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## ABSTRACT

A FORTRAN program DOSE has been written for the calculation of the radiation dose from diagnostic radionuclides. It uses the basic dose equation of the Medical Internal Radiation Dose Committee and published absorbed fraction and decay data. Doses are calculated for a stated initial or cumulated activity in the whole body and those organs in which significant uptake occurs.

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COMPUTER CALCULATIONS; D CODES; FORTRAN; ORGANS; RADIATION DOSE DISTRIBUTION; RADIATION DOSES; RADIOPHARMACEUTICALS; WHOLE-BODY COUNTING

## CONTENTS

## 1. INTRODUCTION

The FORTRAN program DOSE described in this report permits the rapid calculation of a radiation dose estimate for a given activity distribution in the adult human body following the administration of a radiopharmaceutical. The calculation of radiation dose from radiopharmaceuticals has been greatly simplified by the Medical Internal Radiation Dose Committee (MIRD) Schema (Loevinger & Berman 1968, Brownell, Ellett & Reddy 1968). This has provided a single equation to cover calculations for all possible source and target areas in the body and includes all types of radiations emitted by diagnostic radionuclides.

This equation may be written:

$$\bar{D}\ (v \leftarrow r) = \frac{\tilde{A}_r}{M_v} \sum \Delta_i \phi_i \ (v \leftarrow r) \quad ,$$

where $\bar{D}\ (v \leftarrow r)$ = average absorbed dose to a volume v from a source r,

$\tilde{A}_r$ = cumulated activity in μCi-h,

$M_v$ = mass of target organ in grams,

$\Delta_i$ = absorbed dose constant for the ith emission from the source r, in g-rad/μCi-h,

$\phi_i\ (v \leftarrow r)$ = absorbed fraction for the ith emission with the source in r and v the target volume.

Thus, the dose to any organ may be calculated if the source organ cumulated activity, the mass of the target organ, and the appropriate absorbed dose constants and absorbed fractions are known. The source organ cumulated activity is determined experimentally. Absorbed fractions and absorbed dose constants can be found in the various MIRD publications, particularly those of Snyder *et al.* (1969) and Dillman (1969, 1970).

In practice, dose estimates are only obtained for the organs in which significant uptake occurs, and a few additional sensitive target regions. As well as the obvious labour saving involved, this approach eliminates the possibility that an organ of interest receiving an unexpectedly high dose could be ignored.

## 2. OUTLINE OF PROGRAM

A listing of the program is given in Appendix A. It consists of the basic program MAIN, and a subroutine EXTRAP. The absorbed fractions, mainly from Snyder *et al.* (1969), are read in as the array F(I,J,K) (Appendix B). The subscripts refer to the source organ, the target organ and the photon energy.

Where possible, gaps in the absorbed fraction tables were made up by use of the reciprocity principle which states that the ratio of absorbed fractions is equal to the ratio of the organ masses:

$$\frac{\phi_i\ (v \leftarrow r)}{\phi_i\ (r \leftarrow v)} = \frac{M_v}{M_r}$$

For the combination where the heart is both the source and target organ, the absorbed fractions for a small sphere of mass 0.6 kg were used (Brownell, Ellett & Reddy 1968).

Other gaps in the table were filled by linear extrapolation between existing values. To permit extrapolation to energies below 0.01 MeV, values of $\phi_i$ have been included for zero photon energies. If the target organ is also the source organ, the zero energy absorbed fraction is assumed to be unity. For an external target, this absorbed fraction is assumed to be zero. Where it has not been possible to provide any estimate of absorbed fraction, an artificial value of 2 is used in the array F(I,J,K) to instruct the program that the particular data does not currently exist.

The values of the absorbed fractions for energies between those listed in the table are obtained by using the subroutine EXTRAP. Because of the statistical uncertainty of the data, it was decided that linear interpolation between known values would be adequate. If improved absorbed fraction data becomes available, consideration should be given to the use of a more sophisticated method of interpolation.

In its present form, the program calculates doses for eleven organs, which are given together with their respective 'standard man' masses in a series of DATA statements. The organs cited are: whole body, kidney, lung, liver, skeleton, bladder, spleen, pancreas, thyroid, heart and ovaries. Details of the radioisotope involved are provided on data cards. The first card lists its name (SOTOP), the number of photon or particle emissions (NES), and its half life (THALF). The emitted energies, absorbed dose constants and type of emission are read from subsequent cards (one emission per card) and stored in the arrays, E,D, and ITYPE. The most appropriate sources of this information are the MIRD publications of Dillman (1969, 1970). A penetrating emission is indicated by ITYPE=0. A non-penetrating emission is indicated by ITYPE=1. The calculations are based on either initial activities (IOPT=1) or cumulated activities (IOPT=0), read in at Statement 1001, taken up by any or all of the organs included in the program. Cumulated activities are usually found by experiment (Lathrop *et al.* 1972, Hetherington 1973) and provide the basis for a more accurate dose estimate. If the initial uptake in an organ is known but its ultimate fate not determined, then an estimate of the maximum dose is obtained if removal by radioactive decay only is presumed.

For a given source-target combination, the program determines the absorbed fraction, the product of absorbed fraction and absorbed dose constant, the sum of these products for all emitted radiations and, finally, the target organ dose. The total dose to each organ is also determined. If no activity is given for a particular source organ, no calculation is performed and the contribution from that source organ to any target dose is set at zero. For a source-target combination encountering the value of 2 at a particular energy in the absorbed fraction array, F(I,J,K), or in an extrapolation, the dose is set to zero and an appropriate message is included in the output.

A typical example of DOSE input data and the output for two arbitrary activity distributions of the radioisotope technetium-99m are given in Appendix C. The output lists the activity distribution, the calculated dose for each source-target combination and the total dose to each organ.

## 3. DISCUSSION

The published absorbed fractions of Snyder *et al.* (1969) for the whole body as the source organ are based on a uniform distribution of the radionuclide in the body. It has been shown by Cloutier *et al.* (1973) and Smith (1970) that, because of this assumption, doses to organs in which significant uptake occurs, may be over estimated. To minimise this problem, the approach in dose estimates for AAEC produced radiopharmaceuticals (Hetherington 1973, and AAEC unpublished work) has been to consider as the whole body distribution only that activity which cannot be specifically assigned, on the basis of appropriate investigation, to particular organs. Since the unassigned activity is generally small in comparison with the specific organ uptake, the error introduced to individual organ estimates will be small in comparison with that due to the error in the basic organ uptake estimate. This method has the additional advantage that the 'whole body dose' does not include a component from non-penetrating emissions from large concentrations of activity in specific organs. The operation of the program in its present form assumes this approach. Some modifications would be required if a different convention were adopted.

