0	922	63.8	0.30	27.77	200
0	0	0	0	0	0.	0.34	31.04	0

Table A-3. FORTRAN Listing of RTW-1 Program.

```

RTW1
10/07/64
1 IP=0
  ISN=0
  ISC=0
  I=1
  READ INPUT TAPE 10,100,ALAB,(CLAB(1),I=1,10),HL1,NC,(NC(1),I=1,NC
  X)
2 ISC=ISC+1
  IP=IP+1
  ISN=ISN+1
3 READ INPUT TAPE 10, 101,ICL1, ICL2, ISER, IAN, ID, BM, BM, LMD, LD
  XAY, LYR, IWT, CT, IR, IT, IMO, IDAY, IYR, (CH(M), M=1,4)
  IF(CT) 31,31,10
10 IF(ICL2-B) 20,15,11
11 L=1
  DO 12 I=1,NC
    IJ=NC(I)
12 HKG(I)=HKG(I)+CH(IJ)/CT
    CTB=CT
    GO TO 3
15 K=K+1
  DO 16 I=1,NC
    IJ=NC(I)
16 STD(I)=CH(IJ)/CT+STD(I)
  LAN=IAN
  EM=BM
  MM=LMD
  MYR=LYR
  MDAY=LDAY
  GO TO 3
20 IF(L) 23,23,21
21 A=L
  SM=0.
  DO 22 I=1,NC
    BKGA(I)=BKG(I)/A
    SB=SB+BKG(I)/CTB
22 BKG(I)=0.
    SB=SB/A**2
    L=0
23 IF (K) 26,26,24

```

Table A-3. (Continued).

```

24 B=K
   DD 25 I=1,NC
25 STD1(I)=STD(I)/B
   DU 35 I=1,NC
   STD(I)=0.
35 STD1(I)=STD1(I)-BKGA(I)
   K=0
   JCK=0
26 IF (ICK) 30,27,30
27 ICK=ISER
28 J=J+1
   DD 29 I=1, NC
   IJ=NC(I+1)
29 SUB (I)=SUB (I)+CH(IJ)/CT
   SCT=SCT+CT
   CTS=CT
   ICL(I,ISN)=ICL2+ICL1+10
   INSR (ISN)= ICK
   IID(I,ISN)=ID
   ITC(I,ISN)=BM+100. +BM
   ICT (ISN)=CT
   IPID(IP)=ID
   IPSE(I,IP)=ICK
   JMT(I,ISN)=IWT
   JMO =IMO
   JDAY=IDAY
   JYR=IYR
   IIR=IR
   DM(ISN)=BM
   ITT=IT
   DM(ISN)=BM
   IND(ISN)=ID
   GU TU 3
30 IF (ICK=ISER) 31,78,31
31 C=J
   IX=IND(ISN)
   SS(ISN)=0.
   DD 32 I=1,NC
   SUBA(I,IX,I)=SUB(I)/C-BKGA(I)
   SS(I,ISN)=SS(I,ISN)+SUB(I)/C+2/CTS
32 SUB(I)=0.
   ICT (ISN)=SCT
   SCT=0.
   J=0
   ICK=0
   IF (ICT) 34,34,33
33 ICK=ISCR
   ISN=ISN+1
   IP=IP + 1
   GU TO 28
34 ISN=ISN+1
   DM(ISN)=EM
   DM(ISN)=EM
   INH(I,ISN)=99
   A=JDAY
   GO TO (38,39,40,41,42,43,44,45,46,47,48,49),JMO
38 T=A
   GU TO 50
39 T=A+31.
   GO TO 50
40 T=A+59.
   GU TO 50
41 T=A+90.
   GO TO 50
42 T=A+120.
   GO TO 50
43 T=A+151.
   GU TO 50
44 T=A + 181.
   GO TO 50
45 T=A + 212.
   GO TO 50
46 T= A + 243.
   GO TO 50
47 T= A + 273.
   GO TO 50
48 T= A + 304.
   GU TO 50
49 T= A + 334.
50 MDA=T
   IF (ISC=1) 51,51,54
51 DU 52 I=1,NC
52 EOL(I)=STD1(I)
53 INDSO=MDA
   DO 530 I=1,ISN
   IX=IND(I)
   AFD(I)=(DM(I)+DM(I)/60.)/24.
   GET(I)= 0.
   ALTI(I)= 0.
530 FET(I)= 0.
   FET(I)=0.
   DD 533 M=1,NC
   TEOL=TEOL + STD1(M)
   FET(99)=0.
   DO 532 I=1,ISN
   IX=IND(I)
   SUMO(I,IX)=0.
   DD 531 M=1,NC
   SUBO(I,IX)=SUBO(I,IX)+SUBA(I,IX,M)
531 SUBO(I,IX)=SUBO(I,IX)/TEOL
532 KOT(I,IX)=SUBO(I,IX)/TEOL
   GU TO 69
54 MDB=MDA
   INDS1=INDSO
   DO 68 I=1,ISN
   IX = IND(I)
   NY = 60
   DD 55 M=1,4
   IF (JYR-NY) 59,56,55
55 NY = NY + 4
   WRITE OUTPUT TAPE 9,180
   CALL EXIT
56 IF (MDA=60) 59,57,57
57 MDD = MDA +1
58 NY = 60
   LPR = 0
   DO 60 M = 1,4
   IF (MYR-NY) 58,61,60
60 NY = NY + 4
   WRITE OUTPUT TAPE 9,180
   CALL EXIT
61 LPR = 1
   IF (INDSO=60) 58,610,610
610 INDS1=INDSO+1
58 IF (JYR-MYR) 580,580,581
580 IET(IX)=MDB-INDS1
   GO TO 67
581 IF(LPR) 582,582,583
582 KDAY=365-INDS1
   GO TO 584
583 KDAY=366-INDS1
584 IER = JYR-MYR-1
   IET(IX) = KDAY+MDB+IER+365
   IF(IEK) 67,67,63
63 DO 65 M=1,IER
   NY = 60
   DO 64 N=1,4
   IF (MYR+M-NY) 65,66,64
64 NY = NY + 4
65 CONTINUE
   GO TO 67
66 IET(IX) = IET(IX) + 1
67 HFD = (DH(I) + DM(I)/60.)/24.
   FET(IX) = IET(IX)
   FET(IX) = FET(IX) + HFD - AFD(IX)
68 CONTINUE
   KL=0
   DU 680 I=IN,IP
   KL=KL+1
680 AET(I)=GET(KL)
69 TEL=0.
   E1=0.
   DU 70 I=1,NC
   EE1(I) = STD1(I)*EXP(0.69315/HL1+GET(99))
   TEL=TEL+EE1(I)
70 E1=E1+STD1(I)
   Y1=TEOL/TEL
71 ISN=ISN-1
   DU 73 I=1,ISN
   IX=IND(I)
   SA1(I,IX)=0.
   DO 72 M=1,NC
72 SA1(I,IX)=SA1(I,IX)+SUBA(I,IX,M)
   SA1(I,IX)=SA1(I,IX)+Y1
   WF(I)=1./SS(I)+SB1
   PHR(I)=SA1(I,IX)/E1/RO(IX)*100.
73 SS1(I)=SA1(I,IX)
   M=0
   DU 750 I=IN,IP
   M=M+1
   RV(I)=WF(M)
   PSS1(I)=SS1(M)
   PSS2(I)=PBR(M)
750 PRINT ROUTINE FOLLOWS
   SI AVG=0.
   S2AVG=0.
   DO 76 I=1,ISN
   SI AVG=SI AVG+SS1(I)
76 S2AVG=S2AVG+PBR(I)
   AISN=ISN
   ISN=ISN+1
   SS1(I,ISN)= SI AVG/AISN
   PBR(I,ISN)=S2AVG/AISN
   INSR (ISN)=0
   ICL (ISN)=0
   IID (ISN)=0
   JMT (ISN)=0
   ITC (ISN)=0
   GET (ISN)=0.
   ICT (ISN)=0
   IZMI=ISN+2+8
   LL=61-LU-L2BU
   IF (IIRR) 77,77,80
77 IIRR=1
78 WRITE OUTPUT TAPE 9,111
   LU=0
   GO TO 81
80 IF (LL) 78,81,81
81 WRITE OUTPUT TAPE 9,103,(CLAB(I),I=1,10)
   WRITE OUTPUT TAPE 9,104,JMO,JDAY,JYR,MMD,JYR
   WRITE OUTPUT TAPE 9,105,ALAB,HL1,E1,TEL,Y1,IIR,ITT,LAN,INC(I),I=1
   X,NC)
   WRITE OUTPUT TAPE 9, 106
   DU 82 I=1,ISN
82 WRITE OUTPUT TAPE 9,106,ICL(I),INSR(I),IID(I),JMT(I),ITC(I),GET(I)
   X),PBR(I),SS1(I),ICT(I)
   LU=LU+ISN+2+10
   IN=IP+1
   ISN=0
83 READ INPUT TAPE 10, 101, ICL1,ICL2,ISER, JAN, ID, BM,BM, LMO,
   ALDAY,LYR,(MY,CT,IR,IT,IMO,IDAY,IYR,ICH(M),M=1,4)
   IF (CT) 85,85,84
84 ISN=1
   IP=IP+1
   ISC=ISC+1
   GO TO 10
85 IF (ICL1=1) 851,850,852
852 ISC=0
850 IIRR=0
   GO TO 83
851 DO 86 I=1,IP
86 WRITE OUTPUT TAPE 9,110,PSS1(I),AET(I),RV(I),IPSE(I),IPID(I),ALAB
   DO 87 I=1, IP
87 J=0
   K=0
   L=0
   IIRR=0
   ISN=0
   IP=0
   IN=1
   GO TO 1
   END(1,1,0,0,0,1,1,0,0,1,0,0,0,0,0)

