THE CLEAN AIR ACT ASSESSMENT PACKAGE-1988 (CAP-88) A DOSE AND RISK ASSESSMENT METHODOLOGY FOR RADIONUCLIDE EMISSIONS TO AIR

VOLUME 2

APPENDICES A - H

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APPENDIX A

AIRDOS-EPA (AIRDOS2.FOR) PROGRAM FILE

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0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012
C
C                   AIRDOS2 PA CODE
C
C       R. E. MOORE  HEALTH AND SAFETY RESEARCH DIV.  ORNL
C       DOSEN MODIFIED TO SUPPRESS PRINT FOR NSTB.NE.1.  11/10/82
C
C       ADP 534 MODIFICATIONS JUNE 1988 BY CARYN PLUMMER.
C
      COMMON /OCOM/ NNUCS,ANLAM(36),RR,SQSD, ACON(36,20,
     >  20),GCON(36,20,20),LIPO,NOMM(36,11),NRMM(36,11), ORMODI(36,12,8)
     > , VD(36),VDCOEF(20,20),NOL,NOU,NRL,NRU
      COMMON /OCOMCHAR/ NAMNUC(36),WORD
      CHARACTER*8 NAMNUC,WORD
      CHARACTER*36 DATE_AND_TIME

      INTEGER OPTION(9)
      DATA DATE_AND_TIME /'                                    '/

      CALL ERRSET(208,256,-1,1)

C***  GET DATE AND TIME
      READ(50,1000) DATE_AND_TIME
1000  FORMAT(A)

      READ(50,9004)WORD,OPTION
      WRITE(6,9005)
      WRITE(6,9006)
      WRITE(6,9007)
      IF (OPTION(1).EQ.1) WRITE(6,9008)
      IF (OPTION(1).EQ.2) WRITE(6,9017)
      IF (OPTION(2).EQ.1) WRITE(6,9009)
      IF (OPTION(2).EQ.0) WRITE(6,9019)
C
      IF (OPTION(3).EQ.0) WRITE(6,9011)
      IF (OPTION(3).EQ.1) WRITE(6,9010)
C
      IF (OPTION(4).EQ.0) WRITE(6,9012)
      IF (OPTION(4).EQ.1) WRITE(6,9013)
      IF (OPTION(4).EQ.2) WRITE(6,9014)
C
      IF (OPTION(5).EQ.1.AND.OPTION(2).EQ.1) WRITE(6,9015)
      IF (OPTION(5).EQ.1.AND.OPTION(2).NE.1) WRITE(6,9016)
      IF (OPTION(5).EQ.1.AND.OPTION(2).NE.1) STOP
C
      IF (OPTION(6).NE.0) WRITE(6,9018)OPTION(6)
```

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0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

      IF (OPTION(7).EQ.1) WRITE(6,9000)
      IF (OPTION(8).EQ.1) WRITE(6,9001)
      IF (OPTION(9).EQ.1) WRITE(6,9002)
C
      CALL CONCEN(OPTION(2),OPTION(3),OPTION(4),OPTION(5),OPTION(6),
     > OPTION(7),OPTION(8),OPTION(9),DATE_AND_TIME)
      IF (OPTION(1).EQ.0) CALL DOSEN(DATE_AND_TIME)
      STOP
 9000 FORMAT(' ',T30,'THE CALCULATIONS ARE MADE FOR A UNIFORM CIRCULAR A
     >REA SOURCE')
 9001 FORMAT(' ',T30,'THE MAIN OUTPUT TABLE IN SUBROUTINE CONCEN IS NOT
     >PRINTED')
 9002 FORMAT(' ',T30,'THE CHI/Q TABLES ARE NOT PRINTED')
 9004 FORMAT(A8,5I1,I2,3I1)
 9005 FORMAT('1',T50,'OUTPUT OF AIRDOS-EPA COMPUTER CODE')
 9006 FORMAT('0')
 9007 FORMAT(' ',T20,'OPTIONS SELECTED--')
 9008 FORMAT('0',T30,'PROGRAM TERMINATED AFTER PRINTING RADIONUCLIDE CON
     >CENTRATIONS')
 9009 FORMAT(' ',T30,'RADIONUCLIDE CONCENTRATIONS ARE LISTED FOR DIRECTI
     >ON AND DISTANCE FROM FACILITY')
 9010 FORMAT(' ',T30,'RADIONUCLIDE CONCENTRATIONS LISTED ARE PLUME CENTE
     >RLINE VALUES')
 9011 FORMAT('0',T30,'RADIONUCLIDE CONCENTRATIONS LISTED ARE SECTOR-AVER
     >AGED VALUES')
 9012 FORMAT(' ',T30,'PLUME RISE IS COMPUTED FOR BUOYANT PLUMES BY BRIGG
     >S EQUATIONS')
 9013 FORMAT(' ',T30,
     > 'PLUME RISE IS COMPUTED FOR MOMENTUM-TYPE EMISSIONS')
 9014 FORMAT(' ',T30,'SPECIFIC PLUME RISE USED FOR EACH AIR STABILITY CL
     >ASS (METERS)-')
 9015 FORMAT('0',T30,'DEPOSITION VELOCITY IS VARIED WITH DIRECTION AND D
     >ISTANCE')
 9016 FORMAT('0',T30,'ERROR--ILLEGAL USE OF VARIABLE DEPOSITION VELOCITY
     > WITH SQUARE GRID')
 9017 FORMAT('0',T30,'DOSES ARE CALCULATED FROM INPUT AIR CONCENTRATIONS
     > AND GROUND DEPOSITION RATES')
 9018 FORMAT(' ',T30,'AIR CONCENTRATIONS AND GROUND DEPOSITION RATES ARE
     > PUNCHED ON CARDS FOR THE FIRST ',I2,' RADIONUCLIDES')
 9019 FORMAT(' ',T30,'THE ASSESSMENT AREA IS A 20 BY 20 SQUARE GRID')
      END

      BLOCK DATA
      REAL KIQ
      COMMON /TCOM/ KIQ(36,20,20)
      COMMON /OCOM/ NNUCS,ANLAM(36),RR,SQSD,ACON(36,20,20),
```

```
0         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123456789012

     >GCON(36,20,20),LIPO,NOMM(36,11),NRMM(36,11),ORMODI(36,12,8),
     >VD(36),VDCOEF(20,20),NOL,NOU,NRL,NRU
      DATA KIQ /14400*0.0/,VDCOEF /400*1.0/,ORMODI /3456*0/
      DATA ACON /14400*0.0/,GCON /14400*0.0/
      END
C*******************************************************************
C*******************************************************************
      SUBROUTINE CHIQ
      COMMON /OCOM/ NNUCS,ANLAM(36),RR,SQSD, ACON(36,20,
     >  20),GCON(36,20,20),LIPO,NOMM(36,11),NRMM(36,11), ORMODI(36,12,8)
     > , VD(36),VDCOEF(20,20),NOL,NOU,NRL,NRU
      COMMON /OCOMCHAR/ NAMNUC(36),WORD
      CHARACTER*8 NAMNUC,WORD
      COMMON /PCOM/ REL(6,36),IDIST(20),NUMST
      COMMON /TCOM/ KIQ(36,20,20)
      DIMENSION REGL(36)
      REAL KIQ
      DO 50 I=1,NNUCS
         REGL(I)=0
         DO 40 J=1,NUMST
   40       REGL(I)=REGL(I)+REL(J,I)
   50    CONTINUE
      DO 90 I=1,NNUCS
         DO 80 NO=NOL,NOU
            DO 60 NR=NRL,NRU
               IF (REGL(I).EQ.0) GO TO 70
   60          KIQ(I,NO,NR)=(ACON(I,NO,NR)/REGL(I))*1.E6
            GO TO 80
   70       KIQ(I,NO,NR)=0.
   80       CONTINUE
   90    CONTINUE
      DO 130 I=1,NNUCS
         WRITE(51,9000)NAMNUC(I)
         WRITE(51,9001)
         WRITE(51,9002)
         WRITE(51,9003)
         WRITE(51,9001)
         WRITE(51,9004)
         WRITE(51,9005)
         NO=1
         DO 100 NR=NRL,NRU
  100       WRITE(51,9007)IDIST(NR),KIQ(I,NO,NR),KIQ(I,NO+1,NR),KIQ(I,
     >       NO+2,NR),KIQ(I,NO+3,NR),KIQ(I,NO+4,NR),KIQ(I,NO+5,NR),
     >       KIQ(I,NO+6,NR), KIQ(I,NO+7,NR)
         ISP=(22-2*(NRU/2))/2
         DO 110 IG=1,ISP
```

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0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012
  110       WRITE(51,9001)
            WRITE(51,9006)
            WRITE(51,9005)
            NO=9
            DO 120 NR=NRL,NRU
  120       WRITE(51,9007)IDIST(NR),KIQ(I,NO,NR),KIQ(I,NO+1,NR),KIQ(I,
     >       NO+2,NR),KIQ(I,NO+3,NR),KIQ(I,NO+4,NR),KIQ(I,NO+5,NR),
     >       KIQ(I,NO+6,NR), KIQ(I,NO+7,NR)
  130    CONTINUE
       RETURN
 9000 FORMAT('1',T25,'GROUND-LEVEL CHI/Q VALUES FOR ',A8,
     > 'AT VARIOUS DISTANCES IN EACH COMPASS DIRECTION')
 9001 FORMAT('0')
 9002 FORMAT(' ',T20,'DISTANCE',T52,'CHI/Q TOWARD INDICATED DIRECTION')
 9003 FORMAT(' ',T20,'(METERS)',T60,'(SEC/CUBIC METER)')
 9004 FORMAT(' ',T32,'N',T43,'NNW',T54,'NW',T65,'WNW',T76,'W',T87,'WSW',
     > T98,'SW',T109,'SSW')
 9005 FORMAT(' ')
 9006 FORMAT(' ',T32,'S',T43,'SSE',T54,'SE',T65,'ESE',T76,'E',T87,'ENE',
     > T98,'NE',T109,'NNE')
 9007 FORMAT(' ',T19,I7,T30,E9.3,T41,E9.3,T52,E9.3,T63,E9.3,T74,E9.3,
     > T85,E9.3,T96,E9.3,T107,E9.3)
       END
C*********************************************************************
C*********************************************************************
      SUBROUTINE CONCEN(LORT,LOST,LRISE,LDEP,LPUN,LARE,LTAB,LCHI,
     +                  DATE_AND_TIME)

C
       COMMON /OCOM/ NNUCS,ANLAM(36),RR,SQSD, ACON(36,20,
     >  20),GCON(36,20,20),LIPO,NOMM(36,11),NRMM(36,11), ORMODI(36,12,8)
     > , VD(36),VDCOEF(20,20),NOL,NOU,NRL,NRU
       COMMON /PCOM/ REL(6,36),IDIST(20),NUMST
       COMMON /FCOM/ FEQWL,INTPA(20,20)
       COMMON /OCOMCHAR/ NAMNUC(36),WORD
       CHARACTER*8 NAMNUC,WORD
       CHARACTER*3 DIRECTION(16)
       CHARACTER*36 DATE_AND_TIME
       INTEGER ALPH
       LOGICAL RADON_FLAG
C
       DIMENSION AA(7,4,4),DIA(6),FRAW(7,16),PERD(16),AVON(20,20), PH(6),
     >  PR(7),QH(6), SC(36),TAI(36),TG(3),TGD(36), UDAV(7,16), UDCAT(7,
     > 16),VEL(6),VG(36),NOMA(36),NSPTMO(20,20),NSPTM1(200),NSPTM2(200),
     > FDSTOR(36,6,7),BOUND(21),LIST(20),TQ(36)
       DIMENSION DIM(6)
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0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