## 4. REFERENCES

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# APPENDIX A

## LISTING OF THE PROGRAM 'DOSE'

```
C*****************************************************************************
C
C     THIS PROGRAM CALCULATES THE RADIATION DOSE TO VARIOUS ORGANS OF THE
C     HUMAN BODY FROM DISTRIBUTED RADIOACTIVITY IN THE BODY
C
C*****************************************************************************
C
      DIMENSION E(100),D(100),ITYPE(100),ACT(20),WEI(20),F(20,20,13),ORG
     1AN(20,3),DOSE(20),SOTOP(4)
      COMMON F
C
C
C     READ IN DATA COMMON TO ALL RADIOACTIVITY DISTRIBUTIONS
      DATA  ORGAN(1,1),ORGAN(1,2),ORGAN(1,3),WEI(1)/'WHOL','E BO','DY  '
     1,70036.0/
      DATA  ORGAN(2,1),ORGAN(2,2),ORGAN(2,3),WEI(2)/'KIDN','EYS ','    '
     1,288.0/
      DATA  ORGAN(3,1),ORGAN(3,2),ORGAN(3,3),WEI(3)/'LUNG','S   ','    '
     1,999.0/
      DATA  ORGAN(4,1),ORGAN(4,2),ORGAN(4,3),WEI(4)/'LIVE','R   ','    '
     1,1833.0/
      DATA  ORGAN(5,1),ORGAN(5,2),ORGAN(5,3),WEI(5)/'SKEL','ETON','    '
     1,10091.0/
      DATA  ORGAN(6,1),ORGAN(6,2),ORGAN(6,3),WEI(6)/'BLAD','DER ','    '
     1,509.0/
      DATA  ORGAN(7,1),ORGAN(7,2),ORGAN(7,3),WEI(7)/'SPLE','EN  ','    '
     1,176.0/
      DATA  ORGAN(8,1),ORGAN(8,2),ORGAN(8,3),WEI(8)/'PANC','REAS','    '
     1,61.0/
      DATA  ORGAN(9,1),ORGAN(9,2),ORGAN(9,3),WEI(9)/'THYR','OID ','    '
     1,19.9/
      DATA ORGAN(10,1),ORGAN(10,2),ORGAN(10,3),WEI(10)/'HEAR','T   ','
     1  ',603.0/
      DATA ORGAN(11,1),ORGAN(11,2),ORGAN(11,3),WEI(11)/'OVAR','IES ','
     1  ',8.0/
      READ(1,11)(((F(I,J,K),K=1,13),J=1,11),I=1,11)
   11 FORMAT(6F10.3/7F10.3)
      READ(1,19) SOTOP,NES,THALF
   19 FORMAT(4A4,I3,F6.2)
      WRITE(3,456)THALF
  456 FORMAT('1',E10.3)
      DO 7 I=1,NES
      READ(1,6)E(I),D(I),ITYPE(I)
    6 FORMAT(2F7.4,I2)
    7 CONTINUE
C
C
C     READ IN (NEXT) RADIOACTIVITY DISTRUBUTION TO BE ANALYSED
C
C     IOPT=0   CUMULATED ACTIVITY (MILLICURIE-HOURS)
C         =1   INITIAL ACTIVITY (MILLICURIES)
C
 1001 READ(1,13,END=1000) IOPT,(ACT(I),I=1,11)
   13 FORMAT(I1,11F6.3)
```

```
C     STOP IF NO MORE ACTIVITY DISTRIBUTIONS ARE GIVED
C
C
C     WRITE HEADINGS
      WRITE(3,16)
   16 FORMAT(1H1,55HTARGET ORGAN DOSE IN RADS FROM ACTIVITY IN SOURCE OR
     1GAN//1H ,'SOURCE        WHOLE BODY      KIDNEY         LUNG        LIVER
     2  SKELETON     BLADDER       SPLEEN    PANCREAS     THYROID       HEART
     3   OVARIES'//)
      IF(IOPT)30,30,31
   30 WRITE(3,32) SOTOP,(ACT(I),I=1,11)
   32 FORMAT(' CUMULATED ACTIVITY DISTRIBUTION IN MILLICURIE-HOURS OF ',
     14A4/' ',11X,11F11.3)
      GOTO 34
   31 WRITE(3,33) SOTOP,(ACT(I),I=1,11)
   33 FORMAT(' INITIAL ACTIVITY DISTRIBUTION IN MILLICURIES OF ',4A4/' '
     1,11X,11F11.3)
   34 CONTINUE
      WRITE(3,20)
   20 FORMAT(1H ,'  TARGET')
C
C
C     DOSE  CALCULATIONS
      DO 5 J=1,11
      TOTDOS=0.0
      DO 4 I=1,11
C
C     IF ACTIVITY IN SOURCE ORGAN IS 0,SET CONTRIBUTION TO  DOSE IN TARGET
C     ORGAN TO 0
      IF(ACT(I))25,25,26
   26 SIGDF=0.
C
C     LOOP TO 10 CALCULATES SUM OF ALL ENERGIES PER DISINTEGRATION.ABSORBED
C     FRACTIONS
      DO 10 IE=1,NES
C
C     IF EMMISSION IS ELECTRON,ABSORBED FRACTION IS DECIDED ELSEWHERE
      IF(ITYPE(IE))27,27,1
   27 EN=E(IE)
      CALL EXTRAP(I,J,EN,FI)
      IF(EN+1.)23,23,28
   28 CONTINUE
      GOTO 3
    1 CONTINUE
      IF(I-J)29,2,29
C
C     EMMISSION IS ELECTRON,SOURCE ORGAN IS NOT TARGET ORGAN,ABSORBED FRACTION
C     IS SET TO 0
   29 FI=0.
      GOTO 3
C
C     EMMISSION IS ELECTRON,SOURCE ORGAN IS TARGET ORGAN,ABSORBED FRACTION
C     SET TO 1
    2 FI=1.0
    3 CONTINUE
C
C
      DELF=D(IE)*FI
      SIGDF=SIGDF+DELF
   10 CONTINUE
```

```
C
C     DOSE(I) IS THE DOSE CONTRIBUTION TO ORGAN(J) FROM ACTIVITY IN ORGAN(I)
      DOSE(I)=ACT(I)/WEI(J)*SIGDF*(THALF/Ø.69315)**IOPT*1ØØØ.
      TOTDOS=TOTDOS+DOSE(I)
C     TOTDOS IS THE TOTAL DOSE TO ORGAN(J)
      GO TO 4
   25 DOSE(I)=Ø.Ø
C
C
C     WRITE RESULTS
    4 CONTINUE
      WRITE(3,12)(ORGAN(J,K),K=1,3),(DOSE(L),L=1,11)
   12 FORMAT(1H ,3A4,F1Ø.3,1ØF11.3)
      WRITE(3,14)(ORGAN(J,K),K=1,3),TOTDOS
   14 FORMAT(1H ,5ØX,6HTOTAL ,3A4,6HDOSE**,F1Ø.3,4HRADS//)
    5 CONTINUE
      GO TO 1ØØ1
 1ØØØ STOP
   23 WRITE(3,22)(ORGAN(I,K),K=1,3),(ORGAN(J,K),K=1,3)
   22 FORMAT(' ABSORBED FRACTION DATA FOR THE    ',3A4,'TARGETING THE    '
     1,3A4,'IS NOT AVAILABLE'/' DOSE IS SET TO ZERO')
      DOSE(I)=Ø.Ø
      GO TO 4
      END
```

```
      SUBROUTINE EXTRAP(I,J,E,FI)
C     THIS SUBROUTINE PERFORMS LINEAR EXTRAPOLATION  TO OBTAIN VALUES
C     OF THE ABSORBED FRACTION FOR VARIOUS ENERGIES AND SOURCE-TARGET
C     RELATIONSHIPS
C
C     'I' IS INDEX OF SOURCE ORGAN
C     'J' IS INDEX OF TARGET ORGAN
C     'E' IS ENERGY OF PENATRATING EMMISSION
C     'FI' IS THE ABSORBED FRACTION REQUIRED
C
      DIMENSION F(20,20,13),EVAL(13)
      COMMON F
      DATA EVAL/0.0,0.01,0.015,0.02,0.03,0.05,0.1,0.2,0.5,1.0,1.5,2.0,4.
     10/
      DO 1 IJ=1,13
      IF(E-EVAL(IJ))2,1,1
    1 CONTINUE
      WRITE(3,3)
    3 FORMAT(1H ,24HENERGY >4MEV ENCOUNTERED)
      FI=0.0
C     IF ENERGY OF GAMMA > 4 MEV,ABSORBED FRACTION SET TO 0
      RETURN
    2 CONTINUE
      II=IJ-1
      DOWN=F(I,J,II)
      UP=F(I,J,IJ)
C
C     IF ABSORBED FRACTION DATA IS NOT AVAILABLE IN THE CARD LIBRARY,VALUE
C     READ FROM CARD IS 2
      IF((DOWN.GT.1.5).OR.(UP.GT.1.5))GOTO 5
      EDOWN=EVAL(II)
      EUP=EVAL(IJ)
C
C     SIMPLE LINEAR INTERPOLATION
      FI=DOWN+(UP-DOWN)/(EUP-EDOWN)*(E-EDOWN)
      RETURN
C
C     E IS SET TO -2 TO NOTIFY MAIN PROGRAM DATA IS UNAVAILABLE
    5 E=-2.0
      RETURN
      END
```