```

Table A-4. Example of Card Order for Operation of RTW-1A Program.

```

CS 137NA 22      (LEAN) MICE IP 11/02/64      10950.941.7041234
19013591000011085200110264000100311102640005940 0001435 0000820 0000849 02N0V64
19013600000011365200110264000100311102640006065 0001372 0000772 0000862 02N0V64
18013592550011105200110264000100311102640361538 0017263 0000838 0000861 02N0V64
1801360255001115200110264000100311102640360475 0018537 0000822 0000865 02N0V64
18013593110011125200110264000100311102640273484 0099168 0064897 0012247 02N0V64
18013603110011135200110264000100311102640274099 0098968 0064661 0012535 02N0V64
10013594000111155200110264016100311102640647703 0128998 0072381 0014299 02N0V64
10013595000211175200110264016100311102640602230 0118476 0066849 0013258 02N0V64
10013596000311195200110264020100311102640660818 0136354 0078633 0015919 02N0V64
10013597000411215200110264014100311102640592943 0116811 0064812 0013329 02N0V64
10013598000511235200110264016100311102640562082 0101509 0054702 0011259 02N0V64
10013599000611255200110264017100311102640587432 0113299 0062178 0013012 02N0V64
10013600000711275200110264020100311102640574016 0120727 0068434 0014307 02N0V64

2
11 13644 1011365200110264000100311102640005940 0001435 0000820 0000849 02N0V64
11 13644 1011365200110264000100311102640006065 0001372 0000772 0000862 02N0V64
12013645 1111365200110264000100311102640006065 0001372 0000772 0000862 02N0V64
12013645 1111365200110264000100311102640005940 0001435 0000820 0000849 02N0V64

1
19013634000011015200110264000100311103640005947 0001434 0000793 0000866 03N0V64
1901364000001105200110264000100311103640005826 0001410 0000782 0000887 03N0V64
18013635550011065200110264000100311103640359021 0019844 0000876 0000888 03N0V64
18013644550011045200110264000100311103640359887 0020292 0000842 0000835 03N0V64
18013636110011085200110264000100311103640272874 0099390 0065427 0012422 03N0V64
18013645110011065200110264000100311103640272447 0098006 0065766 0013191 03N0V64
10013637000111125200110264020100311103640407612 0083951 0046610 0009837 03N0V64
100136380002111305200110264016100311103640336674 0068246 0038042 0008258 03N0V64
10013639000311155200110264020100311103640399831 0084311 0047452 0009481 03N0V64
10013640000411175200110264014100311103640253134 0058524 0034033 0006569 03N0V64
10013641000511205200110264016100311103640349045 0065246 0034324 0007584 03N0V64
10013642000611215200110264017100311103640370317 0072658 0040289 0008508 03N0V64
10013643000711235200110264020100311103640338450 0070029 0039368 0008501 03N0V64

1
1901399400000105200110264000100311116640005827 0001328 0000658 0000811 16N0V64
1901400500000935200110264000100311116640005826 0001328 0000794 0000853 16N0V64
18013991550009055200110264000100311116640368057 0015429 0000798 0000850 16N0V64
18014003550009295200110264000100311116640366533 0016857 0000733 0000834 16N0V64
18013992110009075200110264000100311116640277975 0094700 0061650 0011166 16N0V64
18014004110009315200110264000100311116640278276 0094997 0061016 0011171 16N0V64
10013993000109095200110264020100311116640099750 0003510 0001173 0000834 16N0V64
10013994000209115200110264018100311116640024702 0002542 0001010 0000840 16N0V64
10013995000309115200110264020100311116640032445 0003181 0001198 0000951 16N0V64
10013996000409155200110264016100311116640017735 0002269 0001058 0000886 16N0V64
10013997000509175200110264018100311116640038857 0003500 0001092 0000902 16N0V64
10013998000609205200110264020100311116640029029 0002873 0001166 0000853 16N0V64
1001399900070925200110264021100311116640029326 0002927 0001064 0000877 16N0V64

1
11014001001009265200110264000100311116640095106 0007535 0002877 0001105 16N0V64
12014002001109275200110264000100311116640017580 0002493 0001207 0000894 16N0V64

```

Table A-5. Output Listing from Analysis of Data of Table A-4.

(LEAN) MICE IP 11/02/64

DAY OF COUNT 11/2/64			INITIAL DATE 11/2/64					
ISOTOPE	HALF-LIFE (DAYS)	COUNT RATE	CORR. RATE	RATIO TO INI. DAY	ROUTE OF ADM.	TISSUE TYPE	ATOMIC NUMBER	CHANNELS SUMMED
CS-137	10950.00	3715.42	3715.42	1.0000	3	1	11	1234
NA-22	941.70	4409.72	4409.72	1.0000				

		CS-137		NA-22				
SERIAL	ANIMAL	WEIGHT	TIME OF	ELAPSED	CORRECTED	CORRECTED	COUNT	
CL	NUMBER	NUMBER	(GMS)	COUNT	TIME (Days)	RATE (CPS)	RATE (CPS)	TIME (SEC)
10	13594	1	16	1115	0.	3529.3	5014.6	100
10	13595	2	16	1117	0.	3306.9	4615.5	100
10	13596	3	20	1119	0.	3382.6	5461.4	100
10	13597	4	14	1121	0.	3277.5	4509.1	100
10	13598	5	10	1123	0.	3406.4	3798.1	100
10	13599	6	17	1125	0.	3329.6	4336.5	100
10	13600	7	20	1127	0.	2920.4	4759.3	100
0	0	0	0	0	0.	3307.5	4642.1	0

Table A-5. (Continued).
(LEAN) MICE IP 11/02/64

DAY OF COUNT 11/2/64					INITIAL DATE 11/2/64			
ISOTOPE	HALF-LIFE (DAYS)	COUNT RATE	CORR. RATE	RATIO TO INI. DAY	ROUTE OF ADM.	TISSUE TYPE	ATOMIC NUMBER	CHANNELS SUMMED
CS-137	10950.00	3715.42	3715.42	1.0000	3	1	11	1234
NA-22	941.70	4409.72	4409.72	1.0000				
		CS-137		NA-22				
SERIAL	ANIMAL	WEIGHT	TIME OF	ELAPSED	CORRECTED	CORRECTED	COUNT	
CL NUMBER	NUMBER	(GMS)	COUNT	TIME (Days)	RATE (CPS)	RATE (CPS)	TIME (SEC)	
11 13644	10	0	1134	0.	0.	0.	200	
12 13645	11	0	1136	0.	0.	0.	200	
0 0	0	0	0	0.	0.	0.	0	

(LEAN) MICE IP 11/02/64

DAY OF COUNT 11/3/64					INITIAL DATE 11/2/64			
ISOTOPE	HALF-LIFE (DAYS)	COUNT RATE	CORR. RATE	RATIO TO INI. DAY	ROUTE OF ADM.	TISSUE TYPE	ATOMIC NUMBER	CHANNELS SUMMED
CS-137	10950.00	3722.70	3722.94	0.9980	3	1	11	1234
NA-22	941.70	4413.89	4417.15	0.9983				
		CS-137		NA-22				
SERIAL	ANIMAL	WEIGHT	TIME OF	ELAPSED	CORRECTED	CORRECTED	COUNT	
CL NUMBER	NUMBER	(GMS)	COUNT	TIME (Days)	RATE (CPS)	RATE (CPS)	TIME (SEC)	
10 13637	1	20	1112	1.0	2193.1	3188.8	100	
10 13638	2	16	1130	1.0	1836.8	2576.9	100	
10 13639	3	20	1115	1.0	2080.7	3236.8	100	
10 13640	4	14	1117	1.0	1138.0	2295.5	100	
10 13641	5	16	1120	1.0	2104.2	2361.2	100	
10 13642	6	17	1121	1.0	2078.3	2753.1	100	
10 13643	7	20	1132	1.0	1798.5	2666.4	100	
0 0	0	0	0	1.0	1890.0	2725.5	0	

(LEAN) MICE IP 11/02/64

DAY OF COUNT 11/16/64					INITIAL DATE 11/2/64			
ISOTOPE	HALF-LIFE (DAYS)	COUNT RATE	CORR. RATE	RATIO TO INI. DAY	ROUTE OF ADM.	TISSUE TYPE	ATOMIC NUMBER	CHANNELS SUMMED
CS-137	10950.00	3763.36	3766.68	0.9864	3	1	11	1234
NA-22	941.70	4367.63	4412.60	0.9993				
		CS-137		NA-22				
SERIAL	ANIMAL	WEIGHT	TIME OF	ELAPSED	CORRECTED	CORRECTED	COUNT	
CL NUMBER	NUMBER	(GMS)	COUNT	TIME (Days)	RATE (CPS)	RATE (CPS)	TIME (SEC)	
10 13993	1	20	909	13.9	324.1	38.0	100	
10 13994	2	18	911	13.9	179.7	22.1	100	
10 13995	3	20	913	13.9	248.9	38.2	100	
10 13996	4	16	915	13.9	107.0	23.9	100	
10 13997	5	18	917	13.9	319.8	30.4	100	
10 13998	6	20	920	13.9	218.3	31.2	100	
10 13999	7	21	922	13.9	222.0	30.2	100	
0 0	0	0	0	13.9	231.4	30.6	0	

Table A-5. (Continued).