      DATA AVON/400*0/
      DATA NOMA/36*0/,ALPH/0/
      DATA RADON_FLAG /.FALSE./
      DATA DIRECTION/'N  ','NNW','NW ','WNW','W  ','WSW','SW ','SSW',
     > 'S  ','SSE','SE ','ESE','E  ','ENE','NE ','NNE'/
      EQUIVALENCE (NSPTMO(1,1),NSPTM1(1)),(NSPTMO(1,11),NSPTM2(1))
      DATA NSPTM1/ 07,07,07,07,08,08,08,08,09,09,09,09,10,10,10,10,11,
     > 11,11,11, 07,07,07,07,08,08,08,08,09,09,09,09,10,10,10,10,11,11,
     > 11;11, 07,07,07,07,07,08,08,08,08,09,09,10,10,10,10,11,11,11,11,
     > 11, 07,07,07,07,07,07,08,08,08,09,09,10,10,10,11,11,11,11,11,11,
     > 06,06,07,07,07,07,08,08,08,09,09,10,10,10,11,11,11,11,12,12, 06,
     > 06,06,07,07,07,07,08,08,09,09,10,10,11,11,11,11,12,12,12, 06,06,
     > 06,06,06,07,07,07,08,09,09,10,11,11,11,12,12,12,12,12, 06,06,06,
     > 06,06,06,07,07,08,09,09,10,11,11,12,12,12,12,12,12, 05,05,06,06,
     > 06,06,06,06,07,08,10,11,12,12,12,12,12,12,13,13, 05,05,05,05,05,
     > 05,05,05,06,07,11,12,13,13,13,13,13,13,13,13/
      DATA NSPTM2/ 05,05,05,05,05,05,05,05,04,03,15,14,13,13,13,13,13,
     > 13,13,13, 05,05,04,04,04,04,04,04,03,02,16,15,14,14,14,14,14,14,
     > 13,13, 04,04,04,04,04,04,03,03,02,01,01,16,15,15,14,14,14,14,14,
     > 14, 04,04,04,04,04,03,03,03,02,01,01,16,15,15,15,14,14,14,14,14,
     > 04,04,04,03,03,03,03,02,02,01,01,16,16,15,15,15,15,14,14,14, 04,
     > 04,03,03,03,03,02,02,02,01,01,16,16,16,15,15,15,15,14,14, 03,03,
     > 03,03,03,03,02,02,02,01,01,16,16,16,15,15,15,15,15,15, 03,03,03,
     > 03,03,02,02,02,02,01,01,16,16,16,16,15,15,15,15,15, 03,03,03,03,
     > 02,02,02,02,01,01,01,01,16,16,16,16,15,15,15,15, 03,03,03,03,02,
     > 02,02,02,01,01,01,01,16,16,16,16,15,15,15,15/
C
C-----THIS ARRAY HOLDS THE VALUES FOR CONSTANTS ASSOCIATED WITH EACH
C-----OF THE 7 PASQUILL AIR STABILITY CATAGORIES (A,C,D,F).
C
      DATA AA/.9757,.9986,.9767,.9600,.9615,.9733,.9986, .8660,.8493,
     > .8540,.8670,.8670,.8540,.8360, .8660,.8493,.8540,.8670,.8670,
     > .8540,.8360, .6294,.6303,.6254,.6342,.6260,.6342,.8360, 3.928,
     > 6.205,7.623,10.00,14.13,21.28,31.03, 1.841,2.213,3.266,5.261,
     > 7.357,9.333,10.093, 1.841,2.213,3.266,5.261,7.357,9.333,10.093,
     > .2083,.2946,.3977,.6166,.8042,1.233,10.093, 1.000,1.000,.9540,
     > .8061,.8600,.8823,.8257, 1.000,1.000,.8330,.6715,.6290,.6321,
     > .6547, 1.000,1.000,.8330,.5099,.4054,.3710,.3818, 1.000,1.000,
     > .5524,.5251,.1110,.1106,.1106, 5.020,8.350,10.015,7.48,15.50,
     > 34.70,61.25, 5.020,8.350,4.400,2.950,3.150,6.132,18.80, 5.020,
     > 8.350,4.400,.8100,.5240,.7640,2.115, 5.020,8.350,.3320,.9300,
     > .0349,.0694,.1739/
C
C---END OF DECLARATIONS
C
      READ(50,9008)NOL,NOU,NRL,NRU
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0        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012
      READ(50,9009)PR
      READ(50,9011)WORD
      READ(50,9009)SQSD
      READ(50,9000)SEQWL
      READ(50,9008)IDIST
      READ(50,9011)WORD
      READ(50,9008)LIDA1
      READ(50,9009)RR,TA,TG
      READ(50,9010)PERD
      READ(50,9010)((UDCAT(I,J),J=1,16),I=1,7)
      READ(50,9010)(( UDAV(I,J),J=1,16),I=1,7)
      READ(50,9012)FRAW
      READ(50,9011)WORD
      READ(50,9008)NUMST
      DO 30 J=1,NUMST
   30    READ(50,9009)PH(J),DIA(J),VEL(J),QH(J),DIM(J)
      READ(50,9011)WORD
      READ(50,9008)NNUCS
      DO 40 I=1,NNUCS
         READ(50,9011) NAMNUC(I)
         IF ( NAMNUC(I) .EQ. 'RN-222' ) THEN
             RADON_FLAG = .TRUE.
         ENDIF
         READ(50,9009)ANLAM(I),SC(I),VD(I),VG(I)
   40    READ(50,9009)(REL(J,I),J=1,NUMST)
      IF (LDEP.EQ.1) THEN
         READ(50,9009) (BOUND(I),I=2,21)
         READ(50,9059) ((VDCOEF(I,J),J=NRL,NRU),I=NOL,NOU)
         READ(50,9060) LIST
         BOUND(1)=0.0
      ELSE
         LID1=LIDA1
         FEQWL=SEQWL
         LA1=LIDA1
      ENDIF
      IF (LIDA1.EQ.10000) LA1=ALPH
  130 IF (LTAB.EQ.0) THEN
         WRITE(51,90521) DATE_AND_TIME
         WRITE(51,9052)
         WRITE(51,9053)
         IF ( RADON_FLAG ) THEN
            WRITE(51,9054)
         ELSE
            WRITE(51,90541)
         ENDIF
         WRITE(51,9013)
```

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0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

      ENDIF
      DO 170 I=1,NNUCS
         DO 160 J=1,NUMST
  160       REL(J,I)=REL(J,I)*3.17098E4
  170    CONTINUE
C---END OF INPUT ROUTINE
C
C---THIS SUBROUTINE CALCULATES AIR CONCENTRATION(ACON)
C---AND GROUND DEPOSITION RATE(GCON)
C-----IF(EXP(-(ANLAM(I)*SQRT(2*10*SQSD**2)/(2*8.64E4)).LT.0.99))
C-----REDUCES TO
C-----IF(ANLAM(I).GT.(122.188054/SQSD))
      DISTG=122.188054/SQSD
C
C-----THIS BLOCK EXAMINES CERTAIN INPUT VALUES FOR EQUALITY.  IF THEY
C-----ARE EQUAL, THEN MUCH OF THE FOLLOWING CALCULATION NEED NOT BE
C-----PERFORMED FOR THAT NUCLIDE.  NOMA IS THE ARRAY OF FLAGS THAT
C-----EQUALITY HAS BEEN FOUND & WITH WHICH NUCLIDE.
C
      IF(NNUCS.GE.2) THEN
         DO 192 I=2,NNUCS
            IEN=I-1
            DO 190 M=1,IEN
               IF (REL(1,M).EQ.0) GO TO 190
               IF (VD(I).NE.VD(M)) GO TO 190
               IF (VG(I).NE.VG(M)) GO TO 190
               IF (SC(I).NE.SC(M)) GO TO 190
               IF (ANLAM(I).GT.DISTG) GO TO 190
               IF (ANLAM(M).GT.DISTG) GO TO 190
               NOMA(I)=M
               GO TO 192
  190       CONTINUE
  192    CONTINUE
      ENDIF
C
C-----THIS BLOCK LOOPS THRU THE GRID COVERING THE AREA AROUND THE PLANT.
C
      DO 680 NO=NOL,NOU
         DO 200 I=1,NNUCS
            IF (LDEP.NE.1) GO TO 210
            DO 200 J=1,NUMST
               DO 200 K=1,7
                  FDSTOR(I,J,K)=1
  200             CONTINUE
  210    DO 670 NR=NRL,NRU
            DO 220 I=1,NNUCS
```

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0         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123456789012

            TQ(I)=0.
               TAI(I)=0.
  220          TGD(I)=0.
  240             X=IDIST(NR)
                  MO=NO
  250             XO=X
                  THETA=1.0
                  M=0
C
C-----THIS BLOCK LOOPS THRU THE STACKS (EMISSION POINTS).
C
                  DO 600 J=1,NUMST
                     M=0
                     IF (LARE.EQ.0) GO TO 290
C
C-----AREA SOURCE BLOCK (BY CHRISTOPHER B. NELSON,EPA).
C
C... CONSIDER SOURCES TO BE POINT SOURCES IF LESS THAN 10 METERS
C... DIAM. OR IF RATIO OF DISTANCE X TO THE DIAM. IS GREATER THAN 2.5.
C
                     TESTAR=X/(DIM(J)+.00001)
                     IF (DIM(J).LT.10..OR.TESTAR.GT.2.5) GO TO 290
C
C... RO IS THE RADIUS OF THE SOURCE.
C... R1 IS THE INNER RADIUS OF THE TRANSFORMED SOURCE.
C... R2 IS THE OUTER RADIUS OF THE TRANSFORMED SOURCE.
C... X IS THE EFFECTIVE DISTANCE FOR CALCULATING CHI/Q.
C... THETA IS THE ANGULAR WIDTH IN SECTORS OF THE TRANSFORMED SOURCE.
C... (MULTIPLY THETA BY PI/8.0 TO CONVERT THETA TO RADIANS.)
C... 0.88622693=SQRT(PI/4.)
C... 2.5198421=4.0**(2/3)
C... 4.5135167=8./SQRT(PI)
C
                     RO=DIM(J)/2.0
                     IF (XO.GT.0.88622693*RO) GO TO 270
                     IF (XO.GT.0.5*RO) GO TO 260
C
C... 0.LE.XO.LE.RO/2.
                     R1=0.
                     R2=RO
                     X=R2/2.5198421
                     THETA=16.
                     GO TO 280
C
C... RO/2.LT.XO.LE.RO*SQRT(PI/4.)
  260                R1=0.
```

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0        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

                    R2=2.*X0
                    X=R2/2.5198421
                    THETA=4.0*(R0/X0)**2
                    GO TO 280
C
C... R0*SQRT(PI/4).LT.X0
  270               R1=X0-0.88622693*R0
                    R2=X0+0.88622693*R0
                    X=(X0*(SQRT(R2)+SQRT(R1))/2.0)**0.66666667
                    THETA=4.5135167*R0/X0
C
C... M IS THE NUMBER OF SECTORS ON EACH SIDE OF MO WHICH
C... INCLUDE THE TRANSFORMED SOURCE.
  280               M=INT(THETA/2.0+0.5)
C... DTHETA IS THE ANGULAR WIDTH OF THE TRANSFORMED SOURCE IN THE FIRST
C... AND LAST SECTORS.
                    DTHETA=AMOD((THETA/2.0+0.5),1.0)
                    IF (DTHETA.LE.0.) THEN
                       M=M-1
                       DTHETA=1.0
                    ENDIF
  290               IF (M.EQ.0) DTHETA=THETA
C... LL IS THE TOTAL NUMBER OF SECTORS WHICH CONTRIBUTE TO CHI/Q.
                    LL=2*M+1
C... L1 IS THE INITIAL SECTOR.
                    L1=MOD(MO-M+15,16)+1
                    DO 580 L=1,LL
                       MO=MOD(L1+L+14,16)+1
                       IF (L.EQ.1.OR.L.EQ.LL) THEN
                          PERW=PERD(MO)*DTHETA/THETA
                       ELSE
                          PERW=PERD(MO)/THETA
                       ENDIF
C
C-----END OF AREA SOURCE BLOCK.
C
C-----THIS BLOCK LOOPS THRU THE 7 PASQUILL AIR STABILITY CATEGORIES.
C
  310                  DO 580 JH=1,7
                          IF (FRAW(JH,MO).EQ.0) GO TO 580
                          U = UDAV(JH,MO)
                          UD=UDCAT(JH,MO)
                          IF (U.GT.6.OR.U.LT.1.) THEN
                             FF1=0.
                             FF2=1.
                             FF3=0.
```