# APPENDIX B

## LISTING OF ABSORBED FRACTION DATA

( AS (((F(I,J,K),K=1,13),J=1,11),I=1,11) )

| | | | | | | |
|---|---|---|---|---|---|---|
| 1.000E+00 | .959E+00 | .933E+00 | .892E+00 | .774E+00 | .548E+00 | |
| .370E+00 | .338E+00 | .340E+00 | .321E+00 | .302E+00 | .284E+00 | .240E+00 |
| .000E+00 | .410E-02 | .446E-02 | .412E-02 | .338E-02 | .233E-02 | |
| .183E-02 | .171E-02 | .142E-02 | .161E-02 | .152E-02 | .154E-02 | .904E-03 |
| .000E+00 | .127E-01 | .142E-01 | .138E-01 | .122E-01 | .808E-02 | |
| .551E-02 | .507E-02 | .496E-02 | .466E-02 | .466E-02 | .427E-02 | .568E-02 |
| .000E+00 | .260E-01 | .244E-01 | .249E-01 | .221E-01 | .154E-01 | |
| .120E-01 | .111E-01 | .101E-01 | .896E-02 | .912E-02 | .847E-02 | .560E-02 |
| .000E+00 | .144E+00 | .153E+00 | .167E+00 | .188E+00 | .153E+00 | |
| .810E-01 | .550E-01 | .488E-01 | .456E-01 | .413E-01 | .396E-01 | .252E-01 |
| .000E+00 | .757E-02 | .762E-02 | .688E-02 | .625E-02 | .445E-02 | |
| .352E-02 | .327E-02 | .341E-02 | .274E-02 | .291E-02 | .231E-02 | .147E-02 |
| .000E+00 | .260E-02 | .237E-02 | .242E-02 | .223E-02 | .149E-02 | |
| .111E-02 | .798E-03 | .116E-02 | .914E-03 | .903E-03 | .740E-03 | .368E-03 |
| .000E+00 | .134E-02 | .103E-02 | .828E-03 | .780E-03 | .567E-03 | |
| .449E-03 | .444E-03 | .382E-03 | .534E-03 | .348E-03 | .358E-03 | .142E-03 |
| .000E+00 | .265E-03 | .263E-03 | .602E-04 | .111E-03 | .114E-03 | |
| .873E-04 | .418E-04 | .500E-04 | .600E-04 | .700E-04 | .810E-04 | .400E-04 |
| 0.000E+00 | 0.756E-02 | 0.804E-02 | 0.769E-02 | 0.635E-02 | 0.469E-02 | |
| 0.420E-02 | 0.337E-02 | 0.372E-02 | 0.301E-02 | 0.345E-02 | 0.312E-02 | 0.145E-02 |
| 0.000E+00 | 0.125E-03 | 0.125E-03 | 0.125E-03 | 0.122E-03 | 0.991E-04 | |
| 0.702E-04 | 0.632E-04 | 0.601E-04 | 0.560E-04 | 0.521E-04 | 0.492E-04 | 0.403E-04 |
| 1.000E+00 | .996E+00 | .996E+00 | .971E+00 | .860E+00 | .633E+00 | |
| .453E+00 | .409E+00 | .468E+00 | .385E+00 | .359E+00 | .336E+00 | .285E+00 |
| 1.000E+00 | .932E+00 | .787E+00 | .582E+00 | .298E+00 | .112E+00 | |
| .661E-01 | .676E-01 | .730E-01 | .690E-01 | .600E-01 | .559E-01 | .449E-01 |
| 0.000E+00 | 0.284E-04 | 0.284E-04 | 0.284E-04 | 0.101E-02 | 0.317E-02 | |
| .332E-02 | .274E-02 | .339E-02 | .357E-02 | .328E-02 | .253E-02 | .265E-02 |
| 0.000E+00 | 0.119E-02 | 0.119E-02 | 0.808E-02 | 0.264E-01 | 0.359E-01 | |
| .282E-01 | .243E-01 | .229E-01 | .218E-01 | .203E-01 | .193E-01 | .157E-01 |
| 0.000E+00 | 0.305E-02 | 0.305E-02 | 0.208E-01 | 0.708E-01 | 0.110E+00 | |
| .662E-01 | .414E-01 | .336E-01 | .318E-01 | .309E-01 | .262E-01 | .250E-01 |
| 0.000E+00 | 0.219E-04 | 0.219E-04 | 0.219E-04 | 0.219E-04 | 0.291E-03 | |
| .450E-03 | .574E-03 | .654E-03 | .854E-03 | .852E-03 | .678E-03 | .697E-03 |
| 0.000E+00 | 0.175E-02 | 0.175E-02 | 0.592E-02 | 0.113E-01 | 0.871E-02 | |
| .612E-02 | .562E-02 | .531E-02 | .457E-02 | .471E-02 | .423E-02 | .313E-02 |
| 0.000E+00 | 0.243E-03 | 0.243E-03 | 0.243E-03 | 0.162E-02 | 0.175E-02 | |
| .168E-02 | .154E-02 | .114E-02 | .939E-02 | .111E-02 | .102E-02 | .802E-03 |
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | |
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 |
| 0.000E+00 | 0.204E-03 | 0.204E-03 | 0.204E-03 | 0.204E-03 | 0.142E-02 | |
| 0.185E-02 | 0.170E-02 | 0.200E-02 | 0.181E-02 | 0.177E-02 | 0.181E-02 | 0.148E-02 |
| 0.000E+00 | 0.260E-05 | 0.260E-05 | 0.260E-05 | 0.260E-05 | 0.247E-04 | |
| 0.290E-04 | 0.298E-04 | 0.357E-04 | 0.305E-04 | 0.318E-04 | 0.306E-04 | 0.348E-04 |
| 1.000E+00 | .996E+00 | .996E+00 | .981E+00 | .878E+00 | .610E+00 | |
| .392E+00 | .359E+00 | .354E+00 | .329E+00 | .301E+00 | .288E+00 | .241E+00 |
| 0.000E+00 | 0.326E-03 | 0.326E-03 | 0 326E-03 | 0.326E-03 | 0.923E-03 | |
| .901E-03 | .934E-03 | .116E-02 | .814E-03 | .915E-03 | .939E-03 | .623E-03 |
| 1.000E+00 | .815E+00 | .665E+00 | .475E+00 | .231E+00 | .892E-01 | |
| .493E-01 | .498E-01 | .514E-01 | .452E-01 | .413E-01 | .382E-01 | .314E-01 |
| .000E+00 | .277E-03 | .420E-02 | .142E-01 | .258E-01 | .239E-01 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| .173E-01 | .155E-01 | .154E-01 | 9138E-01 | .133E-01 | 9117E-01 | .106E-01 |
| .000E+00 | .247E-03 | .583E-02 | .331E-01 | .952E-01 | .113E+00 | |
| .611E-01 | .389E-01 | .324E-01 | .307E-01 | .278E-01 | .278E-01 | .242E-01 |
| 0.000E+00 | 0.497E-04 | 0.497E-04 | 0.497E-04 | 0.497E-04 | 0.497E-04 | |
| .497E-04 | .145E-03 | .161E-03 | .158E-03 | .177E-03 | .325E-03 | .259E-03 |
| 0.000E+00 | 0.128E-03 | 0.128E-03 | 0.819E-03 | 0.182E-02 | 0.205E-02 | |