(LEAN) MICE IP 11/02/64

DAY OF COUNT 11/16/64			INITIAL DATE 11/2/64					
ISOTOPE	HALF-LIFE (DAYS)	COUNT RATE	CORR. RATE	RATIO TO INI. DAY	ROUTE OF ADM.	TISSUE TYPE	ATOMIC NUMBER	CHANNELS SUMMED
CS-137	10950.00	3763.36	3766.68	0.9864	3	1	11	1234
NA-22	941.70	4367.63	4412.60	0.9993				

		CS-137		NA-22				
SERIAL	ANIMAL	WEIGHT	TIME OF	ELAPSED	CORRECTED	CORRECTED	COUNT	
CL	NUMBER	NUMBER	(GMS)	COUNT	TIME (Days)	RATE (CPS)	RATE (CPS)	TIME (SEC)
11	14001	10	0	926	13.9	826.2	141.5	100
12	14002	11	0	927	13.9	98.0	35.5	100
0	0	0	0	0	13.9	462.1	88.5	0

Table A-0. FORTRAN Listing of RTW-1A Program.

```

RTW1-A
C
C RTW1-A
C OPERATES ON DATA FROM LASAC 3
C MULTIPLE ISOTOPE VERSION OF RETENTION PROGRAMS
C THIS VERSION IS FOR 2 ISOTOPES
C
DIMENSION BKG(4), CH(4), SUB(4), STD(4), NCI(4), STL(4),
XSTD(4), BKG(4), SUB(25,99,4), INDI(99), ICL(25),
X ALAB(1), BLAB(1), CLAB(1), INSR(25), IIO(25), ITC(25),
XICT(25), IPID(500), IPSER(500), JMT(25), DM(25), DM(25), AFD(62)
100 FORMAT (10 A6, 2F6.2, 5I1)
101 FORMAT(1X,211,16,212,2F2.0,4X,312,13,313,0,211,312,F7.0,1X,
XF7.0, 1X, F7.0, 1X,F7.0)
DIMENSION EOI(4), EOI(4), INYSOI(25), INDSOI(25), IET(25), AET(500),
XFET(25), EI(4), AI(25), A2(25), SS1(25), SS2(25), PSS1(500),
XPSS2(500), EE2(4), EE1(4), EE2(4), AV1(500), AV2(500), RV1(500),
XR2(500), GET(25)
103 FORMAT (6H- , 8A6)
104 FORMAT(18H0 DAY OF COUNT,13,1H/,12,1H/,12,17H INITIAL DATE
X,13,1H/,12,1H/,12/84H0 HALF-LIFE COUNT CORR. RATI
XO TO ROUTE TISSUE ATOMIC CHANNELS/83H ISOTOPE (DAYS)
X RATE RATE INI. DAY OF ADM. TYPE NUMBER SUMMED)
105 FORMAT(6H0 ,A6,2F10.2,F8.2,F9.4,16,18,19,5X,411)
106 FORMAT(81H SERIAL ANIMAL WEIGHT TIME OF ELAPSED CORRE
XCIED CORRECTED COUNT /82H CL NUMBER NUMBER (GMS) COUNT
X TIME(DAYS) RATE(CPS) RATE(CPS) TIME(SEC))
107 FORMAT (1H0,51X, A6, 5X, A6)
108 FORMAT (1H0,217, 15,18, 17, F10.1, F14.1, F11.1, 18)
109 FORMAT (6H ,8A6)
110 FORMAT(1H8,1P3E12.5,18,14,A6)
111 FORMAT(1H1)
180 FORMAT (68H1THIS PROGRAM IS SET UP TO HANDLE A DATE OF COUNT ONLY
XTHROUGH 1072.)
1 IP=0
ISN=0
ISC=0
IN=1
READ INPUT TAPE 10,100, ALAB, BLAB,(CLAB(1), I=1,8), HL1, HL2,NC,(
XNCI(1),I=1,NC)
IP=IP+1
ISN=ISN+1
ISC=ISC+1
3 READ INPUT TAPE 10, 101,ICL1, ICL2, ISER, IAN, ID, BH, BM, LMO, LD
XAY, LYR, IWT, CT, IR, IT, IMD, IDAY, IYR, (CHIM), M=1,4)
IF(CT) 31,31,10
10 IF(1CL2-8) 20,13,11
11 IF(J)311,311,31
311 IF(K)312,312,20
312 L=L+1
DO 12 I=1,NC
I=INFI(1)
12 BKG(I)=BKG(I)+CH(I)/CT
GO TO 3
13 IF (JCK) 14,14,17
14 JCK=IAN
15 K=K+1
DO 16 I=1,NC
I=INFI(1)
16 STD (I)=CH(I)/CT+STD(I)
LAN=IAN
EH=BH
EM=BM
MMO=LMO
MYK=LYR
MDAY=LDAY
GO TO 3
17 IF(JCK-IAN) 18,15,18
18 JCK=IAN
FM=EM
FW=EH
B=K
DO 19 I=1,NC
STD(I)=STD(I)/B
19 STD(I)=0.
K=0
GO TO 15
20 IF(I) 23,23,21
21 A=L
SBR=0.
DO 22 I=1,NC
BKG(I)=BKG(I)/A
SBR=SBR+BKG(I)
22 BKG(I)=0.
L=0
23 IF (K) 26,26,24
24 B=K
DO 25 I=1,NC
STD(I)=STD(I)/B
25 STD(I)=0.
K=0
JCK=0
DO 35 I=1,NC
STD(I)=STD(I)-BKG(I)
35 STD(I)=STD(I)-BKG(I)
26 IF (ICK) 30,27,30
27 ICK=ISER
28 J=J+1
DO 29 I=1, NC
IJ=NCI(I)
29 SUB (I)=SUB (I)+CH(I)/CT
SCT=SCT+CT
ICL1(SN)=ICL2+ICL1*10
INSR (ISN)= ICK
ID(I(SN))=ID
ITC(SN)=BH*100. +BH
ECT=CT
IND(SN)=ID
IPID(IP)=ID
IPSER(IP)=ICK
JMT(ISN)=IWT
JMO =IMO
JDAY=IDAY
JYR=IYR
IIR=IR
DH1(SN)=BH
ITT=IT
DM1(SN)=BM
GO TO 3
30 IF (ICK-ISER) 31,28,31
31 C=J
IX=IND1(SN)
DO 32 I=1,NC
SUBA1(SN,IX,I)=SUB(I)/C-BKG(I)
32 SUB(I)=0.
J=0
ICK=0
ICT(SN)=SCT
SCT=0.
IF (CT) 34,34,33
33 IF(1CL2-8)330,330,331
331 ISN=ISN+1
GO TO 311
330 ICK=ISER
ISN=ISN+1
IH=IP + 1
GO TO 28
34 ISN=ISN+1
IND(SN)=24
DH1(SN)=FH
DM1(SN)=FM
ISN=ISN+1
IND(SN)=25
DH1(SN)=EH
DM1(SN)=EM
A=JDAY
GO TO (38,39,40,41,42,43,44,45,46,47,48,49),JMU
38 T=A
GO TO 50