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0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012
                              ELSE
                                 FF2=(1.167-U/6.-1./UD)/(1.167-U/6.-1./U)
                                 FF3=((U-1.)*(1.-FF2))/5.
                                 FF1=1.-FF2-FF3
                              ENDIF
C-----THIS BLOCK CALCULATES PLUME RISE
C-----RISE=0..BRIGGS' EQUATIONS FOR BUOYANT PLUMES
C-----RISE=1..RUPP'S EQUATIONS FOR MOMENTUM-TYPE EMISSIONS
C-----RISE=2..READ PLUME RISE FROM CARDS
  330             IF (LRISE.EQ.0) THEN
                     IF (JH.GT.4) THEN
                        S=9.80665/TA*(TG(JH-4)+.0098)
                        IF (X.LE.2.4*U/SQRT(S)) THEN
                           H =PH(J)+(1.6/U*( (.000037*QH(J)*X*X)**
     >                       .33333333 ))
                        ELSE
                           H =PH(J)+(2.9*( (.000037*QH(J)/U/S)**
     >                       .33333333 ) )
                        ENDIF
                     ELSE
                        IF (X.LE.10.*PH(J)) THEN
                           H =PH(J)+(1.6/U*( (.000037*QH(J)*X*X)**
     >                       .33333333 ))
                        ELSE
                           H =PH(J)+(1.6/U*( (.0037000*QH(J)*PH(J)*PH(J)
     >                        )** .33333333))
                        ENDIF
                     ENDIF
                  ELSE
                     IF (LRISE.EQ.1) H=PH(J)+1.5*VEL(J)*DIA(J)/U
                     IF (LRISE.EQ.2) H=PH(J)+PR(JH)
                  ENDIF
C    END OF PLUME RISE CALCULATIONS
  380                 NX=1
                      IF (X.GT.1000) NX=2
                      IF (X.GT.3000) NX=3
                      IF (X.GT.10000) NX=4
                      A=AA(JH,NX,1)
                      C=AA(JH,NX,2)
                      D=AA(JH,NX,3)
                      F=AA(JH,NX,4)
C
C-----THIS BLOCK LOOPS THRU THE DIFFERENT NUCLIDES RELEASED IN THE PLUME
C
                      DO 570 I=1,NNUCS
                         IF (NOMA(I).GT.0.AND.J.EQ.1) GO TO 570
```

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C-----DETERMINE XLIDO (VALUE OF X WHERE LID AFFECTS VERTICAL DISPERSION)
                              Y1=0.
                              Y2=10000.
                              DO 410 IX1=1,3
                                 DO 390 IX2=1,10
                                    Y=Y1+Y2*IX2
                                    IF (Y**D.GT.(.47*F*(LID1+Y*VG(I)/UD)
     >                              )) GO TO 400
  390                               CONTINUE
  400                            Y1=Y1+Y2*(IX2-1)
  410                            Y2=Y2/10.
                              XLIDO=2.*Y
C-----THIS BLOCK FINDS DEPLETION FRACTION
                              VD1=VD(I)
C-----SECTION TO FIND DEPLETION IF BY VARIABLE DEPOSITION
C-----LDEP=1 IS OPTION FOR VARIABLE DEPOSITION VELOCITY
C-----BOUND(NR) IS THE LOWER BOUND ON THE INTERVAL OF INTEGRATION
C-----BOUND(NR+1) IS THE UPPER BOUND
                              IF (LDEP.EQ.1) THEN
                                 VD1=VD1*VDCOEF(NO,NR)
                                 IF (X.LE.XLIDO) THEN
                                    CALL QX(BOUND(NR),X,U,UD,H,VD1,
     >                                      VG(I),JH,FDD)
                                 ELSE
                                    IF (BOUND(NR).LT.XLIDO) THEN
                                       CALL QX(BOUND(NR),XLIDO,U,UD,H,
     >                                         VD1,VG(I),JH, FDD)
                                    ENDIF
                                 ENDIF
                               FDD=FDD*FDSTOR(I,J,JH)
                               IF (X.NE.BOUND(NR+1)) THEN
                                 IF (BOUND(NR+1).GT.XLIDO) THEN
                                    IF (X.GT.XLIDO) THEN
                                       FD1=EXP(-((BOUND(NR+1)-
     >                                          XLIDO)*VD1/(LID1*UD)))
                                       FDSTOR(I,J,JH)=FDD*FD1
                                    ELSE
                                       CALL QX(X,BOUND(NR+1),U,UD,H,
     >                                         VD1,VG(I),JH,FD1)
                                       FD1=FD1*EXP(-((BOUND(NR+1)-
     >                                          XLIDO)*VD1/(LID1* UD)))
                                       FDSTOR(I,J,JH)=FDD*FD1
                                    ENDIF
                                 ELSE
                                    CALL QX(X,BOUND(NR+1),U,UD,H,VD1,
     >                                      VG(I),JH,FD1)
```

AIRDOS-EPA (AIRDOS2.FOR) Program File
(continued)

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0         1         2         3         4         5         6         7
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                                    FDSTOR(I,J,JH)=FDD*FD1
                                  ENDIF
                                ELSE
                                  FDSTOR(I,J,JH)=FDD*FD1
                                ENDIF
                              ELSE
                                IF (X.LE.XLIDO) THEN
                                  IF (VG(I).EQ.0) THEN
                                    CALL QY(0,X,U,UD,H,VD1,VG(I),JH,FDD)
                                  ELSE
                                    CALL QX(0,X,U,UD,H,VD1,VG(I),JH,FDD)
                                  ENDIF
                                ELSE
                                  IF (VG(I).EQ.0) THEN
                                    CALL QY(0,XLIDO,U,UD,H,VD1,
     >                                     VG(I),JH,FDD)
                                  ELSE
                                    CALL QX(0,XLIDO,U,UD,H,VD1,
     >                                     VG(I),JH,FDD)
                                  ENDIF
                                  FDD=FDD*EXP(-((X-XLIDO)*
     >                                      VD1/(LID1*UD)))
                                ENDIF
                              ENDIF
C-----END VARIABLE DEPOSITION SECTION
C-----SECTION FOR DEPLETION IF BY CONSTANT DEPOSITION
                               IF (X.LE.XLIDO) THEN
                                  IF (VG(I).EQ.0) THEN
                                    CALL QY(0,X,U,UD,H,VD1,VG(I),JH,FDD)
                                  ELSE
                                    CALL QX(0,X,U,UD,H,VD1,VG(I),JH,FDD)
                                  ENDIF
                               ELSE
                                  IF (VG(I).EQ.0) THEN
                                     CALL QY(0,XLIDO,U,UD,H,VD1,VG(I),
     >                                      JH,FDD)
                                  ELSE
                                     CALL QX(0,XLIDO,U,UD,H,VD1,VG(I),
     >                                      JH,FDD)
                                  ENDIF
                                  FDD=FDD*EXP(-((X-XLIDO)*VD1/
     >                                      (LID1*UD)))
                               ENDIF
C-----END CONSTANT DEPOSITION SECTION
C-----END DEPLETION FRACTION BLOCK
                               QRED=-ANLAM(I)*X/86400.
```

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0        1         2         3         4         5         6         7
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                              QRED=REL(J,I)*FDD*(FF1*EXP(-SC(I)*X)+FF2*
     >                         EXP(-SC(I)*X/U)+FF3*EXP (-SC(I)*X/6.))*
     >                         (FF1* EXP(QRED)+FF2*EXP(QRED/U)+FF3*
     >                         EXP(QRED/6.))
                              CHAD=QRED/(6.2832*((X**A)/C)*((X**D)/F)*
     >                         UD)
                              IF ((VG(I)*X)/UD.GE.H) H=(VG(I)*X)/UD
                              IF ((.5*(((((VG(I)*X)/UD)-H)/((X**D)/F))**
     >                         2)).GT.50) BX=0
                              IF ((.5*(((((VG(I)*X)/UD)-H)/((X**D)/F))**
     >                         2)).GT.50) GO TO 540
                              BX=CHAD*(EXP(-.5*(((((VG(I)*X)/UD)-H)/((X*
     >                         *D) /F))**2))+ EXP(-.5*(((((-VG(I)*X)/UD)
     >                         +H)/ ((X**D)/F))**2)))
  540                         BT=BX
                              BU=0
                              VERT=QRED/(2.5066*((X**A)/C)*LID1*UD)
                              IF (X.LE.XLIDO) GO TO 550
                              BT=VERT
                              BU=BT
                              VERT=0
  550                         FRAC=(6.300835*((X**A)/C))/X
                              IF (LOST.EQ.1) FRAC=1.
  560                         FRAC=FRAC*PERW
                              VERT=FRAC*VERT
                              BU =FRAC*BU
                              BT =FRAC*BT
                              IF (I.EQ.1) AVON(NO,NR)=(FRAW(JH,MO)*
     >                         (VERT+BU))/1000000.+AVON(NO,NR)
                              TQ(I)=TQ(I)+FRAW(JH,MO)*PERW*QRED
                              TGD(I)=TGD(I)+FRAW(JH,MO)*(VD1*BT+SC(I)*
     >                         LID1* (VERT+BU))
                              TAI(I)=TAI(I)+FRAW(JH,MO)*BT
  570                         CONTINUE
C-----END OF NUCLIDE LOOP-----------------------------------------------
  580                    CONTINUE
C-----END OF PASQUILL CATAGORY LOOP-------------------------------------
                       DO 590 I=1,NNUCS
                          NMA=NOMA(I)
                          IF (NMA.LE.0.OR.J.GT.1) GO TO 590
                          TQ(I)=TQ(NMA)*REL(J,I)/REL(J,NMA)
                          TGD(I)=TGD(NMA)*REL(J,I)/REL(J,NMA)
                          TAI(I)=TAI(NMA)*REL(J,I)/REL(J,NMA)
  590                     CONTINUE
  600                  CONTINUE
C-----END OF STACK LOOP-------------------------------------------------
```

AIRDOS-EPA (AIRDOS2.FOR) Program File
(continued)

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0         1         2         3         4         5         6         7
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  630       IF (LDEP.EQ.1.AND.LIST(NR).EQ.1) GO TO 670
  650       DO 660 I=1,NNUCS
             - ACON(I,NO,NR)=TAI(I)/1000000.
               GCON(I,NO,NR)=TGD(I)/10000.
               VD1=VD(I)
               IF (LDEP.EQ.1) VD1=VD1*VDCOEF(NO,NR)
               DRYCON=ACON(I,NO,NR)*VD1*100
               WETCON=(GCON(I,NO,NR)-DRYCON)*(SC(I)/(SC(I)+1.E-30))
               IF (LTAB.EQ.1) GO TO 660

C*****  IF RADON OUTPUT ACON IN PCI/LITER OTHERWISE OUTPUT IN PCI/M**3
C*****  CURRENT CALCULATION IS IN PCI/CM**3

               IF ( RADON_FLAG ) THEN
                  WRITE(51,9058) DIRECTION(NO),IDIST(NR),NAMNUC(I),
     +                           1000*ACON(I,NO,NR),DRYCON,WETCON,
     +                           GCON(I,NO,NR)
               ELSE
                  WRITE(51,9058) DIRECTION(NO),IDIST(NR),NAMNUC(I),
     +                           1000000*ACON(I,NO,NR),DRYCON,WETCON,
     +                           GCON(I,NO,NR)
               ENDIF