| .146E-02 | .146E-02 | .119E-02 | .113E-02 | .108E-02 | .103E-02 | .854E-03 |
| 0.000E+00 | 0.379E-03 | 0.379E-03 | 0.379E-03 | 0.379E-03 | 0.573E-03 | |
| .607E-03 | .430E-03 | .426E-03 | .571E-03 | .569E-03 | .647E-03 | .240E-03 |
| 0.000E+00 | 0.383E-04 | 0.383E-04 | 0.383E-04 | 0.383E-04 | 0.383E-04 | |
| .329E-04 | .539E-04 | .649E-04 | .633E-04 | .633E-04 | .633E-04 | .633E-04 |
| 0.000E+00 | 0.215E-02 | 0.215E-02 | 0.983E-02 | 0.228E-01 | 0.203E-01 | |
| 0.139E-01 | 0.130E-01 | 0.111E-01 | 0.102E-01 | 0.898E-02 | 0.940E-02 | 0.718E-02 |
| 0.000E+00 | 0.483E-06 | 0.483E-06 | 0.483E-06 | 0.483E-06 | 0.483E-06 | |
| 0.203E-05 | 0.274E-05 | 0.418E-05 | 0.466E-05 | 0.542E-05 | 0.564E-05 | 0.396E-05 |
| 1.000E+00 | .996E+00 | .997E+00 | .984E+00 | .905E+00 | .661E+00 | |
| .454E+00 | .415E+00 | .407E+00 | .381E+00 | .355E+00 | .336E+00 | .282E+00 |
| 0.000E+00 | 0.105E-03 | 0.105E-03 | 0.106E-02 | 0.437E-02 | 0.566E-02 | |
| .437E-02 | .390E-02 | .386E-02 | .335E-02 | .294E-02 | .301E-02 | .256E-02 |
| .000E+00 | .139E-03 | .299E-02 | .859E-02 | .165E-01 | .147E-01 | |
| .101E-01 | .923E-02 | .838E-02 | .825E-02 | .696E-02 | .601E-02 | .568E-02 |
| 1.000E+00 | .967E+00 | .898E+00 | .784E+00 | .543E+00 | .278E+00 | |
| .165E+00 | .158E+00 | .157E+00 | .144E+00 | .132E+00 | .122E+00 | .101E+00 |
| .000E+00 | .721E-03 | .458E-02 | .209E-01 | .587E-01 | .803E-01 | |
| .498E-01 | .324E-01 | .260E-01 | .231E-01 | .229E-01 | .217E-01 | .179E-01 |
| 0.000E+00 | 0.169E-03 | 0.169E-03 | 0.169E-03 | 0.169E-03 | 0.169E-03 | |
| .275E-03 | .389E-03 | .358E-03 | .521E-03 | .515E-03 | .735E-03 | .474E-03 |
| 0.000E+00 | 0.617E-04 | 0.617E-04 | 0.617E-04 | 0.617E-04 | 0.533E-03 | |
| .606E-03 | .645E-03 | .619E-03 | .633E-03 | .396E-03 | .336E-03 | .503E-03 |
| 0.000E+00 | 0.186E-03 | 0.186E-03 | 0.186E-03 | 0.107E-02 | 0.130E-02 | |
| .105E-02 | .102E-02 | .822E-03 | .864E-03 | .587E-03 | .765E-03 | .612E-03 |
| 0.000E+00 | 0.284E-04 | 0.284E-04 | 0.284E-04 | 0.284E-04 | 0.284E-04 | |
| 0.284E-04 | 0.284E-04 | 0.284E-04 | 0.284E-04 | 0.284E-04 | 0.284E-04 | 0.284E-04 |
| 0.000E+00 | 0.112E-03 | 0.112E-03 | 0.132E-02 | 0.531E-02 | 0.762E-02 | |
| 0.674E-02 | 0.570E-02 | 0.573E-02 | 0.501E-02 | 0.498E-02 | 0.392E-02 | 0.373E-02 |
| 0.000E+00 | 0.170E-05 | 0.170E-05 | 0.170E-05 | 0.170E-05 | 0.112E-04 | |
| 0.175E-04 | 0.182E-04 | 0.186E-04 | 0.197E-04 | 0.192E-04 | 0.205E-04 | 0.192E-04 |
| 1.000E+00 | .943E+00 | .939E+00 | .917E+00 | .847E+00 | .608E+00 | |
| .374E+00 | .332E+00 | .335E+00 | .315E+00 | .298E+00 | .278E+00 | .238E+00 |
| 0.000E+00 | 0.728E-04 | 0.728E-04 | 0.728E-04 | 0.600E-03 | 0.912E-03 | |
| .931E-03 | .989E-03 | .892E-03 | .907E-03 | .772E-03 | .897E-03 | .927E-03 |
| .000E+00 | .135E-03 | .370E-03 | .106E-02 | .274E-02 | .357E-02 | |
| .314E-02 | .300E-02 | .285E-02 | .300E-02 | .287E-02 | .210E-02 | .197E-02 |
| 0.000E+00 | 0.225E-03 | 0.225E-03 | 0.826E-03 | 0.303E-02 | 0.486E-02 | |
| .486E-02 | .466E-02 | .433E-02 | .430E-02 | .389E-02 | .428E-02 | .331E-02 |
| 1.000E+00 | .926E+00 | .893E+00 | .830E+00 | .681E+00 | .400E+00 | |
| .173E+00 | .123E+00 | .118E+00 | .110E+00 | .102E+00 | .940E-01 | .797E-01 |
| 0.000E+00 | 0.227E-03 | 0.227E-03 | 0.227E-03 | 0.227E-03 | 0.868E-03 | |
| .106E-02 | .106E-02 | .106E-02 | .843E-03 | .956E-03 | .776E-03 | .669E-03 |
| 0.000E+00 | 0.334E-03 | 0.334E-03 | 0.334E-03 | 0.334E-03 | 0.383E-03 | |
| .345E-03 | .374E-03 | .411E-03 | .499E-03 | .557E-03 | .563E-03 | .300E-03 |
| 0.000E+00 | 0.120E-03 | 0.120E-03 | 0.120E-03 | 0.120E-03 | 0.203E-03 | |
| .156E-03 | .189E-03 | .215E-03 | .151E-03 | .179E-03 | .835E-04 | .153E-03 |
| 0.000E+00 | 0.244E-04 | 0.244E-04 | 0.244E-04 | 0.244E-04 | 0.244E-04 | |
| 0.113E-04 | 0.113E-04 | 0.113E-04 | 0.113E-04 | 0.113E-04 | 0.113E-04 | 0.113E-04 |
| 0.000E+00 | 0.948E-03 | 0.948E-03 | 0.948E-03 | 0.948E-03 | 0.167E-02 | |
| 0.188E-02 | 0.175E-02 | 0.156E-02 | 0.174E-02 | 0.155E-02 | 0.144E-02 | 0.137E-02 |
| 0.000E+00 | 0.268E-06 | 0.268E-06 | 0.117E-04 | 0.714E-04 | 0.104E-03 | |
| 0.616E-04 | 0.375E-04 | 0.289E-04 | 0.250E-04 | 0.249E-04 | 0.216E-04 | 0.196E-04 |
| 1.000E+00 | .996E+00 | .996E+00 | .980E+00 | .902E+00 | .693E+00 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| .500E+00 | .462E+00 | .439E+00 | .418E+00 | .390E+00 | .363E+00 | .302E+00 |
| 0.000E+00 | 0.102E-03 | 0.102E-03 | 0.102E-03 | 0.102E-03 | 0.102E-03 | |