```

Table A-6. (Continued).

```

39 T=A+31.
GO TO 50
40 T=A+59.
GO TO 50
41 T=A+90.
GO TO 50
42 T=A+120.
GO TO 50
43 T=A+151.
GO TO 50
44 T=A + 181.
GO TO 50
45 T=A + 212.
GO TO 50
46 T= A+ 243.
GO TO 50
47 T= A+ 273.
GO TO 50
48 T= A+ 304.
GO TO 50
49 T= A + 334.
50 MDA=T
IF (ISC-1) 51,51,54
51 DO 52 I=1,NC
E01(I)=STD1(I)
52 E02(I)= STD2(I)
53 INDS0=MDA
DO 530 I=1,ISN
IX=IND(I)
AFD(IX)=(DM(I)+DM(I)/60.1/24.
AET(I)=0.
GET(I)=0.
530 FLT(I)=0.
GO TO 69
54 MDB=MDA
INDS1=INDS0
DO 68 I=1,ISN
IX = IND(I)
NY = 60
DO 55 M=1,4
IF (JYR-NY) 59,56,55
55 NY = NY + 4
WRITE OUTPUT TAPE 9,180
CALL EXIT
56 IF (MDA-60) 59,57,57
57 MDB = MDA +1
59 NY = 60
LPR = 0
DO 60 M = 1,4
IF (MYR-NY) 58,61,60
60 NY = NY + 4
WRITE OUTPUT TAPE 9,180
CALL EXIT
61 LPR = 1
IF (INDS0-60) 58,610,610
610 INDS1=INDS0+1
58 IF (JYR-MYR) 580,580,581
580 IET(IX)=MDB-INDS1
GO TO 67
581 IF(LPR) 582,582,583
582 KDAY=365-INDS1
GO TO 584
583 KDAY=366-INDS1
584 IER = JYR-MYR-1
IET(IX) = KDAY+MDB+IER+365
IF(IER) 67,67,63
63 DO 65 M=1,IER
NY = 60
DO 64 N=1,4
IF (MYR+M-NY) 65,66,64
64 NY = NY + 4
65 CONTINUE
GO TO 67
66 IET(IX) = IET(IX) + 1
67 BFD = (DM(I) + DM(I)/60.1/24.
FET(IX) = IET(IX)
FET(IX) = FET(IX) + BFD - AFD(IX)
GET(I) = FET(IX)
68 CONTINUE
KL=0
DO 680 I=IN,IP
KL=KL+1
680 AET(I)=GET(KL)
69 TE1=0.
TE2=0.
TE01=0.
TE02=0.
S1=0.
S2=0.
DO 70 I=1,NC
E01(I)=STD1(I)*EXP(0.69315/HL1*GET(ISN-1))
E02(I)=STD2(I)*EXP(0.69315/HL2*GET(ISN))
TE1=TE1+E01(I)
TE2=TE2+E02(I)
E1(I)=STD1(I)
E2(I)=STD2(I)
S1=S1+STD1(I)
S2=S2+STD2(I)
TE01=TE01 + E01(I)
70 TE02 = TE02 + E02(I)
Y1=TE01/TE1
Y2= TE02/TE2
71 ISN=ISN-2
DO 73 I=1, ISN
SYE2=0.
SE2=0.
SE1=0.
SE12=0.
SYE1=0.
IX=IND(I)
DO 72 M=1,NC
SYE1=SYE1+SUBA(I,IX,M)*E1(M)
SYE2=SYE2+SUBA(I,IX,M)*E2(M)
SE2=SE2+E2(M)**2
SE1=SE1+E1(M)**2
72 SE12=SE12+E1(M)*E2(M)
D=SE1* SE2-SE12 **2
A1(I)=(SYE1*SE2-SYE2*SE12)/D
73 A2(I)=(SE1*SYE2-SE12*SYE1)/D
DO 75 I=1,ISN
SS1(I)=0.
SS2(I)=0.
DO 74 M=1,NC
SS1(I)=SS1(I)+A2(I)*E1(M)
SS2(I)=SS2(I)+A2(I)*E2(M)
74 AV1(I)=(SS1(I)+2.*(SS2(I)+SBR))/ECT
AV2(I)=(SS2(I)+2.*(SS1(I)+SBR))/ECT
SS1(I)=SS1(I)*Y1
75 SS2(I)=SS2(I)*Y2
M=0
DO 750 I=IN,IP
M=M+1
RV1(I)=1./AV1(M)
RV2(I)=1./AV2(M)
PSS1(I)=SS1(M)
PSS2(I)=SS2(M)
750 PRINT ROUTINE FOLLOWS
S1AVG=0.
S2AVG=0.
DO 76 I=1,ISN
S1AVG=S1AVG+SS1(I)
76 S2AVG=S2AVG+SS2(I)
AISN=ISN
ISN=ISN+1
SS1(ISN)= S1AVG/AISN
SS2(ISN)=S2AVG/AISN
INSTR (ISN)=0
ITC (ISN)=0
ICL (ISN)=0
IID (ISN)=0
JMT(ISN)=0
ITC (ISN)=0
FET(ISN)=0.
ICT(ISN)=0
L2BU=ISN-2+18
LL=61-LL-L2BU
IF (IIRR) 77,77,80
77 IIRR=1
78 WRITE OUTPUT TAPE 9,111
LU=0
GO TO 81
80 IF (LL) 78,81,81
81 WRITE OUTPUT TAPE 9,103,(CLAB(I),I=1,8)
WRITE OUTPUT TAPE 9,104,JMD,JDAY,JYR,MMOY,MOAY,MYR
WRITE OUTPUT TAPE 9,105,ALAB,HL1,S1,TC1,Y1,IIR,ITI,LAN,(NC(I),I=1
X,NC)
WRITE OUTPUT TAPE 9,105,BLAB,HL2,S2,TE2,Y2
WRITE OUTPUT TAPE 9, 107, ALAB,BLAB
WRITE OUTPUT TAPE 9, 106
DO 82 I=1,ISN
82 WRITE OUTPUT TAPE 9, 108, ICL(I), INSR(I), IID(I), JMT(I),
XITC(I),GET(I),SS1(I),SS2(I),ICT(I)
LU=LU+ISN-2+18
IN=IP+1
ISN=0
83 READ INPUT TAPE 10, 101, ICL1,ICL2,ISER, IAN, ID, BH,BM, LMD,
XLDAY,LVX,INT,CT,IX,I1,IMU,IDAY,IYR,ICH(M),M=1,4)
IF (ICT) 85,85,84
84 ISN=1
IP=IP+1
ISC=ISC+1
GO TO 80
85 IF(ICL1-1)851,850,852
852 ISC=0
850 IIRR=0
GO TO 83
851 DO 86 I=1,IP
86 WRITE OUTPUT TAPE 9,110,PSS1(I),AET(I),RV1(I),IPSER(I),IPID(I),
XLAB
DO 87 I=1, IP
87 WRITE OUTPUT TAPE 9,110, PSS2(I),AET(I),RV2(I),IPSER(I),IPID(I),
XLAB
J=0
K=0
L=0
IKK=0
ISN=0
IP=0
IN=1
GO TO 1
END(1,1,0,0,0,0,1,0,0,1,0,0,0,0,0,0)

```

Table A-7. Example of Card Order for Operation of RTW-2 Program.

```

SH 125          IV DOGS 05 04 64          986 3123
5900/06219601213007050040661025500221646272470271450159993170569154051 29APR64
5900/06419601232007050040661025500219053272834272534160279170116153932 29APR64
5900/0661960125200705004066103550021913027278271885160567169932153095 29APR64
5300/068196012720070500406611750023562929390300163167143180096156164 29APR64
5100/065196012430070500406611750023562929390300163167143180096156164 29APR64
5300/06719601302007050040661175002267392928383062167072180453155382 29APR64
5900/071196113210070500406610355002239727379221444159756170864154727 29APR64
5900/07319611340007050040661035500216560273141273779159929169393154054 29APR64
5900/07519611350007050040661035500219846273190272846159778170323154990 29APR64
5300/07219611330007050040661165002280329513030585167299183441157363 29APR64
5300/07419611349007050040661165002234070294087306846167623182506157284 29APR64
5300/076196114080070500406611650022374829553335800168373182656157580 29APR64
5900/099196212210000050050164035500216246276251272105158196170099154404 01MAY64
5900/10119621242000050040661035500212090275102276490159336188165154557 01MAY64
5900/10319621301000050040661035500210737275871271796158358169727154141 01MAY64
5300/10019621232000050050164158500226706301880312227166590182836158276 01MAY64
5300/10219621251000050040661158500225102302996312910167063182880157205 01MAY64
5300/1041962111000005004066115850023506630197531266316778118304158266 01MAY64
5000/10819631132000050040661035500212356727494272441159155149192155908 01MAY64
5900/11019631150000050040661035500210154276552723458729169204155564 01MAY64
5900/11219631140900050040661035500209011275756272748158838169783155161 01MAY64
5300/1091963113900050040661185500226937304026315934166963183104158130 01MAY64
5300/1111963114000005004066118550022568730374231660416639318232158770 01MAY64
5300/1131963114800050040661185500227610305941316449166904182831158374 01MAY64
05064
5900/1155100115600000050464000100044068C54721053655031729C34196030632 04MAY64
5800/125100121000000005046407310C164605312847256101033070C33979030983 04MAY64
5900/1215160121800000005046403510C042953057594057861032141C34196030665 04MAY64
5100/116160115800000005046416010C16C725302863245994034403036195031351 04MAY64
5900/122516112200000005046403510C0429005536054230032334C33740030925 04MAY64
5100/11717516112010000000504645210015716A28796A7276A003A258C3A490031257 04MAY64
5900/123516212230000005046403510C04190605358C54103031661C3A253030961 04MAY64
5100/1185162120400000050464153100162030295C45236662034742C36020301442 04MAY64
5900/124516312260000005046403510C043689055367051294031700C34427030397 04MAY64
5100/119516312260000005046418710C16574829663123105034360C36784031492 04MAY64
05064
5900/1255100125000000050564000100044E1505100085117003E1640344E0031203 05MAY64
5800/1365100125200000050564073100166334305671253546033063C34705030957 05MAY64
5900/137516012550000005056403510C045490C59227058038012144C34933030933 05MAY64
5100/138516012580000005056416C100059109C83240077904033389C36594031641 05MAY64
5900/139516113010000005056403510C044129C54882054649031735034672031212 05MAY64
5100/140516113030000005056415510CC5675907C054075213033691C37301032112 05MAY64
5900/141516213060000005056403510C043629C55310C5441431921C34501031306 05MAY64
5100/142516213090000005056415410CC5799C68278307288031660037362031892 05MAY64
5900/1435163113100000050564035100044386055348055011031697C34642031250 05MAY64
5100/1445163114000000050564185100062946C8891808368703914C37429032204 05MAY64
05064
5900/145510012090000005046400C10C047485C53508053567031551033871031037 06MAY64
5900/155510012430000005046400C10CC48807054C48053211031764C33633030772 06MAY64
5900/164510013040000005046400C100048926C54425053358031664C33821031251 06MAY64
5800/154510012370000005046407310C17C091307425253926033150033944031064 06MAY64
5900/146516012140000005046403510C04376C577605737705784803253C34204031192 06MAY64
5100/147516012170000005046415810CC6C365C74265072426033580535948031467 06MAY64
5900/1485161122000000050464035100048661054563053817031615C33167031034 06MAY64
5100/1495161122200000050464154100061137C75948073200033573C36603031659 06MAY64
5900/150516212250000005046403510CC5C050054920054214031794C34240031270 06MAY64
5100/151516212280000005046415810CC61725C785120762040338033685031769 06MAY64
5900/152516312310000005046403510CC47574C5416053511031962034165031040 06MAY64
5100/153516312340000005046418510CC59674077826075125033630C36713031577 06MAY64

```

TABLE A-8. Output Listing from Analysis of Data of Table A-7.