  660          CONTINUE
  670        CONTINUE
  680     CONTINUE
       IF (LCHI.EQ.0) CALL CHIQ -
C-----END OF GRID LOOP----------------------------------------------------
  720 RETURN
 9000 FORMAT(F10.0)
 9001 FORMAT('1',T30,'NOTE-THE AREA SURROUNDING THE PLANT IS A SQUARE
     >WITH AN AREA')
 9002 FORMAT(' ',T35,'OF',F10.1,1X,
     > 'SQUARE KILOMETERS WITH THE PLANT AT THE CENTER.')
 9003 FORMAT(' ',T35,'THE SQUARE AREA IS ALIGNED DUE NORTH-SOUTH AND EAS
     >T-WEST. THE')
 9004 FORMAT(' ',T35,'400 SMALLER SQUARES, WHICH ARE EACH ',F7.1,1X,
     > 'METERS ON A SIDE,')
 9005 FORMAT(' ',T35,'ARE IDENTIFIED BY COLUMN AND ROW. COLUMNS ARE NUMB
     >ERED FROM')
 9006 FORMAT(' ',T35,'1 TO 20 FROM WEST TO EAST. ROWS ARE NUMBERED FROM
     >1 TO 20 FROM')
 9007 FORMAT(' ',T35,'SOUTH TO NORTH.')
 9008 FORMAT(8I10)
 9009 FORMAT(8F10.0)
 9010 FORMAT(16F5.0)
```

Concentration in air at ground level
- rate of deposition on ground
Dry Deposition velocity

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0        1         2         3         4         5         6         7
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 9011 FORMAT(A8)
 9012 FORMAT(7F10.0)
 9013 FORMAT('0')
90521 FORMAT('1',T10,'DATE',2X,A)
 9052 FORMAT('0',T20,'ESTIMATED RADIONUCLIDE CONCENTRATIONS')
 9053 FORMAT('0','  WIND',T10,'DISTANCE',T29,'AIR CONCEN',T41,
     > 'DRY DEP RATE',T55,'WET DEP RATE',T69,'GND DEP RATE')
 9054 FORMAT('  TOWARD',T10,'(METERS)',T20,'NUCLIDE',
     >  T31,'(PCI/L)',T42,'(PCI/M2/S)',T56,'(PCI/M2/S)',
     >  T70,'(PCI/M2/S)')
90541 FORMAT('  TOWARD',T10,'(METERS)',T20,'NUCLIDE',
     >  T30,'(PCI/M3)',T42,'(PCI/M2/S)',T56,'(PCI/M2/S)',
     >  T70,'(PCI/M2/S)')
 9057 FORMAT(' ',T4,'COLUMN',T21,'ROW')
 9058 FORMAT(' ',T4,A3,T10,I6,T20,A8,T31,1PE7.1,T43,1PE7.1,T57,1PE7.1,
     >  T71,1PE7.1)
 9059 FORMAT(10F8.4)
 9060 FORMAT(20I1)
      END
      FUNCTION CV(I,LAMI,DEPRAT,GCRU,TSUBE,YSUBV,TSUBH,R)
C CALCULATES THE CONCENTRATION OF NUCLIDE I IN AND ON VEGETATION USING
C EQ C-5, REG GUIDE 1.109-25. THE INPUT PARAMETERS ARE DEFINED AS FOLLOW
C
C     I          INDEXES NUCLIDE
C     LAMI       RADIOACTIVE DECAY CONSTANT FOR THE NUCLIDE  (HR**-1)
C     DEPRAT     DEPOSITION RATE OF RADIONUCLIDE I ONTO GROUND
C                AT THE GIVEN LOCATION ( PCI /M**2-HR)
C     TSUBE      PERIOD OF CROP, LEAFY VEGETABLE, OR PASTURE GRASS EXPOSU
C                DURING GROWING SEASON (HR)
C     YSUBV      AGRICULTURAL PRODUCTIVITY BY UNIT AREA (MEASURED IN WET
C                WEIGHT)  (KG/M**2)
C     TSUBH      TIME DELAY BETWEEN HARVEST OF VEGETATION OR CROPS AND
C                INGESTION (HR)
C     R          FRACTION OF DEPOSITED ACTIVITY RETAINED
C                ON CROPS, DIMENSIONLESS
C
      REAL LAMEI,LAMSI,LAMI,LAMS,LAMRR,LAMW
      COMMON /INGDOS/LAMW,LAMS,TSUBB,P,BSUBV,DR,RATUA
      COMMON /OCOM/ NNUCS,ANLAM(36),RR,SQSD,ACON(36,20,
     > 20),GCON(36,20,20),LIPO,NOMM(36,11),NRMM(36,11),ORMODI(36,12,8),
     > VD(36),VDCOEF(20,20),NOL,NOU,NRL,NRU
      COMMON /OCOMCHAR/ NAMNUC(36),WORD
      CHARACTER*8 NAMNUC,WORD
C THE EFFECTIVE REMOVAL RATE CONSTANT FOR THE RADIONUCLIDE FROM CROPS
C IN HR**-1 IS  (REG GUIDE 1.109-4)
      LAMEI = LAMI + LAMW
```

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0        1         2         3         4         5         6         7
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C WHERE LAMW IS THE REMOVAL RATE CONSTANT FOR WEATHERING.
C
C THE FOLLOWING CODE CALCULATES CV= CONCENTRATION OF NUCLIDE I USING EQ
      STUBB=TSUBB*8760.
      ALT=LAMEI*TSUBE
      IF (ALT.GT.0.03) GO TO 10
      XNUD1=(R*DR/YSUBV)*((0.1666667*ALT-0.5)*ALT+1.0)*TSUBE
      GO TO 20
   10 XNUD1=(R*DR/YSUBV)*((1.0-EXP(-LAMEI*TSUBE))/LAMEI)
   20 CONTINUE
      LAMSI=LAMS+LAMI
      ALT=LAMSI*STUBB
      IF (ALT.GT.0.03) GO TO 30
      XNUD2=(BSUBV/P)*((0.1666667*ALT-0.5)*ALT+1.0)*STUBB
      GO TO 40
   30 XNUD2=(BSUBV/P)*((1.0-EXP(-LAMSI*STUBB))/LAMSI)
   40 CONTINUE
      SUM=XNUD1+XNUD2
      PROD=SUM*EXP(-LAMI*TSUBH)
      SUM2=XNUD2
      PROD2=SUM2*EXP(-LAMI*TSUBH)
      RATUA=0.
      IF(SUM2.NE.0.) RATUA=SUM2/SUM
      CV = GCRU * PROD + (DEPRAT-GCRU)*PROD2
      RETURN
      END
C*************************************************************************
C*************************************************************************
C*     NEW SUBROUTINE ADDED MAY 1988 TO VARY EQUILIBRIUM FRACTIONS      *
C*     OLD METHOD HAD EQUIL. FRACTIONS SET TO A CONSTANT OF .7          *
C*     THE NEW METHOD VARIES THE EQUILIBRIUM FRACTIONS DEPENDING ON THE*
C*     DISTANCE FROM THE SOURCE.                                        *
C*     THIS ROUTINE USES LINEAR INTERPOLATION TO DETERMINE THE EQUIL.   *
C*     FRACTIONS FOR DISTANCES THAT DO MATCH THE SET DISTANCES          *
C*     GIVEN AND THEIR EQUIL. FRACTIONS.  THE EQUATION IS AS FOLLOWS    *
C*        EFY = EFX + ( (EFZ - EFX) * (( Y - X) / (Z - X) ))            *
C*     WHERE YOU HAVE     X__________Y__________Z                       *
C*          X AND Z ARE THE SET DISTANCES GIVEN AND Y IS THE USER GIVEN*
C*          DISTANCE (BETW X AND Z)  YOU ARE FINDING THE EQ. FRACTION   *
C*          FOR . EFX AND EFZ IS THE SET_EQUIL_FRACTIONS CORRESPONDING  *
C*          TO THE SET DISTANCES.                                       *
C*************************************************************************

      SUBROUTINE DETERMINE_EQUIL_FRACTIONS(IDIST,
     +                                     CALC_EQUIL_FRACTIONS,NRL,NRU)
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0         1         2         3         4         5         6         7
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      REAL CALC_EQUIL_FRACTIONS(20)
      INTEGER IDIST(20), NRL, NRU

      REAL SET_EQUIL_FRACTIONS(20)
      REAL SET_DISTANCES(20) ,DISTANCES(20)
      INTEGER*2 I , PTR, IN , UPPER_BOUNDRY, LOWER_BOUNDRY

C******SET EQUILIBRIUM FRACTIONS TO CONSTANTS FOR CHOSEN DISTANCES
C*****
      DATA SET_EQUIL_FRACTIONS /.267,.273,.276,.278,.284,.289,.293,.302,
     +                          .311,.331,.349,.366,.382,.414,.443,.471,
     +                          .522,.566,.650,.698/
      DATA SET_DISTANCES / 150.,200.,250.,300.,400.,500.,600.,800.,
     +                     1000.,1500.,2000.,2500.,3000.,4000.,
     +                     5000.,6000.,8000.,10000.,15000.,19551./
C****** SET UPPER AND LOWER BOUNDRY OF DISTANCE ARRAY
      DATA LOWER_BOUNDRY /1/,UPPER_BOUNDRY/20/

C****** SET INTEGER DISTANCES TO REALS FOR CALCULATIONS
      DO 5 I = NRL,NRU
         DISTANCES(I) = IDIST(I)
  5   CONTINUE
C***** IN IS THE INDEX TO THE FIRST DISTANCE SPECIFIED BY THE USER
      IN = NRL

C***** LOOP UNTIL USER GIVEN DISTANCES ARE <= TO 150 AND SET EQUIL
C***** FRACTIONS TO .267 (DISTANCES <= 150 ARE ALWAYS .267 )
 10   CONTINUE
      IF (( DISTANCES(IN) .LE. SET_DISTANCES(LOWER_BOUNDRY) ) .AND.
     +    ( IN .LE. NRU ) ) THEN
            CALC_EQUIL_FRACTIONS(IN) =SET_EQUIL_FRACTIONS(LOWER_BOUNDRY)
            IN = IN + 1
            GOTO 10
      ENDIF

C****** PTR     = Z (UPPER LIMIT)
C****** PTR - 1 = X (LOWER LIMIT)
C****** IN      = Y (GIVEN DISTANCE IN WHICH EQ. FRACTIONS IS BEING
C******              DETERMINED)