| .360E-03 | .313E-03 | .390E-03 | .473E-03 | .440E-03 | .363E-03 | .308E-03 |
| 0.000E+00 | 0.344E-04 | 0.344E-04 | 0.344E-04 | 0.344E-04 | 0.344E-04 | |
| .344E-04 | .110E-03 | .162E-03 | .328E-03 | .375E-03 | .361E-03 | .524E-03 |
| 0.000E+00 | 0.364E-03 | 0.364E-03 | 0.364E-03 | 0.364E-03 | 0.364E-03 | |
| .108E-02 | .132E-02 | .167E-02 | .174E-02 | .179E-02 | .197E-02 | .182E-02 |
| 0.000E+00 | 0.309E-03 | 0.309E-03 | 0.309E-03 | 0.131E-01 | 0.496E-01 | |
| .425E-01 | .283E-01 | .212E-01 | .182E-01 | .179E-01 | .179E-01 | .147E-01 |
| 1.000E+00 | .963E+00 | .885E+00 | .745E+00 | .464E+00 | .201E+00 | |
| .117E+00 | .116E+00 | .116E+00 | .107E+00 | .100E+00 | .910E-01 | .722E-01 |
| 0.000E+00 | 0.164E-04 | 0.164E-04 | 0.164E-04 | 0.164E-04 | 0.164E-04 | |
| .105E-03 | .853E-04 | .816E-04 | .208E-03 | .136E-03 | .213E-03 | .113E-03 |
| 0.000E+00 | 0.302E-04 | 0.302E-04 | 0.302E-04 | 0.302E-04 | 0.302E-04 | |
| .302E-04 | .320E-04 | .523E-04 | .130E-03 | .476E-04 | .476E-04 | .476E-04 |
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | |
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | |
| 0.000E+00 | 0.105E-04 | 0.105E-04 | 0.105E-04 | 0.105E-04 | 0.105E-04 | |
| 0.105E-04 | 0.680E-04 | 0.867E-04 | 0.277E-03 | 0.166E-03 | 0.207E-03 | 0.156E-03 |
| 0.000E+00 | 0.259E-04 | 0.259E-04 | 0.259E-04 | 0.230E-03 | 0.344E-03 | |
| 0.252E-03 | 0.223E-03 | 0.200E-03 | 0.175E-03 | 0.161E-03 | 0.159E-03 | 0.130E-03 |
| 1.000E+00 | .996E+00 | .997E+00 | .987E+00 | .911E+00 | .661E+00 | |
| .449E+00 | .412E+00 | .407E+00 | .378E+00 | .356E+00 | .336E+00 | .279E+00 |
| 0.000E+00 | 0.221E-02 | 0.221E-02 | 0.972E-02 | 0.192E-01 | 0.142E-01 | |
| .946E-02 | .842E-02 | .896E-02 | .759E-02 | .760E-02 | .641E-02 | .562E-02 |
| 0.000E+00 | 0.109E-02 | 0.109E-02 | 0.455E-02 | 0.135E-01 | 0.124E-01 | |
| .910E-02 | .772E-02 | .812E-02 | .716E-02 | .638E-02 | .618E-02 | .538E-02 |
| 0.000E+00 | 0.866E-03 | 0.866E-03 | 0.866E-03 | 0.866E-03 | 0.542E-02 | |
| .718E-02 | .692E-02 | .566E-02 | .651E-02 | .576E-02 | .614E-02 | .440E-02 |
| 0.000E+00 | 0.275E-02 | 0.275E-02 | 0.163E-01 | 0.590E-01 | 0.838E-01 | |
| .515E-01 | .325E-01 | .267E-01 | .255E-01 | .229E-01 | .228E-01 | .203E-01 |
| 0.000E+00 | 0.793E-04 | 0.793E-04 | 0.793E-04 | 0.793E-04 | 0.793E-04 | |
| .160E-03 | .301E-03 | .529E-03 | .426E-03 | .513E-03 | .646E-03 | .414E-03 |
| 1.000E+00 | .944E+00 | .817E+00 | .625E+00 | .331E+00 | .128E+00 | |
| .709E-01 | .735E-01 | .769E-01 | .699E-01 | .650E-01 | .599E-01 | .483E-01 |
| 0.000E+00 | 0.253E-02 | 0.253E-02 | 0.759E-02 | 0.106E-01 | 0.772E-02 | |
| .465E-02 | .391E-02 | .373E-02 | .367E-02 | .317E-02 | .329E-02 | .236E-02 |
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | |
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 |
| 0.000E+00 | 0.431E-04 | 0.431E-04 | 0.431E-04 | 0.143E-02 | 0.368E-02 | |
| 0.389E-02 | 0.328E-02 | 0.319E-02 | 0.319E-02 | 0.263E-02 | 0.260E-02 | 0.238E-02 |
| 0.000E+00 | 0.580E-05 | 0.580E-05 | 0.580E-05 | 0.580E-05 | 0.580E-05 | |
| 0.152E-04 | 0.157E-04 | 0.192E-04 | 0.166E-04 | 0.144E-04 | 0.211E-04 | 0.201E-04 |
| 1.000E+00 | .996E+00 | .997E+00 | .993E+00 | .965E+00 | .776E+00 | |
| .546E+00 | .485E+00 | .469E+00 | .435E+00 | .405E+00 | .382E+00 | .315E+00 |
| 0.000E+00 | 0.106E-02 | 0.106E-02 | 0.106E-02 | 0.701E-02 | 0.102E-01 | |
| .735E-02 | .637E-02 | .611E-02 | .551E-02 | .552E-02 | .418E-02 | .402E-02 |
| 0.000E+00 | 0.105E-02 | 0.105E-02 | 0.105E-02 | 0.888E-02 | 0.128E-01 | |
| .101E-01 | .872E-02 | .816E-02 | .753E-02 | .669E-02 | .689E-02 | .584E-02 |
| 0.000E+00 | 0.347E-03 | 0.347E-03 | 0.500E-02 | 0.283E-01 | 0.401E-01 | |
| .326E-01 | .273E-01 | .251E-01 | .221E-01 | .223E-01 | .206E-01 | .165E-01 |
| 0.000E+00 | 0.456E-03 | 0.456E-03 | 0.750E-02 | 0.493E-01 | 0.966E-01 | |
| .672E-01 | .424E-01 | .319E-01 | .293E-01 | .250E-01 | .247E-01 | .225E-01 |
| 0.000E+00 | 0.511E-04 | 0.511E-04 | 0.511E-04 | 0.511E-04 | 0.511E-04 | |
| .247E-03 | .460E-03 | .475E-03 | .518E-03 | .614E-03 | .440E-03 | .387E-03 |
| .000E+00 | .514E-03 | .700E-02 | .224E-01 | .309E-01 | .217E-01 | |
| .134E-01 | .113E-01 | .108E-01 | .100E-01 | .881E-02 | .907E-02 | .685E-02 |
| 1.000E+00 | .887E+00 | .666E+00 | .442E+00 | .195E+00 | .676E-01 | |
| .383E-01 | .418E-01 | .437E-01 | .401E-01 | .374E-01 | .341E-01 | .267E-01 |
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 |
| 0.000E+00 | 0.358E-03 | 0.358E-03 | 0.358E-03 | 0.381E-02 | 0.918E-02 | |