IV DOGS 05 04 64								
DAY OF COUNT 5/4/64			INITIAL DATE 5/4/64					
ISOTOPE	HALF-LIFE	COUNT	CORR.	RATIO TO	CHANNELS			
SB-125	(DAYS)	RATE	RATE	INI. DAY	SUMMED			
	986.00	5811.09	5811.09	1.0000	123			
SERIAL	SUBJECT	WEIGHT	TIME OF	ELAPSED	PERCENT	CORRECTED	TOTAL COUNT	
CL NUMBER	NUMBER	(KG)	COUNT	TIME (Days)	BIOL. RET.	RATE (CPS)	TIME (SEC)	
51 7116	60	16.0	1158	0.	100.00	5389.13	100	
51 7117	61	15.2	1201	0.	100.00	5020.78	100	
51 7118	62	15.3	1204	0.	100.00	5251.81	100	
51 7119	63	18.7	1206	0.	100.00	5225.29	100	
0 0	0	0.	0	0.	100.00	5221.75	0	

IV DOGS 05 04 64								
DAY OF COUNT 5/5/64			INITIAL DATE 5/5/64					
ISOTOPE	HALF-LIFE	COUNT	CORR.	RATIO TO	CHANNELS			
SB-125	(DAYS)	RATE	RATE	INI. DAY	SUMMED			
	986.00	5762.28	5766.45	1.0077	123			
SERIAL	SUBJECT	WEIGHT	TIME OF	ELAPSED	PERCENT	CORRECTED	TOTAL COUNT	
CL NUMBER	NUMBER	(KG)	COUNT	TIME (Days)	BIOL. RET.	RATE (CPS)	TIME (SEC)	
51 7138	60	16.0	1258	1.0	8.53	455.87	100	
51 7140	61	15.5	1303	1.0	8.88	441.98	100	
51 7142	62	15.6	1309	1.0	9.62	500.98	100	
51 7144	63	18.5	1314	1.0	12.30	637.39	100	
0 0	0	0.	0	0.	9.83	509.06	0	

Table A-8. (Continued).

IV DOGS 05 04 64

DAY OF COUNT 5/6/64

INITIAL DATE 5/4/64

ISOTOPE	HALF-LIFE (DAYS)	COUNT RATE	CORR. RATE	RATIO TO INI. DAY	CHANNELS SUMMED			
SB-125	986.00	5756.64	5764.81	1.0080	123			
SERIAL	SUBJECT	WEIGHT	TIME OF	ELAPSED	PERCENT	CORRECTED	TOTAL COUNT	
CL	NUMBER	NUMBER	(KG)	COUNT	TIME (Days)	BIOL. RET.	RATE (CPS)	TIME (SEC)
51	7147	60	15.8	1217	2.0	5.44	290.25	100
51	7149	61	15.4	1222	2.0	8.05	400.56	100
51	7151	62	15.8	1228	2.0	7.80	405.92	100
51	7153	63	18.5	1234	2.0	7.72	399.46	100
0	0	0	0.	0	0.	7.25	374.05	0

Table A-9. FORTRAN Listing of RTW-2 Program.

```

RTW-2
C HUMCO-2 SINGLE ISOTOPE VERSION
C CAGE BACKGROUNDS CAN BE USED
C INITIAL OR ZERO DATE COUNT RATE OF SUBJECTS ENTERED FIRST
C BACKGROUND AND SUBJECT COUNT RATES USED TO COMPUTE WEIGHTS
C DIMENSION ALAB(1),CLAB(10),NCI(6),CHI(6),BKG(6),BKGA(6),
XSUB(6),IND(100),BSUB(100,6),STD(6),ICL(25),INSER(25),
XIIDI(25),ITC(25),IPID(500),IPSER(500),PWT(25),DH(25),DMI(25),SS(25),
XSUBA(25,99,6),ICT(25),EOL(6),AFDI(100),GET(25),AET(500),FET(100),
XSUBO(100),ROI(100),IET(100),EEI(6),SAL(25,100),WF(25),PBR(25),
X,SS(25),RV(500),PSS(100),PSS2(500)
100 FORMAT(11A6,F6.2,7I11)
101 FORMAT(1X,21I,16,212,2F2.0,6X,312,F3.1,F3.0,6F6.0)
103 FORMAT(6H- 10A6)
104 FORMAT(18H0 DAY OF COUNT,13,1H/,12,1H/,12,17H INITIAL DATE
X,13,1H/,12,1H/,12,16H0 HALF-LIFE COUNT CORR. RA
XTIO TO CHANNELS/59H ISOTOPE DAYS RATE RATE INI.
X DAY SUMMED)
105 FORMAT(6H0 ,A6,2F10.2,F9.2,F9.4,3X,6I11)
106 FORMAT(85H0 SERIAL SUBJECT WEIGHT TIME OF ELAPSED PERCE
XNT CORRECTED TOTAL COUNT /83H CL NUMBER NUMBER (KG) C
XOUNT TIME(DAYS) BIOL. RET. RATE(CPS) TIME(SEC))
108 FORMAT(1H0,17,16,17,F8.1,18,F8.1,F12.2,F13.2,19)
110 FORMAT(1H6,1P3E12.5,18,14,A6,23X,3HEFF)
111 FORMAT(11H1)
112 FORMAT(23X,312)
113 FORMAT(1H6,1P3C12.5,18,14,A6,23X,3HR10)
180 FORMAT(68H1THIS PROGRAM IS SET UP TO HANDLE A DATE OF COUNT ONLY
XTHROUGH 1972.)
1 IP=0
ISN=0
ISC=0
I=1
READ INPUT TAPE10,100,ALAB,(CLAB(I),I=1,10),HL1,NC,(NCI(I),I=1,NC)
ISN=1
300 READ INPUT TAPE 10,101,ICL1,ICL2,ISER,IO,IAN,BH,BH,LMO,LDAY,LYR,
XFMT,CT,(CH(M),M=1,6)
IF(CT) 211,211,200
200 IF(ICL2-9) 203,201,201
201 IF(IJ) 2010,2010,211
2010 L=L+1
DO 202 I=1,NC
IJ=NCI(I)
202 BKG(I)=BKG(I)+CH(IJ)/CT
GO TO 300
203 IF(I) 206,206,204
204 A=L
DO 205 I=1,NC
BKGA(I)=BKG(I)/A
205 BKGI(I)=0.
L=0
206 IF(ICK) 210,207,210
207 ICK=IAN
J=J+1
DO 209 I=1,NC
IJ=NCI(I)
209 SUB(I)=SUB(I)+CH(IJ)/CT
IND(ISN)=IAN
GO TO 300
210 IF(ICK-IAN) 211,208,211
211 C=J
IX=IND(ISN)
DO 212 I=1,NC
BSUB(IX,I)=SUB(I)/C-BKGA(I)
212 SUB(I)=0.
ISN=ISN+1
J=0
ICK=0
IF(CT) 213,213,2080
2080 IF(ICL2-9) 207,2010,2010
213 ISN=0
ICK=0
JMO=LMO
JDAY=LDAY
12/17/64
JYR=LYR
IP=IP+1
ISN=ISN+1
2 ISC=ISC+1
3 READ INPUT TAPE 10,101,ICL1,ICL2,ISER,IO,IAN,BH,BH,LMO,LDAY,LYR,
XFMT,CT,(CH(M),M=1,6)
IF(CT) 31,31,10
10 IF(ICL2-8)20,15,11
11 IF(IJ) 311,311,31
311 IF(IK) 312,312,20
312 L=L+1
DO 12 I=1,NC
IJ=NCI(I)
12 BKGI(I)=BKG(I)+CH(IJ)/CT
CTB=CT
GO TO 3
15 K=K+1
DO 16 I=1,NC
IJ=NCI(I)
16 STD(I)=CH(IJ)/CT+STD(I)
EH=BH
EM=RM
MMD=LMO
MYR=LYR
MDAY=LDAY
LAN=IO
GO TO 3
20 IF(I) 23,23,21
21 A=L
SB=0.
DO 22 I=1,NC
SB=SB+BKG(I)/CTB
BKGA(I)=BKG(I)/A
22 BKGI(I)=0.
SB=SB/A+2
L=0
23 IF (K) 26,26,24
24 B=K
DO 25 I=1,NC
DO 35 I=1,NC
STD(I)=0.
35 STD(I)=STD(I)+BKGA(I)
K=0
IF(ICL2-8) 26,311,311
26 IF (ICK) 30,27,30
27 ICK=ISER
28 J=J+1
DO 29 I=1, NC
IJ=NCI(I)
29 SUB(I)=SUB (I)+CH(IJ)/CT
SCT=SCT+CT
ICL(ISN)=ICL2+ICL1*10
INSER (ISN)= ICK
IID(ISN)=IAN
ITC(ISN)=BH+100.+BH
IPIDI(IP)=IAN
IPSER(IP)=ICK
PWT(ISN)=FMT
IIR=IR
ECT=CT
DH(ISN)=BH
ITF=IT
DMI(ISN)=RM
IND(ISN)=IAN
CTS=CT
IF(ICL2-6)1000,1001,1000
1000 IF(ICL2-7) 1002,1001,1002
1001 IEX=1
1002 CONTINUE
GO TO 3
30 IF (ICK-ISER) 31,28,31
31 C=J
IX=IND(ISN)
SS(ISN)=0.
IF(IEX) 3000,3002,3000