      PTR = 2

C****** WHILE INDEX TO USER SPECIFIED DISTANCES IS LESS THAN LAST
C****** GIVEN DISTANCES NDEX DO
  20  CONTINUE
      IF ( IN .LE. NRU) THEN
```

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0        1         2         3         4         5         6         7
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C****** WHILE INDEX TO SET DISTANCES IS <= UPPER BOUNDRY INTERPOLATE
C****** THE EQ. FRACTIONS FOR EACH DISTANCE GIVEN. IF > UPPER BOUNDRY
C****** SET FRACTION TO GIVEN FRACTION FOR DISTANCES > 19550 = .698

         IF ( PTR .LE. UPPER_BOUNDRY ) THEN
C******       USE LINEAR EQ IF DISTANCE IS < SET DISTANCE Z
              IF ( DISTANCES(IN) .LT. SET_DISTANCES(PTR) ) THEN
                 CALC_EQUIL_FRACTIONS(IN) = SET_EQUIL_FRACTIONS(PTR - 1) +
     +           ((SET_EQUIL_FRACTIONS(PTR) - SET_EQUIL_FRACTIONS(PTR-1))
     +           * (( DISTANCES(IN) - SET_DISTANCES(PTR - 1 ) ) /
     +           (SET_DISTANCES(PTR) - SET_DISTANCES(PTR - 1))))
                  IN = IN + 1
C******           IF DISTANCES ARE = SAME EQ. FRACTIONS IE Y = Z
              ELSE IF ( DISTANCES(IN) .EQ. SET_DISTANCES(PTR) ) THEN
                  CALC_EQUIL_FRACTIONS(IN) = SET_EQUIL_FRACTIONS(PTR)
                  IN = IN + 1
                  PTR = PTR + 1
C******           OTHERWISE Y > Z ..NEXT SET DISTANCE
              ELSE
                  PTR = PTR + 1
              ENDIF
C******       SET REST OF FRACTIONS ALL ARE > 19550
           ELSE
             CALC_EQUIL_FRACTIONS(IN) = SET_EQUIL_FRACTIONS(UPPER_BOUNDRY)
              IN = IN + 1
           ENDIF
           GOTO 20
         ENDIF
         RETURN
         END
C***********************************************************************
C***********************************************************************
C***********************************************************
      SUBROUTINE DOSEN(DATE_AND_TIME)
C
C       USNRC REG. GUIDE 1.109 MODELS FOR INGESTION DOSE CALCULATIONS
C       WERE IMPLEMENTED AND INCORPORATED WITHIN DOSEN BY J. C. PLEASANT
C       OF THE MATHEMATICS DEPARTMENT, EAST TENNESSEE STATE UNIVERSITY.
C
      COMMON /OCOM/ NNUCS,ANLAM(36),RR,SQSD, ACON(36,20,
     >  20),GCON(36,20,20),LIPO,NOMM(36,11),NRMM(36,11), ORMODI(36,12,8)
     > , VD(36),VDCOEF(20,20),NOL,NOU,NRL,NRU
      COMMON /INGDOS/LAMW,LAMS,TSUBB,P,BSUBV,DR,RATUA
      COMMON /NCOM/ NOML(11),NRML(11)
      COMMON /RVAL/ S1,S3,SD1,SD3,ACN,GCN,SW1,SW3
      COMMON /TCOM/ KIQ(36,20,20)
```

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0         1         2         3         4         5         6         7
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      COMMON /PCOM/ REL(6,36),IDIST(20),NUMST
      COMMON /FCOM/ FEQWL,INTPA(20,20)
      COMMON /OCOMCHAR/NAMNUC(36),WORD
C
      DIMENSION VAGAC(36),VAGCON(36),BAGAC(36),BAGCON(36)
      DIMENSION FING(36,20,20),GBUP(36,20,20)
      DIMENSION GI(36,4),PARSIZ(36),CLASS(36)
      DIMENSION GFIN(36,20,20),CEXP(4,36)
      REAL KIQ
      CHARACTER*36 DATE_AND_TIME
      CHARACTER*8 NADRN, NAMES(11)
      CHARACTER*8 NAMNUC,WORD,NADEC1,NADEC3,NAME(11),NAMORG(11)
      REAL CFINGA(11),CFINHA(11),DOSING(11),FROG(11),INTPA,
     > LAMH2O,LAMSUR,MSUBB,LAMRR,INTFC(20,20), DCC14(11),DOSIN(11,36),
     > VEGDOS(11),BEFDOS(11),MLKDOS(11),LAMI,LAMW,LAMS,LEFDOS,MAGAC(36),
     > MAGCON(36)
C**  NEW ARRAYS ADDED MAY 1988 FOR VARYING EQUILIBRIUM FRACTIONS
      REAL CALC_EQUIL_FRACTIONS(20),NEWWAL(20,20)
      INTEGER NOBCT(20,20),NOMCT(20,20),TNOBCT,TNOMCT
      INTEGER CLASS
      INTEGER*2 RNPTR
      LOGICAL RNFLAG
      DATA RNFLAG/.FALSE./,RNPTR/0/

      DATA NAME/'TOT.BODY','R MAR   ','LUNGS   ','ENDOST  ','S WALL  ',
     > 'LLI WALL','THYROID ','LIVER   ','KIDNEYS ','TESTES  ',
     > 'OVARIES '/
      DATA NADRN/'RN-222  '/
      DATA NADEC1/'H-3     '/,NADEC3/'C-14    '/
      DATA DCC14/1.16E3,2.03E3,5.07E2,1.85E3,7.43E2,8.92E2,5.27E2,
     > 7.30E2,6.49E2,4.46E2,4.46E2/,CEXP/144*0./,GI/144*0./
      DATA DOSIN/396*0.0/,GBUP/14400*0.0/,FING/14400*0.0/
C---END OF DECLARATIONS
      DO 5 I=1,11
    5   NAMES(I)=NAME(I)
      READ(50,9061)LIPO
      READ(50,9061)NNTB,NRTB,NSTB,NTTB,NUTB,NVTB
      READ(50,9062)((NOBCT(I,J),J=1,20),I=1,20)
      READ(50,9063)((NOMCT(I,J),J=1,20),I=1,20)
      READ(50,9064)((INTFC(I,J),J=1,20),I=1,20)
      READ(50,9065)((INTPA(I,J),J=1,20),I=1,20)
      READ(50,9067)IMPFIX
      READ(50,9068)RVEG,F3VEGM,RBEF,F3BEFM,RMLK,F3MLKM
      READ(50,9069)BRTHRT,DILFAC,USEFAC,T,DD1
C READ PARAMETERS FOR NRC MODEL
      READ(50,9000)TSUBH1,TSUBH2,TSUBH3,TSUBH4
```

AIRDOS-EPA (AIRDOS2.FOR) Program File
(continued)

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0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012
      READ(50,9000)LAMW
      READ(50,9000)TSUBE1,TSUBE2
      READ(50,9000)YSUBV1,YSUBV2
      READ(50,9000)FSUBP
      READ(50,9000)FSUBS
      READ(50,9000)QSUBF
      READ(50,9000)TSUBF
      READ(50,9000)UV,UM,UF,UL
      READ(50,9000)TSUBS
      READ(50,9000)FSUBG,FSUBL
      READ(50,9000)TSUBB
      READ(50,9000)P
      READ(50,9070)TAUBEF,MSUBB,VSUBM
      TAUCM=UM/365.
      TAUBM=UF/365.
      V=(UL+UV)/365.
      A=(UV+UL)/YSUBV2
      READ(50,9070)R1,R2
      S10=R2
      S30=R1
      S1=R2
      S3=R1
      WRITE(51,90011) DATE_AND_TIME
      WRITE(51,9001)
      IF (LIPO.EQ.1) WRITE(51,9003)
      IF (LIPO.EQ.0) WRITE(51,9002)
      WRITE(51,9004)
      WRITE(51,90004)
      IF (NUTB.NE.0) THEN
         WRITE(51,9009)
         WRITE(51,90009)
      ENDIF
      IF (NVTB.NE.0) WRITE(51,19010)
      WRITE(51,90011) DATE_AND_TIME
      WRITE(51,9079)
      WRITE(51,9080)NNUCS
      WRITE(51,9012)TSUBH1
      WRITE(51,9013)TSUBH2
      WRITE(51,9014)TSUBH3
      WRITE(51,9015)TSUBH4
      WRITE(51,9016)
      WRITE(51,90116)LAMW
      WRITE(51,9017)TSUBE1
      WRITE(51,9018)
      WRITE(51,90118)TSUBE2
      WRITE(51,9019)
```

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0         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123456789012

      WRITE(51,90119)YSUBV1
      WRITE(51,9020)
      WRITE(51,90220)YSUBV2
      WRITE(51,9021)FSUBP
      WRITE(51,9022)
      WRITE(51,90222)FSUBS
      WRITE(51,9023)
      WRITE(51,90223)QSUBF
      WRITE(51,9024)TSUBF
      WRITE(51,9025)UV
      WRITE(51,9026)UM
      WRITE(51,9027)UF
      WRITE(51,9028)UL
      WRITE(51,9029)
      WRITE(51,90229)TSUBS
      WRITE(51,9030)FSUBG
      WRITE(51,9031)FSUBL
      WRITE(51,9011)TSUBB
      WRITE(51,9010)
      WRITE(51,90110)P
      WRITE(51,9081)
      WRITE(51,90881)RVEG
      WRITE(51,9082)
      WRITE(51,90882)RBEF
      WRITE(51,9083)
      WRITE(51,90883)RMLK
      WRITE(51,9072)
      IF (IMPFIX.EQ.0) THEN
         WRITE(51,9085)
         WRITE(51,90885)
      ELSE
         WRITE(51,9084)
         WRITE(51,90884)
      ENDIF
  120 WRITE(51,9086)F3VEGM
      WRITE(51,9087)F3BEFM
      WRITE(51,9088)F3MLKM
      WRITE(51,9089)BRTHRT
      WRITE(51,9090)
      WRITE(51,90990)T
      WRITE(51,9091)DILFAC
      WRITE(51,9092)USEFAC
      WRITE(51,9093)MSUBB
      WRITE(51,9096)TAUBEF
      WRITE(51,9097)VSUBM
      WRITE(51,9094)S1
```

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0         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123456789012

      WRITE(51,9095)S3
      WRITE(51,9098)
      WRITE(51,90998)DD1
      TPOP=0
      TNOBCT=0
      TNOMCT=0
      TARFC=0
      DO 140 NR=NRL,NRU
         DO 130 NO=NOL,NOU
            TPOP=INTPA(NO,NR)+TPOP
            TNOBCT=NOBCT(NO,NR)+TNOBCT
            TNOMCT=NOMCT(NO,NR)+TNOMCT
  130       TARFC=INTFC(NO,NR)+TARFC
  140    CONTINUE
      ANUMM=TARFC/A
      TKGBCA=TAUBM*365.*TPOP
      ANOBCT=TNOBCT
      TKGBPA=ANOBCT*TAUBEF*365.*MSUBB
      CONMK=TAUCM*TPOP
      ANOMCT=TNOMCT
      PRNMK=VSUBM*ANOMCT
      YCONMK=CONMK*365.
      YPRNMK=PRNMK*365.
      PFCY=YSUBV2*TARFC
      CFCY=TPOP*V*365.

C***  CHECK ADDED 8/88 TO STOP DIVIDE BY ZERO ERROR WHEN TPOP = 0.
      IF ( ANUMM .GE. TPOP ) THEN
         AF = 1.0
      ELSE
        AF=ANUMM/TPOP
      ENDIF

      F3V=F3VEGM
      IF ((1.-AF).GE.F3V) F3V=1.-AF
      IF (IMPFIX.EQ.1) F3V=F3VEGM
      F1V=RVEG*(1.-F3V)
      F2V=1.-F3V-F1V

C*** DIVIDE BY ZERO CHECK ADDED 8/88
      IF ( TKGBPA .GE. TKGBCA ) THEN
         BF = 1.0
      ELSE
         BF=TKGBPA/TKGBCA
      ENDIF
```

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0        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

      F3B=F3BEFM
      IF ((1.-BF).GE.F3B) F3B=1.-BF
      IF (IMPFIX.EQ.1) F3B=F3BEFM
      F1B=RBEF*(1.-F3B)
      F2B=1.-F3B-F1B

C*** DIVIDE BY ZERO CHECK ADDED 8/88
      IF ( PRNMK .GE. CONMK ) THEN
         CF = 1.0
      ELSE
         CF=PRNMK/CONMK
      ENDIF