| 0.740E-02 | 0.661E-02 | 0.562E-02 | 0.599E-02 | 0.563E-02 | 0.431E-02 | 0.399E-02 |
| 0.000E+00 | 0.733E-05 | 0.773E-05 | 0.773E-05 | 0.773E-05 | 0.773E-05 | |
| 0.206E-04 | 0.170E-04 | 0.215E-04 | 0.173E-04 | 0.102E-04 | 0.273E-04 | 0.273E-04 |
| 1.000E+00 | .996E+00 | .992E+00 | .944E+00 | .756E+00 | .481E+00 | |
| .327E+00 | .307E+00 | .313E+00 | .296E+00 | .278E+00 | .263E+00 | .218E+00 |
| 0.000E+00 | 0.232E-04 | 0.232E-04 | 0.232E-04 | 0.232E-04 | 0.232E-04 | |
| .232E-04 | .335E-04 | .649E-04 | .995E-04 | .101E-03 | .131E-03 | .927E-04 |
| 0.000E+00 | 0.137E-02 | 0.137E-02 | 0.137E-02 | 0.137E-02 | 0.374E-02 | |
| .364E-02 | .339E-02 | .406E-02 | .383E-02 | .352E-02 | .309E-02 | .290E-02 |
| 0.000E+00 | 0.229E-03 | 0.229E-03 | 0.229E-03 | 0.229E-03 | 0.229E-03 | |
| .649E-03 | .682E-03 | .939E-03 | .122E-02 | .155E-02 | .136E-02 | .120E-02 |
| 0.000E+00 | 0.217E-02 | 0.217E-02 | 0.217E-02 | 0.243E-01 | 0.590E-01 | |
| .422E-01 | .288E-01 | .244E-01 | .235E-01 | .213E-01 | .213E-01 | .188E-01 |
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | |
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 |
| 0.000E+00 | 0.241E-04 | 0.241E-04 | 0.241E-04 | 0.241E-04 | 0.241E-04 | |
| .426E-04 | .288E-04 | .847E-04 | .190E-03 | .116E-03 | .116E-03 | .997E-04 |
| 0.000E+00 | 0.170E-04 | 0.170E-04 | 0.170E-04 | 0.170E-04 | 0.170E-04 | |
| .170E-04 | .349E-04 | .000E-04 | .116E-03 | .116E-03 | .160E-04 | .160E-04 |
| 1.000E+00 | .[illegible]46E+00 | .79[illegible]E+00 | .3[illegible]7E+00 | .37[illegible]E+00 | .6[illegible]E-01 | .200E-01 |
| 0.000E+00 | 0.112E-03 | 0.112E-03 | 0.112E-03 | 0.112E-03 | 0.718E-03 | |
| 0.122E-02 | 0.135E-02 | 0.147E-02 | 0.154E-02 | 0.148E-02 | 0.172E-02 | 0.114E-02 |
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | |
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 |
| 1.000E+00 | 0.878E+00 | 0.934E+00 | 0.893E+00 | 0.737E+00 | 0.545E+00 | |
| 0.488E+00 | 0.391E+00 | 0.432E+00 | 0.350E+00 | 0.401E+00 | 0.362E+00 | 0.168E+00 |
| 0.000E+00 | 0.974E-04 | 0.974E-04 | 0.974E-04 | 0.974E-04 | 0.678E-03 | |
| 0.884E-03 | 0.812E-03 | 0.993E-03 | 0.864E-03 | 0.845E-03 | 0.864E-03 | 0.707E-03 |
| 0.000E+00 | 0.356E-02 | 0.356E-02 | 0.163E-01 | 0.378E-01 | 0.336E-01 | |
| 0.230E-01 | 0.215E-01 | 0.184E-01 | 0.169E-01 | 0.149E-01 | 0.156E-01 | 0.119E-01 |
| 0.000E+00 | 0.340E-03 | 0.340E-03 | 0.401E-02 | 0.161E-01 | 0.232E-01 | |
| 0.205E-01 | 0.173E-01 | 0.174E-01 | 0.152E-01 | 0.151E-01 | 0.119E-01 | 0.113E-01 |
| 0.000E+00 | 0.159E-01 | 0.159E-01 | 0.159E-01 | 0.159E-01 | 0.279E-01 | |
| 0.315E-01 | 0.293E-01 | 0.261E-01 | 0.291E-01 | 0.259E-01 | 0.241E-01 | 0.229E-01 |
| 0.000E-01 | 0.886E-05 | 0.886E-05 | 0.886E-05 | 0.886E-05 | 0.886E-05 | |
| 0.886E-05 | 0.574E-04 | 0.732E-04 | 0.233E-03 | 0.140E-03 | 0.174E-03 | 0.132E-03 |
| 0.000E+00 | 0.126E-04 | 0.126E-04 | 0.126E-04 | 0.417E-03 | 0.107E-02 | |
| 0.113E-02 | 0.957E-03 | 0.931E-03 | 0.931E-03 | 0.767E-03 | 0.759E-03 | 0.695E-03 |
| 0.000E+00 | 0.362E-04 | 0.362E-04 | 0.362E-04 | 0.385E-03 | 0.929E-03 | |
| 0.749E-03 | 0.669E-03 | 0.568E-03 | 0.606E-03 | 0.569E-03 | 0.436E-03 | 0.404E-03 |
| 0.000E+00 | 0.370E-05 | 0.370E-05 | 0.370E-05 | 0.370E-05 | 0.237E-04 | |
| 0.403E-04 | 0.446E-04 | 0.485E-04 | 0.508E-04 | 0.488E-04 | 0.568E-04 | 0.376E-04 |
| 1.000E+00 | 0.920E+00 | 0.860E+00 | 0.745E+00 | 0.431E+00 | 0.190E+00 | |
| 0.105E+00 | 0.110E+00 | 0.120E+00 | 0.110E+00 | 0.109E+00 | 0.100E+00 | 0.900E-01 |
| 0.000E+00 | 0.489E-06 | 0.489E-06 | 0.489E-06 | 0.489E-06 | 0.489E-06 | |
| 0.251E-05 | 0.235E-05 | 0.485E-05 | 0.298E-05 | 0.473E-05 | 0.608E-05 | 0.575E-05 |
| 1.000E+00 | 0.996E+00 | 0.997E+00 | 0.993E+00 | 0.968E+00 | 0.789E+00 | |
| 0.559E+00 | 0.506E+00 | 0.478E+00 | 0.446E+00 | 0.415E+00 | 0.392E+00 | 0.321E+00 |
| 0.000E+00 | 0.850E-04 | 0.850E-04 | 0.850E-04 | 0.850E-04 | 0.808E-03 | |
| 0.949E-03 | 0.975E-03 | 0.117E-02 | 0.998E-03 | 0.104E-02 | 0.100E-02 | 0.114E-02 |
| 0.000E+00 | 0.548E-04 | 0.548E-04 | 0.548E-04 | 0.548E-04 | 0.548E-04 | |
| 0.230E-03 | 0.311E-03 | 0.475E-03 | 0.529E-03 | 0.615E-03 | 0.640E-03 | 0.450E-03 |
| 0.000E+00 | 0.354E-03 | 0.354E-03 | 0.354E-03 | 0.354E-03 | 0.234E-02 | |
| 0.365E-02 | 0.379E-02 | 0.387E-02 | 0.410E-02 | 0.399E-02 | 0.428E-02 | 0.400E-02 |
| 0.000E+00 | 0.307E-03 | 0.307E-03 | 0.128E-01 | 0.819E-01 | 0.119E+00 | |
| 0.707E-01 | 0.430E-01 | 0.331E-01 | 0.287E-01 | 0.286E-01 | 0.248E-01 | 0.225E-01 |
| 0.000E+00 | 0.150E-02 | 0.150E-02 | 0.150E-02 | 0.133E-01 | 0.199E-01 | |