```

Table A-9. (Continued).

```

3000 IEX=0
      DO 3001 I=1,NC
        SUBA(ISN,IX,I)=SUB(I)/C-BKGA(I)
        SS(ISN)=SS(ISN)+SUB(I)/C**2/CTS
3001 SUB(I)=0.
      WF(ISN)=1./(SS(ISN)+SB)
      GO TO 3003
3002 CONTINUE
      DO 32 I=1,NC
        SUBA(ISN,IX,I)=SUB(I)/C-BKGA(I)-BSUB(IX,I)
        SS(ISN)=SS(ISN)+SUB(I)/C**2/CTS
      32 SUB(I)=0.
      WF(ISN)=1./(SS(ISN)+SB)
3003 CONTINUE
      ICT(ISN)=SCT
      SCT=0.
      J=0
      ICK=0
      IF (CT) 34,34,33
      33 IF (ICL2-8) 330,330,331
      331 ISN=ISN+1
      IP=IP+1
      GO TO 311
330 ICK=ISER
      ISN=ISN+1
      IP=IP+1
      GO TO 28
34 ISN=ISN+1
      DM(ISN)=EM
      DM(ISN)=EM
      IND(ISN)=99
      A=JDAY
      GO TO (38,39,40,41,42,43,44,45,46,47,48,49),JMD
38 T=A
      GO TO 50
39 T=A+31.
      GO TO 50
40 T=A+59.
      GO TO 50
41 T=A+90.
      GO TO 50
42 T=A+120.
      GO TO 50
43 T=A+151.
      GO TO 50
44 T=A+181.
      GO TO 50
45 T=A+212.
      GO TO 50
46 T=A+243.
      GO TO 50
47 T=A+273.
      GO TO 50
48 T=A+304.
      GO TO 50
49 T=A+334.
      GO TO 50
50 MDA=T
      IF (ISC-1)51,51,54
      51 DO 52 I=1,NC
        EOI(I)=STOI(I)
      52 INDS=MDA
      53 DO 530 I=1,ISN
        IX=IND(I)
        AFD(IX)=(DM(I)+DM(I)/60.)/24.
        GET(I)=0.
        AET(I)=0.
530 FET(I)=0.
      TE01=0.
      DO 533 M=1,NC
        TE01=TE01+STOI(IX)
      533 FET(99)=0.
      DO 532 I=1,ISN
        IX=IND(I)
        SUBO(IX)=0.
      DO 531 M=1,NC
        SUBO(IX)=SUBO(IX)+SUBA(I,IX,M)
      531 SUBO(IX)=SUBO(IX)/TEG1
      GO TO 69
54 MDB=MDA
      INDS1=INDS0
      DO 68 I=1,ISN
        IX=IND(I)
        NY=60
        DO 55 M=1,4
          IF (JYR-NY) 59,56,55
        55 NY=NY+4
        WRITE OUTPUT TAPE 9,180
        CALL EXIT
      56 IF (MDA-60) 59,57,57
      57 MDH=MDA+1
      59 NY=60
      LPR=0
      DO 60 K=1,4
        IF (MYR-NY) 58,61,60
      60 NY=NY+4
      WRITE OUTPUT TAPE 9,180
      CALL EXIT
      61 LPR=1
      IF (INDS0-60) 58,610,610
      610 INPS1=INDS0+1
      58 IF (JYR-MYR) 580,580,581
      580 IET(IX)=MDB-INDS1
      GO TO 67
581 IF (LPR) 582,582,583
582 KDAY=365-INDS1
      GO TO 584
583 KDAY=366-INDS1
584 IER=JYR-MYR-1
      IET(IX)=KDAY+MDB+IER*365
      IF (IER) 67,67,63
      63 DO 65 M=1,IER
        NY=60
        DO 64 M=1,4
          IF (MYR-M-NY) 65,66,64
        64 NY=NY+4
      65 CONTINUE
      GO TO 67
      66 IET(IX)=IET(IX)+1
      67 BFD=(DM(I)+DM(I)/60.)/24.
      FET(IX)=IET(IX)
      FET(IX)=FET(IX)+BFD-AFD(IX)
      GET(I)=FET(IX)
      68 CONTINUE
      KLU
      DO 680 I=IN,IP
        KL=KL+1
      680 AET(I)=GET(KL)
      69 TE1=0.
      E1=0.
      DO 70 I=1,NC
        EE1(I)=STOI(I)*EXP(0.69315/HL)*FET(99)
        TE1=TE1+EE1(I)
      70 E1=E1+STOI(I)
      Y1=TE01/TE1
      71 ISN=ISN+1
      DO 73 I=1,ISN
        IX=IND(I)
        SA1(I,IX)=0.
        DO 72 M=1,NC
          SA1(I,IX)=SA1(I,IX)+SUBA(I,IX,M)
          SA1(I,IX)=SA1(I,IX)*I
          PBR(I)=SA1(I,IX)/EO(IX)*100.
      73 SS1(I)=SA1(I,IX)
      M=0
      DO 750 I=IN,IP
        M=M+1
        RV(I)=WF(M)
        PSS2(I)=SS1(M)
      750 PSS2(I)=PBR(M)
      PRINT ROUTINE FOLLOWS
      SI AVG=0.
      S2 AVG=0.
      DO 76 I=1,ISN
        SI AVG=SI AVG+SS1(I)
      76 S2 AVG=S2 AVG+PBR(I)
      AISN=ISN
      ISN=ISN+1
      SS1(ISN)=SI AVG/AISN
      PBR(ISN)=S2 AVG/AISN
      INSEK (ISN)=0
      ICI (ISN)=0
      IID (ISN)=0
      JMT=0
      ITC (ISN)=0
      GET (ISN)=0
      ICT (ISN)=0
      LZBU=ISN*2+18
      LL=61-LZBU
      IF (IHR) 77,77,80
      77 IRR=1
      78 WRITE OUTPUT TAPE 9,111
      LU=0
      GO TO 81
      80 IF (LL) 70,01,01
      81 WRITE OUTPUT TAPE 9,103,(CLAR(I),I=1,10)
      WRITE OUTPUT TAPE 9,104,JMD,JDAY,JYR,MMD,MDAY,MYR
      WRITE OUTPUT TAPE 9,105,ALAB,HL1,E1,TE1,Y1,(NC(I),I=1,NC)
      WRITE OUTPUT TAPE 9,106
      DO 82 I=1,ISN
        82 WRITE OUTPUT TAPE 9,108,ICL(I),INSEK(I),IID(I),PWT(I),ITC(I),
          XGET(I),PBR(I),SS1(I),ICT(I)
        LU=LU+ISN*2+18
        IN=IP+1
        ISN=0
      83 IF (LMD)88,88,84
      84 JMO=LMO
      JDAY=LDAY
      JYR=LYR
      ISN=1
      IP=IP+1
      ISC=ISC+1
      GO TO 3
      88 IF (LYR-1) 85,89,90
      85 DO 86 I=1,IP
      86 WRITE OUTPUT TAPE 9,110,PSS1(I),AET(I),KV(I),IPSER(I),IPID(I),ALAB
        DO 87 I=1,IP
      87 WRITE OUTPUT TAPE 9,113,PSS2(I),AET(I),RV(I),IPSER(I),IPID(I),ALAB
        J=0
        K=0
        L=0
        IRR=0
        ISN=0
        IP=0
        IN=1
        GO TO 1
      END(1,1,0,0,0,0,1,0,0,1,0,0,0,0,0)

```

Table A-10. Example of Card Order for Operation of RTW-2A Program.

```

SR 85 NA 22      DOGS IV      65  941706123456
59 1 60          3 7 52163 3510C 44006 58798 64810 33141 34915 31477
51 2 60          3 7 52163 3510C 45897 61670 69705 34295 36790 32092
3 61          3 7 52163 3510C 44332 58819 65286 33190 34853 31469
51 4 61          3 7 52163 3510C 46480 62590 70560 34409 37050 32077
59 5 62          3 7 52163 3510C 42934 59403 65727 33340 35010 31464
51 6 62          3 7 52163 3510C 45109 62906 71601 34790 37380 31938
59 7 63          3 7 52163 3510C 41691 59128 65210 33215 34934 31092
51 8 63          3 7 52163 3510C 43999 62862 71031 34618 37097 31408
052163
590029841100125800300705216300010004408058621064132032962C35285031412 21MAY63
58002964380013160030005216313C100108816202272197702034731C36447033070 21MAY63
5800256311001313000C0705216311710C062695138698287953173688200608189637 21MAY63
590029591160130200300705216303510004212905980065223033498C34971031942 21MAY63
51002965116013200300705216314C100122655298067477053232018271526300574 21MAY63
59002960116113050300705216303510C041657C5946C065271032914C35050031964 21MAY63
51002966116113250300705216314110012472229770845981120717824222277097 21MAY63
590025611162130700300705216303510C041905C59155065328032776C35113032142 21MAY63
51C029671162132800300705216314110013380133C4145C675823787273365312043 21MAY63
5900296211631310003007052163035100042098059114065388033154C35262031679 21MAY63
5100256811631320030070521631110C130632307581459651209736244240249662 21MAY63
052263
590029841100125800300705216300010004408058621064132032962C35285031412 21MAY63
58002963816131C0C300005216313C10C111296195421193689034219C36072033507 21MAY63
580029651117130700000705216311710005988413C746278799171244197259216047 21MAY63
5900298C1160124700300705216303510C047467C59C0106520803524C35360032167 21MAY63
51C02987116013140030070521631451001C922925686143278222551240642287196 21MAY63
5900298111611250003007052163035100043059059700C52903336C35572032238 21MAY63
5100298811611317003007052163142100112008256390412028199286231197264161 21MAY63
590029821162125300300705216303510C043174C58610065486033C81C35408032196 21MAY63
510025691162132000300705216314110C11281726340247965321294624090278826 21MAY63
590029831163125500300705216303510C045312C5128065170035294C35472031789 21MAY63
510029901163132300300705216317110C1122592566264124712C2358235312239467 21MAY63
06C563
5900316911001214003007052163000100041234C58542063290033253C35413031430 05JUN63
58003170381612180030005216313C10C0696517799117535033280635582031769 05JUN63
58003171111722100000705216311710005887112857627687114949194408202761 05JUN63
590031721160122400300705216303510C041697C62637075817039623043848049781 05JUN63
51C031731160122800300705216314C10C062570121681192059099029115568127551 05JUN63
5900317411611231003007052163035100041738058835065494033545C36272032629 05JUN63
510031751161123400300705216313810006373122731186619093226107858110834 05JUN63
590031761162123700300705216303510C042690C6401208C28808258C47649058616 05JUN63
5100317711621240003007052163148100063885118218161001072894C83798093441 05JUN63
590031781163124200300705216303510C041427C58931066070034535C3619034704 05JUN63
51C031791163124500300705216317C10C066315125421179283084563C97127095885 05JUN63

```

Table A-11. Output Listing from Analysis of Data of Table A-10.