      F3M=F3MLKM
      IF ((1.-CF).GE.F3M) F3M=1.-CF
      IF (IMPFIX.EQ.1) F3M=F3MLKM
      F1M=RMLK*(1.-F3M)
      F2M=1.-F3M-F1M
      WRITE(51,90011) DATE_AND_TIME
      WRITE(51,9099)
      WRITE(51,9100)TPOP
      WRITE(51,9101)TNOBCT
      WRITE(51,9102)TNOMCT
      WRITE(51,9103)TARFC
      WRITE(51,9104)TKGBCA
      WRITE(51,9105)TKGBPA
      WRITE(51,9106)YCONMK
      WRITE(51,9107)YPRNMK
      WRITE(51,9108)CFCY
      WRITE(51,9109)PFCY
      IF (NVTB.NE.0) READ(50,9139)NAMES
      DO 680 I = 1, NNUCS
         IF ((NAMNUC(I) .EQ. NADRN ) .AND. ( .NOT. RNFLAG ) ) THEN
            RNFLAG = .TRUE.
            RNPTR  = I
         ENDIF
         READ(50,9110)NUMORG,LAMRR,CFSBA,CFSBW,CFSUR,KFLAG,TDCF,TDCW
         READ(50,9111)(FROG(IM),IM=1,11)
         READ(50,9000)FSUBMI,FSUBFI,BSUBV1,BSUBV2
         READ(50,9112)LAMSUR,LAMH2O,IFLAG,RD1,RD2,RW1,RW2
         READ(50,9032)I1,I2,I3,I4,I5,F1,F2,F3,F4,F5
         LAMI = LAMRR/24.
         LAMS = LAMSUR/24.
C  IFLAG=1 IF SPECIAL VALUES USED FOR R1 AND R2
C  IFLAG=2 IF R1 AND R2 ARE GIVEN FOR DRY AND WET DEPOSITION
         SD3=RD1
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0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

         SD1=RD2
         SW3=RW1
         SW1=RW2
C READ INHALATION DOSE CONVERSION FACTORS
C HEADER CARD GIVES  SOLUBILITY, PARTICLE SIZE, AND G.I. UPTAKE FRACTION
         READ(50,9033)ISOL,AMAD,F1INH
         DO 150 J=1,NUMORG
            READ(50,9034)NAMORG(J),CFINHA(J)
  150       CONTINUE
C READ INGESTION DOSE CONVERSION FACTORS
C HEADER CARD GIVES G.I. UPTAKE FRACTION
         READ(50,9035)F1ING
         DO 160 J=1,NUMORG
            READ(50,9035)CFINGA(J)
  160       CONTINUE
         CLASS(I)=ISOL
         PARSIZ(I)=AMAD
         GI(I,1)=F1INH
         GI(I,2)=F1ING
         IF (I1.NE.0) THEN
            IF (I2.EQ.0) I2=1
            IF (I3.EQ.0) I3=1
            IF (I4.EQ.0) I4=1
            IF (I5.EQ.0) I5=1
         ENDIF
         IF (I.LE.NNTB) THEN
            WRITE(51,9113)NAMNUC(I)
            WRITE(51,9072)
            WRITE(51,9114)
            WRITE(51,9115)
            WRITE(51,9072)
            WRITE(51,9116)
            WRITE(51,9117)
            WRITE(51,9072)
         ENDIF
  180    VAGCON(I)=0.
         BAGCON(I)=0.
         MAGCON(I)=0.
         VAGAC(I)=0.
         BAGAC(I)=0.
         MAGAC(I)=0.
         IF (I1.EQ.0) THEN
         DO 200 NR=NRL,NRU
            DO 190 NO=NOL,NOU
               VAGCON(I)=INTFC(NO,NR)*GCON(I,NO,NR)+VAGCON(I)
               BAGCON(I)=NOBCT(NO,NR)*GCON(I,NO,NR)+BAGCON(I)
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0         1         2         3         4         5         6         7
1234567890123456789012345678901234567890123456789012345678901234567890123456789012

                MAGCON(I)=NOMCT(NO,NR)*GCON(I,NO,NR)+MAGCON(I)
                VAGAC(I)=INTFC(NO,NR)*ACON(I,NO,NR)+VAGAC(I)
                BAGAC(I)=NOBCT(NO,NR)*ACON(I,NO,NR)+BAGAC(I)
                MAGAC(I)=NOMCT(NO,NR)*ACON(I,NO,NR)+MAGAC(I)
  190           CONTINUE
  200         CONTINUE
            VAGCON(I)=VAGCON(I)/TARFC
            BAGCON(I)=BAGCON(I)/ANOBCT
            MAGCON(I)=MAGCON(I)/ANOMCT
            VAGAC(I)=VAGAC(I)/TARFC
            BAGAC(I)=BAGAC(I)/ANOBCT
            MAGAC(I)=MAGAC(I)/ANOMCT
            ELSE
  210       IF (REL(1,I).EQ.0.) THEN
            DO 230 NR=NRL,NRU
               DO 220 NO=NOL,NOU
                  GCI=F1*GCON(I1,NO,NR)+F2*GCON(I2,NO,NR)+F3*GCON(I3,NO,NR)
     >             + F4*GCON(I4,NO,NR)+F5*GCON(I5,NO,NR)
                  VAGCON(I)=INTFC(NO,NR)*GCI+VAGCON(I)
                  BAGCON(I)=NOBCT(NO,NR)*GCI+BAGCON(I)
                  MAGCON(I)=NOMCT(NO,NR)*GCI+MAGCON(I)
  220             CONTINUE
  230          CONTINUE
            VAGCON(I)=VAGCON(I)/TARFC
            BAGCON(I)=BAGCON(I)/ANOBCT
            MAGCON(I)=MAGCON(I)/ANOMCT
            ELSE
  240       MODE=1
            BSUBV=BSUBV2
            TSUBE=TSUBE2
            YSUBV=YSUBV2
            TSUBH=TSUBH4
            DR=DD1
            DO 260 NR=NRL,NRU
               DO 250 NO=NOL,NOU
                  GCN=GCON(I,NO,NR)
                  ACN=ACON(I,NO,NR)
                  CALL RVALUE(IFLAG,MODE,I,NO,NR,R)
                  A=CV(I,LAMI,1.,1.,TSUBE,YSUBV,TSUBH,R)
                  GCI=F1*GCON(I1,NO,NR)+F2*GCON(I2,NO,NR)+F3*GCON(I3,NO,NR)
     >             + F4*GCON(I4,NO,NR)+F5*GCON(I5,NO,NR)
                  GFA=GCON(I,NO,NR)+RATUA*GCI
                  VAGCON(I)=INTFC(NO,NR)*GFA+VAGCON(I)
  250             CONTINUE
  260          CONTINUE
               VAGCON(I)=VAGCON(I)/TARFC
```

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0        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012
        MODE=2
        DR=1.
        TSUBE=TSUBE1
        YSUBV=YSUBV1
        BSUBV=BSUBV1
        TSUBH=TSUBH1
        DO 280 NR=NRL,NRU
           DO 270 NO=NOL,NOU
              GCN=GCON(I,NO,NR)
              ACN=ACON(I,NO,NR)
              CALL RVALUE(IFLAG,MODE,I,NO,NR,R)
              A=CV(I,LAMI,1.,1.,TSUBE,YSUBV,TSUBH,R)
              GCI=F1*GCON(I1,NO,NR)+F2*GCON(I2,NO,NR)+F3*GCON(I3,NO,NR)
     >         + F4*GCON(I4,NO,NR)+F5*GCON(I5,NO,NR)
              GFA=GCON(I,NO,NR)+RATUA*GCI
              BAGCON(I)=NOBCT(NO,NR)*GFA+BAGCON(I)
              MAGCON(I)=NOMCT(NO,NR)*GFA+MAGCON(I)
  270         CONTINUE
  280      CONTINUE
        BAGCON(I)=BAGCON(I)/ANOBCT
        MAGCON(I)=MAGCON(I)/ANOMCT
        ENDIF
        ENDIF
        IF (NAMNUC(I) .EQ. NADEC1) THEN
           NTRIT = 1
        ELSE
           NTRIT = 0
        ENDIF
        DO 560 NO=NOL,NOU
           DO 550 NR=NRL,NRU
              GCI=0
              IF (I1.NE.0) THEN
              GCI=F1*GCON(I1,NO,NR)+F2*GCON(I2,NO,NR)+F3*GCON(I3,NO,NR)
     >         + F4*GCON(I4,NO,NR)+F5*GCON(I5,NO,NR)
              ENDIF
  330         GCN=GCON(I,NO,NR)+GCI
  340         ACN=ACON(I,NO,NR)
              IF (I1.EQ.0) THEN
                 D1=1.
                 D2=1.
                 D3=1.
                 D4=1.
                 IF (GCON(I,NO,NR).NE.0.) THEN
                    D4=F1M+F2M*(MAGCON(I)/GCON(I,NO,NR))
                    D3=F1B+F2B*(BAGCON(I)/GCON(I,NO,NR))
                    D2=F1V+F2V*(VAGCON(I)/GCON(I,NO,NR))
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AIRDOS-EPA (AIRDOS2.FOR) Program File
(continued)

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0        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012
                     D1=D2
                  ELSE
                     IF (REL(1,I).EQ.0.) THEN
                        D4=F1M+F2M*(MAGCON(I)/GCI)
                        D3=F1B+F2B*(BAGCON(I)/GCI)
                        D2=F1V+F2V*(VAGCON(I)/GCI)
                        D1=D2
                     ENDIF
                  ENDIF
               ELSE
                  IF (REL(1,I).EQ.0.) THEN
                     D4=F1M+F2M*(MAGCON(I)/GCI)
                     D3=F1B+F2B*(BAGCON(I)/GCI)
                     D2=F1V+F2V*(VAGCON(I)/GCI)
                     D1=D2
                  ENDIF
               ENDIF
  370          DO 540 J=1,11
                  X=LAMRR+LAMSUR
                  IF (KFLAG.EQ.1) X=ANLAM(I)+LAMSUR
                  DO 380 N=1,NUMORG
                     IF (NAMES(J) .EQ. NAMORG(N)) THEN
                        L=N
                     ELSE
                        L=1
                     ENDIF
  380                CONTINUE
C  INHALATION DOSE CALCULATIONS
  400             CFINH=CFINHA(L)
                  CFING=CFINGA(L)
                  IF (ACN.EQ.0) DOS1=0
                  IF (ACN.EQ.0) DOS2=0
                  IF (ACN.NE.0.) THEN
                     DOS1=ACN*1.E-6*BRTHRT*8760.*CFINH
C  AIR SUBMERSION DOSE CALCULATIONS
                     DOS2=ACN*1.E-6*8760.*CFSBA*FROG(J)
                  ENDIF
C  SURFACE EXPOSURE DOSE CALCULATIONS
  410             ALT=X*T
                  IF (ALT.GT.0.03) THEN
                  DOS3=GCN*1.E-6*8760.*CFSUR*FROG(J)*(1-EXP(-X*T))/X*
     >             3600.*24.
                  GBUP(I,NO,NR)=GCN*1.E-8*24.*3600.*(1.-EXP(-X*T))/X
                  ELSE
                  DOS3=GCN*1.E-6*8760.*CFSUR*FROG(J)*((0.1666667*ALT-
     >             0.5)*ALT+T) *3600.*24.
```

AIRDOS-EPA (AIRDOS2.FOR) Program File
(continued)

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0        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