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|---|---|---|---|---|---|---|
| 0.146E-01 | 0.129E-01 | 0.116E-01 | 0.101E-01 | 0.930E-02 | 0.918E-02 | 0.752E-02 |
| 0.000E+00 | 0.116E-03 | 0.116E-03 | 0.116E-03 | 0.116E-03 | 0.116E-03 | |
| 0.304E-03 | 0.314E-03 | 0.385E-03 | 0.333E-03 | 0.289E-03 | 0.422E-03 | 0.402E-03 |
| 0.000E+00 | 0.536E-04 | 0.536E-04 | 0.536E-04 | 0.536E-04 | 0.536E-04 | |
| 0.143E-03 | 0.118E-03 | 0.149E-03 | 0.120E-03 | 0.704E-04 | 0.189E-03 | 0.189E-03 |
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | |
| 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 | 0.200E+01 |
| 0.000E+00 | 0.335E-04 | 0.335E-04 | 0.335E-04 | 0.335E-04 | 0.335E-04 | |
| 0.172E-03 | 0.161E-03 | 0.332E-03 | 0.204E-03 | 0.393E-03 | 0.417E-03 | 0.394E-03 |
| 1.000E+00 | 0.808E+00 | 0.501E+00 | 0.272E+00 | 0.984E-01 | 0.294E-01 | |
| 0.174E-01 | 0.196E-01 | 0.229E-01 | 0.199E-01 | 0.176E-01 | 0.170E-01 | 0.137E-01 |