DOGS IV								
DAY OF COUNT 5/21/63			INITIAL DATE 5/21/63					
ISOTOPE	HALF-LIFE (DAYS)	COUNT RATE	CORR. RATE	RATIO TO INI. DAY	CHANNELS SUMMED			
SR-85	65.00	3465.46	3465.46	1.0000	123456			
NA-22	941.70	7867.87	7867.87	1.0000				
					SR-85	NA-22		
CL	SERIAL NUMBER	ANIMAL NUMBER	WEIGHT (KG)	TIME OF COUNT	ELAPSED TIME (Days)	CORRECTED RATE (CPS)	CORRECTED RATE (CPS)	COUNT TIME (SEC)
51	2965	60	14.0	1322	0.	2507.16	11527.64	100
51	2966	61	14.1	1325	0.	2845.41	10239.84	100
51	2967	62	14.1	1328	0.	3165.82	11727.99	100
51	2968	63	17.1	1332	0.	3192.75	9849.90	100
0	0	0	0.	0	0.	2927.79	10836.34	0

DOGS IV								
DAY OF COUNT 5/22/63			INITIAL DATE 5/21/63					
ISOTOPE	HALF-LIFE (DAYS)	COUNT RATE	CORR. RATE	RATIO TO INI. DAY	CHANNELS SUMMED			
SR-85	65.00	3417.12	3453.60	1.0034	123456			
NA-22	941.70	7874.87	7880.64	0.9984				
					SR-85	NA-22		
CL	SERIAL NUMBER	ANIMAL NUMBER	WEIGHT (KG)	TIME OF COUNT	ELAPSED TIME (Days)	CORRECTED RATE (CPS)	CORRECTED RATE (CPS)	COUNT TIME (SEC)
51	2987	60	14.5	1314	1.0	2180.91	10620.04	100
51	2988	61	14.2	1317	1.0	2447.14	9414.60	100
51	2989	62	14.1	1320	1.0	2413.27	10145.47	100
51	2990	63	17.1	1323	1.0	2567.43	9135.49	100
0	0	0	0.	0	0.	2402.19	9828.90	0

DOGS IV

INITIAL DATE 5/21/63

ISOTOPE		HALF-LIFE (DAYS)	COUNT RATE	CORR. RATE	RATIO TO INI. DAY	CHANNELS SUMMED		
SR-85		65.00	2877.68	3375.40	1.0267	123456		
NA-22		941.70	7702.64	7787.95	1.0103			

						SR-85	NA-22	
CL	SERIAL NUMBER	ANIMAL NUMBER	WEIGHT (KG)	TIME OF COUNT	ELAPSED TIME (Days)	CORRECTED RATE (CPS)	CORRECTED RATE (CPS)	COUNT TIME (SEC)
51	3173	60	14.0	1228	15.0	578.62	3363.80	100
51	3175	61	13.8	1234	15.0	681.92	3373.43	100
51	3177	62	14.8	1240	15.0	861.50	1584.50	100
51	3179	63	17.0	1245	15.0	890.11	2752.88	100
0	0	0	0.	0	0.	753.04	2768.65	0

RIN-2A

12/18/64

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RTN-24
OPERATES ON DATA FROM HUMCO 2
MULTIPLE ISOTOPE VERSION
THIS VERSION IS FOR 2 ISOTOPIES
PROGRAM REVISION WILL LIST TOTAL COUNT TIME FOR EACH MEASUREMENT
BOTH OBSERVED AND CORRECTED STD RATES LISTED IN THIS REVISION
WEIGHT FACTOR CONSIDERS ALL EXCEPT EACH NUCLIDE TO BE BACKGROUND
WEIGHT FACTOR IS EQUAL TO RECIPROCAL OF VARIANCE OF BKGD PLUS THE
VARIANCE OF THE SUBJECT. *PROGRAM ASSUMES ONLY ONE COUNTING TIME
FOR BACKGROUNDS AND SUBJECTS.
DIMENSION RV(125),RV2(25),AV1(25),AV2(25),SMBR(99)
DIMENSION BKG(6),CH(6),SUB(6),STD(6),NCI(6),STD1(6),STD2(6),
XBKGA(6),SUBA(99,6),ICL(25),ALAB(1),BLAB(1),CLAB(8),INSER(25),
XI(10125),ITC(25),ICT(25),IP(10500),IPSER(500),PWT(25),DH(25),
XDM(25),AFD(62),E0(16),E02(6),          IET(25),AET(500),
XET(25),EI(6),AI(25),A2(25),SS1(25),SS2(25),PSS1(500),PSS2(500),
KE2(6),EE1(6),EE2(6),ASUB(99,6),IND(25)
100 FORMAT(10A6,2F6.2,7I1)
101 FORMAT(1X,21,16,212,2F2.0,6X,312,F3.1,F3.0,6F6.0)
103 FORMAT (6H-      , 8A6)
104 FORMAT(18H0      DAY OF COUNT,13,1H/,12,1H/,12,17H      INITIAL DATE
X,13,1H/,12,1H/,12/59H0      HALF-LIFE COUNT CORR. RATI
X0 TO CHANNELS/59H      ISOTOPE      DAYS      RATE      RATE INI. OA
XV      SUMMED)
105 FORMAT(6H0      ,A6,2F10.2,F8.2,F9.4,3X,611)
106 FORMAT(81H      SERIAL ANIMAL WEIGHT TIME OF ELAPSED CORRE
XCIED CORRECTED COUNT /82H      CL NUMBER NUMBER (KG) COUNT
X TIME(DAYS) RATE(CPS) RATE(CPS) TIME(SEC))
107 FORMAT (1H0,51X, A6, 5X, A6)
108 FORMAT(1H0,217,15,F8.1,17,F10.1,F14.2,F11.2,18)
110 FORMAT(1H8,IP3E12.5,18,14,A6)
111 FORMAT(1H1)
112 FORMAT(23X,312)
180 FORMAT (A8H1THIS PROGRAM IS SET UP TO HANDLE A DATE OF COUNT ONLY
XTHROUGH 1972.)
181 FORMAT(1H0,6F8.2)
1 IP=0
1SN=0
1SC=0
1IN=1
READ INPUT TAPE 10,100, ALAB, BLAB,(CIAB(I), I=1,8), HL1, HL2,NC,(
XNCI(I),I=1,NC)
1SN=1
300 READ INPUT TAPE 10,101,ICL1,ICL2,ISER,ID,IAN,BH,8M,LMO,LDAY,LYR,
XFWT,CT,(CH(I),M=1,6)
IF(CT) 211,211,200
200 IF(ICL2-9) 203,201,201
201 IF(J) 2010,2010,211
210 L=L+1
DO 202 I=1,NC
IJ=NCI(I)
402 BKG(I)=BKG(I)+GHI(I)/GT
GO TO 300
203 IF(IL) 206,206,204
204 A=L
DO 205 I=1,NC
BKGA(I)=BKG(I)/A
205 BKG(I)=0.
L=0
206 IF(IJK) 210,207,210
207 ICK=ISER
208 J=J+1
DO 209 I=1,NC
IJ=NCI(I)
209 SUB(I)=SUB(I)+CH(IJ)/CT
IND(ISN)=IAN
GO TO 300
210 IF(IJK-ISER) 211,208,211
211 C=J
IX=IND(ISN)
DO 212 I=1,NC
BSUB(IX,I)=SUB(I)/C-BKGA(I)
212 SUB(I)=SUB
ISN=ISN+1
J=0
ICK=0
IF(CT) 213,213,2080
2080 IF(ICL2-9) 207,2010,2010
213 ISN=0
ICK=0
JMO=LMO
JDAY=LDAY
JYR=LYR
IP=IP+1
ISN=ISN+1
2 ISC=ISC+1
3 REWIND INPUT TAPE 10,101,ICL1,ICL2,ISER,ID,IAN,BH,8M,LMO,LDAY,LYR,
XFWT,CT,(CH(I),M=1,6)
IF(CT) 311,311,10
10 IF(ICL2-8) 20,13,11
11 IF(J) 311,311,31
311 IF(K) 312,312,20
312 L=L+1
DO 12 I=1,NC
IJ=NCI(I)
12 BKGI(I)=BKG(I)+CH(IJ)/CT
GO TO 3
13 IF (JCK) 14,14,17
14 JCK=ID
15 K=K+1
DO 16 I=1,NL
IJ=NCI(I)
16 STD(I)=CH(IJ)/CT+STD(I)
EH=8H
EW=8H
MMO=LMO
MYR=LYR
MDAY=LDAY
GO TO 3
17 IF(JCK-ID) 18,15,18
18 JCK=ID
FM=EH
FW=EW
B=K
DO 19 I=1,NC
STD1(I)=STD1(I)/B
19 STD1(I)=0.
K=0
GO TO 19
20 IF(L) 23,23,21
21 A=L
DO 22 I=1,NC
BKGA(I)=BKG(I)/A
22 BKGI(I)=0.
L=0
23 IF (IK) 24,24,24
24 B=K
DO 25 I=1,NC
STD2(I)=STD1(I)/B
25 STD1(I)=0.
K=0
JCK=0
DO 35 I=1,NC
STD1(I)=STD1(I)-BKGA(I)
35 STD2(I)=STD2(I)-BKGA(I)
IF(ICL2-8) 26,311,311
26 IF (ICK) 30,27,30
27 ICK=ISER
28 J=J+1
DO 29 I=1, NC
IJ=NCI(I)
29 SUB(I)=SUB (I)+CH(IJ)/CT
SCT=SCT+CT

```

Table A-12. (Continued).