                   GBUP(I,NO,NR)=GCN*1.E-8*24.*3600.* ((0.1666667*ALT-
     >              0.5)*ALT+T)
                   ENDIF
C  INGESTION DOSE CALCULATIONS
  430              IF (NTRIT.NE.1.AND.NAMNUC(I).NE.NADEC3) GO TO 450
                   IF (NTRIT.NE.1) GO TO 440
C  INGESTION DOSE CALCULATIONS FOR H-3
                   VEGDOS(J)=(F1V*ACN+F2V*VAGAC(I))*TDCF*.505
                   BEFDOS(J)=(F1B*ACN+F2B*BAGAC(I))*TDCF*.185
                   MLKDOS(J)=(F1M*ACN+F2M*MAGAC(I))*TDCF*.310
                   DOSING(J)=VEGDOS(J)+BEFDOS(J)+MLKDOS(J)+ACN*TDCW
                   KIQ(I,NO,NR)=(((F1V*ACN+F2V*VAGAC(I))*1.E6)/8.)*1560.*
     >              .505*365.+(((ACN*1.E6)/8.)*1440.*365.)*(TDCW/5.70)
                   GFIN(I,NO,NR)=(((F1B*ACN+F2B*BAGAC(I))*1.E6)/8.)*1560.
     >              *.185*365.
                   FING(I,NO,NR)=(((F1M*ACN+F2M*MAGAC(I))*1.E6)/8.)*1560.
     >              *.310*365.
                   TDCWB=TDCW
                   GO TO 480
  440              CONTINUE
C  INGESTION DOSE CALCULATIONS FOR C-14
                   WTCV=79.96*V
                   WTCB=238.16*TAUBM
                   WTCM=68.9*TAUCM
                   WTF=WTCV+WTCB+WTCM
                   DOSING(J)=(DCC14(J)/WTF)*(WTCV*(F1V*ACN+F2V*VAGAC(I))+
     >               WTCB*(F1B*ACN+F2B*BAGAC(I))+WTCM*(F1M*ACN+F2M*
     >              MAGAC(I)))
                   VEGDOS(J)=(DCC14(J)/WTF)*(WTCV*(F1V*ACN+F2V*VAGAC(I)))
                   BEFDOS(J)=(DCC14(J)/WTF)*(WTCV*(F1B*ACN+F2B*BAGAC(I)))
                   MLKDOS(J)=(DCC14(J)/WTF)*(WTCV*(F1M*ACN+F2M*MAGAC(I)))
                   KIQ(I,NO,NR)=((F1V*ACN+F2V*VAGAC(I))/1.8E-7)*WTCV*365.
                   GFIN(I,NO,NR)=((F1B*ACN+F2B*BAGAC(I))/1.8E-7)*WTCB*365
     >              .
                   FING(I,NO,NR)=((F1M*ACN+F2M*MAGAC(I))/1.8E-7)*WTCM*365
     >              .
                   GO TO 480
C  INGESTION DOSES DEFINED AS ZERO IF GROUND CONCENTRATION IS ZERO
  450              IF (GCN.NE.0) GO TO 460
                   DOSING(J)=0.
                   VEGDOS(J)=0.
                   BEFDOS(J)=0.
                   MLKDOS(J)=0.
                   KIQ(I,NO,NR)=0.
                   GFIN(I,NO,NR)=0.
                   FING(I,NO,NR)=0.
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0         1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

                    GO TO 480
C INGESTION DOSE CALCULATIONS USING NRC MODEL
C CALCULATE CIV-CONCENTRATION OF RADIONUCLIDE IN THE ANIMAL'S FEED USING
C SLIGHTLY SIMPLIFIED FORM OF EQ C-11, REG GUIDE 1.109.27.
C CIV= FSUBP*FSUBS*(CONC. OF NUCLIDE ON PASTURE GRASS)
C      + (1.0-FSUBP*FSUBS)*(CONC. OF NUCLIDE IN STORED FEEDS)
C USE PARAMETERS FOR GRASS-COW-MILK-MAN-PATHWAY
C FIRST TERM..  USE TSUBH VALUE FOR INGESTION BY ANIMALS OF PASTURE GRAS
C THE DEPOSITION RATE GCN IS IN UNITS OF PCI/SQUARE CM-SEC.
C TO CONVERT TO PCI/SQUARE METER-HR,MULTIPLY BY 3.6E7.
  460               DEPRAT= GCN*3.6E7
                    GCRU=GCON(I,NO,NR)*3.6E7
                    GCN=GCRU/3.6E7
                    TSUBH=TSUBH1
                    TSUBE=TSUBE1
                    YSUBV=YSUBV1
                    BSUBV=BSUBV1
C LAMI IS THE RADIOACTIVE DECAY CONSTANT OF NUCLIDE I, IN HR**-1.
                    LAMI = LAMRR/24.
                    MODE=2
                    CALL RVALUE(IFLAG,MODE,I,NO,NR,R)
                    DR=1.
                    TERM1=FSUBP*FSUBS *CV(I,LAMI,DEPRAT,GCRU,TSUBE,YSUBV,
     >                TSUBH,R)
C SECOND TERM..  USE TSUBH VALUE FOR INGESTION BY ANIMALS OF STORED FEED
                    TSUBH=TSUBH2
                    TERM2=(1.0-FSUBP*FSUBS)*CV(I,LAMI,DEPRAT,GCRU,TSUBE,
     >                YSUBV,TSUBH,R)
                    CIV=TERM1 + TERM2
C
C CALCULATE CIM=NUCLIDE CONCENTRATION IN MILK USING EQ C-10, REG GUIDE
C 1.109-27
                    CIM=FSUBMI*CIV*QSUBF*EXP(-LAMRR*TSUBF)
C DFIJ IS THE DOSE CONVERSION FACTOR FOR THE INGESTION OF NUCLIDE I, ORG
C IN MREM/PCI.
                    DFIJ = 0.001*CFING
C CALCULATE MLKDOS(J)-ANNUAL DOSE TO ORGAN J FROM INGESTION OF RADIONUCL
C IN MILK USING EQ C-13,  REG GUIDE 1.109-28.
                    IF(I1.EQ.0.OR.REL(1,I).EQ.0..OR.RATUA.EQ.0.) GO TO 462
                    D4 = F1M+F2M*(MAGCON(I)/(GCON(I,NO,NR)+RATUA*GCI))
                    D3 = F1B+F2B*(BAGCON(I)/(GCON(I,NO,NR)+RATUA*GCI))
  462               MLKDOS(J)=DFIJ*UM*CIM*D4
C THE NRC MODEL GIVES DOSES IN MREM/YR.  TO CONVERT TO REM/YR,
C MULTIPLY BY 0.001
                    MLKDOS(J) = MLKDOS(J)*.001
C CALCULATE CIF=NUCLIDE CONCENTRATION IN MEAT USING EQ C-12, REG GUIDE 1
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                    CIF=FSUBFI*CIV*QSUBF*EXP(-LAMRR *TSUBS)
C CALCULATE BEFDOS(J)=ANNUAL DOSE TO ORGAN J FROM INGESTION OF
C RADIONUCLIDE I IN MEAT.  (REG GUIDE 1.109-28, EQ C-13)
                    BEFDOS(J)=DFIJ*UF*CIF*D3
                    BEFDOS(J) = BEFDOS(J) *.001
C CALCULATE CIVP=CONCENTRATION OF RADIONUCLIDE IN PRODUCE CONSUMED BY MA
C USE PARAMETERS FOR CROP/VEGETATION-MAN PATHWAY., TSUBH VALUE FOR PRODU
                    TSUBE= TSUBE2
                    YSUBV= YSUBV2
                    TSUBH= TSUBH4
                    BSUBV=BSUBV2
                    DR=DD1
                    MODE=1
                    CALL RVALUE(IFLAG,MODE,I,NO,NR,R)
                    CIVP=CV(I,LAMI,DEPRAT,GCRU,TSUBE,YSUBV,TSUBH,R)
C CALCULATE PRODOS=ANNUAL DOSE TO ORGAN J FROM INGESTION BY MAN OF RADIO
C IN PRODUCE.   (REG GUIDE 1.109-28, EQ C-13)
                    IF(I1.EQ.0.OR.REL(1,I).EQ.0..OR.RATUA.EQ.0.) GO TO 464
                    D2 = F1V+F2V*(VAGCON(I)/(GCON(I,NO,NR)+RATUA*GCI))
  464               D1=D2
                    PRODOS=DFIJ*UV*FSUBG*CIVP*D2
C CALCULATE CIVL=CONCENTRATION OF RADIONUCLIDE IN LEAFY VEGETABLES.
C USE PARAMETERS FOR CROP/VEGETATION-MAN PATHWAY.
C THE TSUBH VALUE IS FOR LEAFY VEGETABLES.
                    TSUBE=TSUBE2
                    YSUBV=YSUBV2
                    TSUBH=TSUBH3
                    BSUBV=BSUBV2
                    DR=DD1
                    CIVL=CV(I,LAMI,DEPRAT,GCRU,TSUBE,YSUBV,TSUBH,R)
C CALCULATE LEFDOS=ANNUAL DOSE TO ORGAN J FROM INGESTION OF RADIONUCLIDE
C IN LEAFY VEGETABLES.   (REG GUIDE 1.109-28, EQ C-13)
                    LEFDOS=DFIJ*UL*FSUBL*CIVL*D1
C VEGDOS(J) IS THE ANNUAL DOSE TO ORGAN J FROM INGESTION OF RADIONUCLIDE
C IN PRODUCE AND LEAFY VEGETABLES.
                    VEGDOS(J)=PRODOS + LEFDOS
                    VEGDOS(J) = VEGDOS(J)*.001
                    DOSING(J)=BEFDOS(J) + MLKDOS(J) + VEGDOS(J)
                    IF (J.NE.11) GO TO 470
                    KIQ(I,NO,NR)=UL*FSUBL*CIVL*D1+UV*FSUBG*CIVP*D2
                    GFIN(I,NO,NR)=UF*CIF*D3
                    FING(I,NO,NR)=UM*CIM*D4
  470               GCN=DEPRAT/3.6E7
C  WATER SUBMERSION DOSE CALCULATIONS
  480               X=LAMRR+LAMH2O
                    IF (KFLAG.EQ.1) X=ANLAM(I)+LAMH2O
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AIRDOS-EPA (AIRDOS2.FOR) Program File
(continued)