# APPENDIX C

## INPUT TO AND RESULTANT OUTPUT FROM 'DOSE'

### C1. TYPICAL BLOCK OF DATA FOR 'DOSE'

```
TECHNETIUM 99M   20  6.00
  .0021  .0000 0
  .0017  .0036 1
  .1405  .2643 0
  .1195  .0225 1
  .1377  .0032 1
  .1427  .0001 0
  .1217  .0025 1
  .1399  .0009 1
  .1423  .0003 1
  .0184  .0017 0
  .0183  .0008 0
  .0206  .0005 0
  .0210  .0001 0
  .0024  .0000 0
  .0155  .0005 1
  .0178  .0002 1
  .0202  .0000 1
  .0019  .0004 1
  .0004  .0010 1
  .1401  .0011 1
 0 8.000 8.000 3.000 3.00030.00010.000
 1 1.000 0.800 0.000 1.000 5.000 1.000
```

## C2. TYPICAL RESULTANT OUTPUT

TARGET ORGAN DOSE IN RADS FROM ACTIVITY IN SOURCE ORGAN

| SOURCE | WHOLE BODY | KIDNEY | LUNG | LIVER | SKELETON | BLADDER | SPLEEN | PANCREAS | THYROID | HEART | OVARIES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CUMULATED ACTIVITY DISTRIBUTION IN MILLICURIE-HOURS OF TECHNETIUM 99M | 8.000 | 8.000 | 3.000 | 3.000 | 30.000 | 10.000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TARGET WHOLE BODY | 0.017 | 0.013 | 0.004 | 0.005 | 0.042 | 0.019 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL WHOLE BODY | | DOSE** | 0.191RADS | | | | |
| KIDNEYS | 0.013 | 1.652 | 0.003 | 0.012 | 0.026 | 0.003 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL KIDNEYS | | DOSE** | 1.709RADS | | | | |
| LUNGS | 0.012 | 0.007 | 0.161 | 0.008 | 0.025 | 0.000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL LUNGS | | DOSE** | 0.212RADS | | | | |
| LIVER | 0.014 | 0.031 | 0.007 | 0.148 | 0.021 | 0.002 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL LIVER | | DOSE** | 0.222RADS | | | | |
| SKELETON | 0.015 | 0.012 | 0.004 | 0.003 | 0.260 | 0.010 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL SKELETON | | DOSE** | 0.305RADS | | | | |
| BLADDER | 0.015 | 0.002 | 0.000 | 0.001 | 0.017 | 1.430 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL BLADDER | | DOSE** | 1.524RADS | | | | |
| SPLEEN | 0.012 | 0.072 | 0.007 | 0.003 | 0.016 | 0.001 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL SPLEEN | | DOSE** | 0.111RADS | | | | |
| PANCREAS | 0.016 | 0.056 | 0.007 | 0.014 | 0.022 | 0.001 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL PANCREAS | | DOSE** | 0.116RADS | | | | |

ABSORBED FRACTION DATA FOR THE KIDNEYS TARGETING THE THYROID IS NOT AVAILABLE
DOSE IS SET TO ZERO
ABSORBED FRACTION DATA FOR THE BLADDER TARGETING THE THYROID IS NOT AVAILABLE
DOSE IS SET TO ZERO

| SOURCE | WHOLE BODY | KIDNEY | LUNG | LIVER | SKELETON | BLADDER | SPLEEN | PANCREAS | THYROID | HEART | OVARIES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| THYROID | 0.007 | 0.0 | 0.002 | 0.001 | 0.005 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL THYROID | | DOSE** | 0.015RADS | | | | |
| HEART | 0.014 | 0.006 | 0.018 | 0.008 | 0.024 | 0.000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL HEART | | DOSE** | 0.071RADS | | | | |
| OVARIES | 0.017 | 0.007 | 0.000 | 0.002 | 0.047 | 0.072 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL OVARIES | | DOSE** | 0.145RADS | | | | |

TARGET ORGAN DOSE IN RADS FROM ACTIVITY IN SOURCE ORGAN

| SOURCE | WHOLE BODY | KIDNEY | LUNG | LIVER | SKELETON | BLADDER | SPLEEN | PANCREAS | THYROID | HEART | OVARIES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| INITIAL ACTIVITY DISTRIBUTION IN MILLICURIES OF TECHNETIUM 99M | 1.000 | 0.800 | 0.0 | 1.000 | 5.000 | 1.000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| TARGET WHOLE BODY | 0.019 | 0.012 | 0.0 | 0.015 | 0.060 | 0.016 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL WHOLE BODY | | DOSE** | 0.122RADS | | | | |
| KIDNEYS | 0.015 | 1.430 | 0.0 | 0.033 | 0.038 | 0.003 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL KIDNEYS | | DOSE** | 1.519RADS | | | | |
| LUNGS | 0.013 | 0.006 | 0.0 | 0.023 | 0.035 | 0.000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL LUNGS | | DOSE** | 0.076RADS | | | | |
| LIVER | 0.015 | 0.027 | 0.0 | 0.427 | 0.030 | 0.001 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL LIVER | | DOSE** | 0.500RADS | | | | |
| SKELETON | 0.016 | 0.010 | 0.0 | 0.010 | 0.376 | 0.008 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL SKELETON | | DOSE** | 0.420RADS | | | | |
| BLADDER | 0.016 | 0.002 | 0.0 | 0.001 | 0.024 | 1.290 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL BLADDER | | DOSE** | 1.333RADS | | | | |
| SPLEEN | 0.013 | 0.062 | 0.0 | 0.008 | 0.023 | 0.001 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL SPLEEN | | DOSE** | 0.108RADS | | | | |
| PANCREAS | 0.017 | 0.049 | 0.0 | 0.039 | 0.032 | 0.001 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL PANCREAS | | DOSE** | 0.138RADS | | | | |

ABSORBED FRACTION DATA FOR THE KIDNEYS TARGETING THE THYROID IS NOT AVAILABLE
DOSE IS SET TO ZERO
ABSORBED FRACTION DATA FOR THE BLADDER TARGETING THE THYROID IS NOT AVAILABLE
DOSE IS SET TO ZERO

| SOURCE | WHOLE BODY | KIDNEY | LUNG | LIVER | SKELETON | BLADDER | SPLEEN | PANCREAS | THYROID | HEART | OVARIES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| THYROID | 0.008 | 0.0 | 0.0 | 0.003 | 0.007 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL THYROID | | DOSE** | 0.018RADS | | | | |
| HEART | 0.015 | 0.005 | 0.0 | 0.024 | 0.035 | 0.000 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL HEART | | DOSE** | 0.079RADS | | | | |
| OVARIES | 0.018 | 0.006 | 0.0 | 0.005 | 0.068 | 0.063 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | | | TOTAL OVARIES | | DOSE** | 0.159RADS | | | | |