```

ITC(ISN)=BM*100.*BM
IPDI(IP)=IAN
IPSER(IP)=ICK
PMT(ISN)=FMT
IIR=IR
ECT=CT
DM(ISN)=BM
ITT=IT
DM(ISN)=BM
IND(ISN)=IAN
GO TO 3
30 IF (ICK-ISER) 31,28,31
31 C=J
IX=IND(ISN)
SMBR(IX)=0.
DO 32 I=1,NC
SUBA(IX,I)=SUB(I)/C-BKGA(I)-BSUB(IX,I)
SMBR(IX)=SMBR(IX)+BKGA(I)
32 SUB(I)=0.
ICT(ISN)=SCT
SCT=0.
J=0
ICK=0
IF (CT) 34,34,33
33 IF (ICL2-B) 330,330,331
331 ISN=ISN+1
IP=IP+1
GO TO 311
330 ICK=ISER
ISN=ISN+1
IP=IP+1
GO TO 28
34 ISN=ISN+1
DM(ISN)=FM
DM(ISN)=FM
ISN=ISN+1
DM(ISN)=EM
DM(ISN)=EM
A=JDAY
GO TO (38,39,40,41,42,43,44,45,46,47,48,49),JMU
38 T=A
GO TO 50
39 T=A+31.
GO TO 50
40 T=A+59.
GO TO 50
41 T=A+90.
GO TO 50
42 T=A+120.
GO TO 50
43 T=A+151.
GO TO 50
44 T=A+181.
GO TO 50
45 T=A+212.
GO TO 50
46 T=A+243.
GO TO 50
47 T=A+273.
GO TO 50
48 T=A+304.
GO TO 50
49 T=A+334.
50 MDA=T
IF (ISC-1) 51,51,54
51 DO 52 I=1,NC
E01(I)=STD1(I)
52 E02(I)=STD2(I)
53 INDSO=MDA
DO 530 I=1,ISN
AFD(I)=(DM(I)+DM(I)/60.)/24.
AET(I)=0.
530 FET(I)=0.
GO TO 69
54 MDB=MDA
INDS1=INDSO
DO 68 I=1,ISN
NY=60
DO 55 M=1,4
IF (JYR-NY) 59,56,55
55 NY=NY+4
WRITE OUTPUT TAPE 9,180
CALL EXIT
56 IF (MDA-60) 59,57,57
57 MDB=MDA+1
59 NY=60
LPR=0
DO 60 M=1,4
IF (MYR-NY) 58,61,60
60 NY=NY+4
WRITE OUTPUT TAPE 9,180
CALL EXIT
61 LPR=1
IF (INDSO-60) 58,610,610
610 INDS1=INDS1+1
58 IF (JYR-MYR) 580,580,581
580 IET(I)=MDB-INDS1
GO TO 67
581 IF (LPR) 582,582,583
582 KDAY=365-INDS1
GO TO 584
583 KDAY=366-INDS1
584 IER=JYR-MYR-1
IET(I)=KDAY+MDB+IER+365
IF (IER) 67,67,63
63 DO 65 M=1,IER
NY=60
DO 64 N=1,4
IF (MYR+M-NY) 65,66,64
64 NY=NY+4
65 CONTINUE
GO TO 67
66 IET(I)=IET(I)+1
67 dPD=(DM(I)+DM(I)/60.)/24.
FET(I)=IET(I)
FET(I)=FET(I)+dPD-AFD(I)
68 CONTINUE
KL=0
DO 680 I=IN,IP
KL=KL+1
680 AET(I)=FET(KL)
69 TE1=0.
TE2=0.
TE01=0.
TE02=0.
S1=0.
S2=0.
DO 70 I=1,NC
EE1(I)=STD1(I)*EXP(0.69315/HL1+FET(ISN-1))
EE2(I)=STD2(I)*EXP(0.69315/HL2+FET(ISN))
TE1=TE1+EE1(I)
TE2=TE2+EE2(I)
E1(I)=STD1(I)
E2(I)=STD2(I)
S1=S1+STD1(I)
S2=S2+STD2(I)
TE01=TE01+E01(I)
70 TE02=TE02+E02(I)
Y1=TE01/TE1
Y2=TE02/TE2
71 ISN=ISN-2
DO 73 I=1,ISN
SYE2=0.
SE2=0.
SE1=0.
SE12=0.
SYE1=0.
IX=IND(I)
DO 72 M=1,NC
SYE1=SYE1+SUBA(IX,M)*E1(M)
SYE2=SYE2+SUBA(IX,M)*E2(M)
SE2=SE2+E2(M)*2
SE1=SE1+E1(M)*2
72 SE12=SE12+E1(M)*E2(M)
D=SE1*SE2-SE12*2
A1(I)=(SYE1*SE2-SYE2*SE12)/D
73 A2(I)=(SE1*SYE2-SE12*SYE1)/D
DO 75 I=1,ISN
IX=IND(I)
SBR=SMBR(IX)
SS1(I)=0.
SS2(I)=0.
DO 74 M=1,NC
SS1(I)=SS1(I)+A1(I)*E1(M)
74 SS2(I)=SS2(I)+A2(I)*E2(M)
AV1(I)=(SS1(I)+SS2(I)+SBR)/ECT+(SBR+SS2(I))/ECT
AV2(I)=(SS1(I)+SS2(I)+SBR)/ECT+(SBR+SS1(I))/ECT
SS1(I)=SS1(I)+Y1
75 SS2(I)=SS2(I)+Y2
M=0
DO 750 I=IN,IP
M=M+1
RV1(I)=1./AV1(M)
RV2(I)=1./AV2(M)
PSS1(I)=SS1(M)
750 PSS2(I)=SS2(M)
PRINT ROUTINE FOLLOWS
S1AVG=0.
S2AVG=0.
DO 76 I=1,ISN
S1AVG=S1AVG+SS1(I)
76 S2AVG=S2AVG+SS2(I)
A1SN=ISN
ISN=ISN+1
SS1(ISN)=S1AVG/A1SN
SS2(ISN)=S2AVG/A1SN
INER (ISN)=0
ITC (ISN)=0
ICL (ISN)=0
ITD (ISN)=0
PMT (ISN)=0.
ITC (ISN)=0
FET (ISN)=0.
ICT (ISN)=0
L2BU=ISN*2+18
LL=61-LU-L2BU
IF (IIRR) 77,77,80
77 IIRR=1
78 WRITE OUTPUT TAPE 9,111
LU=0
GO TO 81
80 IF (LL) 78,81,81
81 WRITE OUTPUT TAPE 9,103,(CLAB1),I=1,81
WRITE OUTPUT TAPE 9,104,JMO,JDAY,JYR,MMO,MDAY,MYR
WRITE OUTPUT TAPE 9,105,ALAB,HL1,S1,TE1,Y1,(INCI),I=1,NC
WRITE OUTPUT TAPE 9,105,BLAB,HL2,S2,TE2,Y2
WRITE OUTPUT TAPE 9,107,ALAB,BLAB
WRITE OUTPUT TAPE 9,106
DO 82 I=1,ISN
82 WRITE OUTPUT TAPE 9,108,ICL(I),INER(I),ITD(I),PMT(I),ITC(I),
XFET(I),SS1(I),SS2(I),ICT(I)
LU=LU+ISN*2+18
IN=IP+1
ISN=0
83 IF (LMO) 88,88,84
89 IIRR=0
READ INPUT TAPE 10,112,LMO,LDAY,LYR
84 JMO=LMO
JDAY=LDAY
JYR=LYR
ISN=1
IP=IP+1
ISC=ISC+1
GO TO 3
88 IF (LYR) 85,85,89
85 DO 86 I=1,IP
86 WRITE OUTPUT TAPE 9,110,PSS1(I),AET(I),RV1(I),IPSER(I),IPDI(I),
XLAB
DO 87 I=1,IP
87 WRITE OUTPUT TAPE 9,110,PSS2(I),AET(I),RV2(I),IPSER(I),IPDI(I),
XLAB
J=0
K=0
L=0
IIRR=0
ISN=0
IP=0
IN=1
GO TO 1
END(1,1,0,0,0,0,1,0,0,1,0,0,0,0,0)

```

Fig. A-4. Flow Diagram for RTW-2 Program (Calculate Elapsed Time).

Fig. A-5. Flow Diagram for RTW-2 Program (Print and Punch Routine).