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                  IF (GCN.NE.0) THEN
                     ALT=X*T
                     IF (ALT.GT.0.03) THEN
                        DOS5=GCN*1.E-6*8760.*CFSBW*FROG(J)*USEFAC
     >                       /DILFAC*(1-EXP(-X*T))/X *3600.*24.
                     ELSE
                        DOS5=GCN*1.E-6*8760.*CFSBW*FROG(J)*USEFAC
     >                    /DILFAC*((0.1666667* ALT-0.5)*ALT+T)*3600.*24.
                     ENDIF
                  ELSE
                     DOS5=0
                  ENDIF
  510             TDOS=DOS1+DOS2+DOS3+DOSING(J)+DOS5
                  IF (I.LE.NNTB) THEN
                     WRITE(51,9118)NO,NR,NAMES(J),DOS1,DOS2,DOS3,
     >                             DOSING(J),DOS5,TDOS
                  ENDIF
                  IF (LIPO.EQ.1) THEN
C POPULATION DOSE CALCULATIONS
                     ORMODI(I,J,1)=DOS1*INTPA(NO,NR)+ORMODI(I,J,1)
                     ORMODI(I,J,2)=DOS2*INTPA(NO,NR)+ORMODI(I,J,2)
                     ORMODI(I,J,3)=DOS3*INTPA(NO,NR)+ORMODI(I,J,3)
                     ORMODI(I,J,4)=DOSING(J)*INTPA(NO,NR)+ORMODI(I,J,4)
                     ORMODI(I,J,5)=DOS5*INTPA(NO,NR)+ORMODI(I,J,5)
                     ORMODI(I,J,6)=VEGDOS(J)*INTPA(NO,NR)+ORMODI(I,J,6)
                     ORMODI(I,J,7)=BEFDOS(J)*INTPA(NO,NR)+ORMODI(I,J,7)
                     ORMODI(I,J,8)=MLKDOS(J)*INTPA(NO,NR)+ORMODI(I,J,8)
C  CALCULATIONS OF THE HIGHEST INDIVIDUAL DOSE FOR EACH RADIONUCLIDE
C  AND ORGAN AND GRID LOCATION WHERE RECEIVED
                  ELSE
  530                IF (TDOS.GT.DOSIN(J,I)) THEN
                        NOMM(I,J)=NO
                        NRMM(I,J)=NR
                        ORMODI(I,J,1)=DOS1
                        ORMODI(I,J,2)=DOS2
                        ORMODI(I,J,3)=DOS3
                        ORMODI(I,J,4)=DOSING(J)
                        ORMODI(I,J,5)=DOS5
                        ORMODI(I,J,6)=VEGDOS(J)
                        ORMODI(I,J,7)=BEFDOS(J)
                        ORMODI(I,J,8)=MLKDOS(J)
                        DOSIN(J,I)=TDOS
                     ENDIF
                  ENDIF
  540             CONTINUE
  550          CONTINUE
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0        1         2         3         4         5         6         7
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  560       CONTINUE
  570     CONTINUE
  580     WRITE(51,90011) DATE_AND_TIME
          WRITE(51,9119)NAMNUC(I)
          IF (IFLAG.GT.2.OR.IFLAG.LT.0) PRINT 9120
  590     IF (IFLAG.EQ.1) THEN
             WRITE(51,9121)SD1
             WRITE(51,9122)SD3
          ENDIF
  600     IF (IFLAG.EQ.2) THEN
             WRITE(51,9123)SD1
             WRITE(51,9124)SW1
             WRITE(51,9125)SD3
             WRITE(51,9126)SW3
          ENDIF
  610     WRITE(51,9127)LAMRR
          IF (KFLAG.EQ.1) THEN
             WRITE(51,9128)
             WRITE(51,9129)
          ENDIF
  620     WRITE(51,9130)LAMSUR
          WRITE(51,9131)LAMH2O
          IF (NTRIT.EQ.1) THEN
             WRITE(51,9132)TDCF
             WRITE(51,9133)TDCW
  630     ELSE
             WRITE(51,9036)
             WRITE(51,90336) FSUBMI
             WRITE(51,9037)
             WRITE(51,90337) FSUBFI
             WRITE(51,9038)
             WRITE(51,90338) BSUBV1
             WRITE(51,9039)
             WRITE(51,9040)
             WRITE(51,90440) BSUBV2
             WRITE(51,9041)
             WRITE(51,9042)F1INH
             WRITE(51,9043)F1ING
             WRITE(51,9044)AMAD
             WRITE(51,9045)ISOL
             IF (I1.NE.0) THEN
                WRITE(51,9046)
                WRITE(51,9047)
                WRITE(51,9048)
                WRITE(51,9049)NAMNUC(I1),F1
                IF (F2.NE.0.) WRITE(51,9050)NAMNUC(I2),F2
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               IF (F3.NE.0.) WRITE(51,9050)NAMNUC(I3),F3
               IF (F4.NE.0.) WRITE(51,9050)NAMNUC(I4),F4
               IF (F5.NE.0.) WRITE(51,9050)NAMNUC(I5),F5
            ENDIF
         ENDIF
         WRITE(51,9072)
         DO 670 J=1,NUMORG
            DO 660 K=1,11
               IF (NAMORG(J).EQ.NAMES(K)) THEN
                  CASBA=CFSBA*FROG(K)
                  CASUR=CFSUR*FROG(K)
                  CASBW=CFSBW*FROG(K)
               ENDIF
  660          CONTINUE
  670       CONTINUE
  680    CONTINUE
C START OF MAXIMIZING CALCULATIONS FOR THE INDIVIDUAL DOSE OPTION
       IF (LIPO.EQ.0) THEN
       DO 840 J=1,11
          ADSE=0
          DO 750 NO=NOL,NOU
             DO 740 NR=NRL,NRU
                DSE=0
                AKR=0
                BKR=0
                DKR=0
                EKR=0
                VEG=0
                BEF=0
                AME=0
                DO 730 I=1,NNUCS
                   AC=ACON(I,NOMM(I,J),NRMM(I,J))
                   IF (AC.EQ.0.) GO TO 690
                   AKR=ORMODI(I,J,1)/AC*ACON(I,NO,NR)+AKR
                   BKR=ORMODI(I,J,2)/AC*ACON(I,NO,NR)+BKR
  690              BC=GBUP(I,NOMM(I,J),NRMM(I,J))
                   IF (BC.EQ.0) GO TO 700
                   DKR=ORMODI(I,J,3)/BC*GBUP(I,NO,NR)+DKR
                   EKR=ORMODI(I,J,5)/BC*GBUP(I,NO,NR)+EKR
  700              IF (NAMNUC(I).EQ.NADEC1.OR.NAMNUC(I).EQ.NADEC3) GO TO
     >              710
                   IF (BC.EQ.0) GO TO 720
                   VEG=ORMODI(I,J,6)*(KIQ(I,NO,NR)/(KIQ(I,NOMM(I,J),
     >              NRMM(I,J))+1.E-60))+VEG
                   BEF=ORMODI(I,J,7)*(GFIN(I,NO,NR)/(GFIN(I,NOMM(I,J),
     >              NRMM(I,J))+1.E-60))+BEF
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                  AME=ORMODI(I,J,8)*(FING(I,NO,NR)/(FING(I,NOMM(I,J),
     >             NRMM(I,J))+1.E-60))+AME
                  GO TO 720
  710             ACO=ACON(I,NO,NR)
                  VEG=((F1V*ACO+F2V*VAGAC(I))/(F1V*AC+F2V*VAGAC(I)+1.E-
     >             60))* ORMODI(I,J,6)+VEG
                  BEF=((F1B*ACO+F2B*BAGAC(I))/(F1B*AC+F2B*BAGAC(I)+1.E-
     >             60))* ORMODI(I,J,7)+BEF
                  AME=((F1M*ACO+F2M*MAGAC(I))/(F1M*AC+F2M*MAGAC(I)+1.E-
     >             60))* ORMODI(I,J,8)+AME
                  IF (NAMNUC(I).EQ.NADEC1) AME=AME+ACO*TDCWB
  720             CONTINUE
                  TING=VEG+BEF+AME
  730             DSE=AKR+BKR+DKR+EKR+TING
                IF (DSE.GE.ADSE) THEN
                  ADSE=DSE
                  NOML(J)=NO
                  NRML(J)=NR
                ENDIF
  740           CONTINUE
  750         CONTINUE
            NO=NOML(J)
            NR=NRML(J)
            DO 830 I=1,NNUCS
              AC=ACON(I,NOMM(I,J),NRMM(I,J))
              IF(AC.NE.0.) THEN
                ACI=ACON(I,NO,NR)
                IF (ACI.NE.0.) THEN
                  ORMODI(I,J,1)=ORMODI(I,J,1)/AC*ACI
                  ORMODI(I,J,2)=ORMODI(I,J,2)/AC*ACI
                ELSE
                  ORMODI(I,J,1)=0.
                  ORMODI(I,J,2)=0.
                ENDIF
              ELSE
                  ORMODI(I,J,1)=0.
                  ORMODI(I,J,2)=0.
              ENDIF
  770         BC=GBUP(I,NOMM(I,J),NRMM(I,J))
              IF(BC.EQ.0.) THEN
                ORMODI(I,J,3)=0
                ORMODI(I,J,5)=0
              ELSE
                BCI=GBUP(I,NO,NR)
                IF (BCI.EQ.0) THEN
                  ORMODI(I,J,3)=0
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                  ORMODI(I,J,5)=0
               ELSE
                  ORMODI(I,J,3)=ORMODI(I,J,3)/BC*BCI
                  ORMODI(I,J,5)=ORMODI(I,J,5)/BC*BCI
               ENDIF
            ENDIF
  790       IF (NAMNUC(I).EQ.NADEC1.OR.NAMNUC(I).EQ.NADEC3) GO TO 810
            IF (BCI.EQ.0) GO TO 800
            ORMODI(I,J,6)=ORMODI(I,J,6)*(KIQ(I,NO,NR)/(KIQ(I,NOMM(I,J),
     >       NRMM(I,J))+1.E-60))
            ORMODI(I,J,7)=ORMODI(I,J,7)*(GFIN(I,NO,NR)/(GFIN(I,NOMM(I,J)
     >       ,NRMM(I,J))+1.E-60))
            ORMODI(I,J,8)=ORMODI(I,J,8)*(FING(I,NO,NR)/(FING(I,NOMM(I,J)
     >       ,NRMM(I,J))+1.E-60))
            GO TO 820
  800       ORMODI(I,J,6)=0
            ORMODI(I,J,7)=0
            ORMODI(I,J,8)=0
            GO TO 820
  810       CONTINUE
            ORMODI(I,J,6)=((F1V*ACI+F2V*VAGAC(I))/(F1V*AC+F2V*VAGAC(I)+
     >       1.E-60) )* ORMODI(I,J,6)
            ORMODI(I,J,7)=((F1B*ACI+F2B*BAGAC(I))/(F1B*AC+F2B*BAGAC(I)+
     >       1.E-60) )* ORMODI(I,J,7)
            ORMODI(I,J,8)=((F1M*ACI+F2M*MAGAC(I))/(F1M*AC+F2M*MAGAC(I)+
     >       1.E-60) )* ORMODI(I,J,8)
  820       ORMODI(I,J,4)=ORMODI(I,J,6)+ORMODI(I,J,7)+ORMODI(I,J,8)
            IF (NAMNUC(I).EQ.NADEC1) ORMODI(I,J,4)=ORMODI(I,J,4)+ACI*
     >       TDCWB
  830       CONTINUE
  840    CONTINUE
C END OF MAXIMIZING CALCULATIONS FOR THE INDIVIDUAL DOSE OPTION
      ENDIF

C***  CALCULATE VARYING EQUILIBRIUM FRACTIONS..NO LONGER CONSTANT OF .7
C****   CHANGED MAY 1988
C***
      IF ( ( RNFLAG ) .AND. ( NUTB .NE. 0 ) ) THEN
          CALL DETERMINE_EQUIL_FRACTIONS(IDIST,CALC_EQUIL_FRACTIONS,
     +                                   NRL,NRU)
      ENDIF
C  OUTPUT FOR HEALTH RISK CALCULATIONS
      DO 970 I=1,NNUCS
         TIME=0
         WRITE(25)NAMNUC(I),PARSIZ(I),CLASS(I),(GI(I,J),J=1,4),TIME,LIPO
         WRITE(25)NOL,NOU,NRL,NRU,(IDIST(IG),IG=NRL,NRU)
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  922     ALIP=LIPO
          DO 960 NO=NOL,NOU
             DO 950 NR=NRL,NRU
                ACUP=ACON(I,NO,NR)*1.E-6*(ALIP*(INTPA(NO,NR)-1.)+1.)
                CEXP(1,I)=CEXP(1,I)+ACUP
                GBIP=GBUP(I,NO,NR)*(ALIP*(INTPA(NO,NR)-1.)+1.)
                CEXP(2,I)=CEXP(2,I)+GBIP
                FIOP=(KIQ(I,NO,NR)+GFIN(I,NO,NR)+FING(I,NO,NR))* (ALIP*
     >           (INTPA(NO,NR)-1.)+1.)
                CEXP(3,I)=CEXP(3,I)+FIOP
                FINH=ACON(I,NO,NR)*BRTHRT*8760.*(ALIP*(INTPA(NO,NR)-1.)+
     >           1.)
                CEXP(4,I)=CEXP(4,I)+FINH
  924           IF (NAMNUC(I).NE.NADRN) THEN
                   WRITE(25) ACUP,GBIP,FIOP,FINH
                ELSE
  930              NEWWAL(NO,NR) = CALC_EQUIL_FRACTIONS(NR) * 10. *
     +                 ACON(I,NO,NR) * (ALIP * (INTPA(NO,NR) - 1.) + 1.)

C***  CHECK TO SEE IF POPULATION RUN.. IF INDIVIDUAL OUTPUT GROUND CONCENTRA.
C***    FOR NEW SYNOPSIS REPORT IN DARTAB

C***               IF   ( LIPO .EQ. 0 ) THEN
                      WRITE(25) CALC_EQUIL_FRACTIONS(NR),NEWWAL(NO,NR),
     +                          1000*ACON(I,NO,NR)
C***               ELSE
C***                  WRITE(25) CALC_EQUIL_FRACTIONS(NR),NEWWAL(NO,NR)
C***               ENDIF

                ENDIF
  950           CONTINUE
  960        CONTINUE
          IF (LIPO.EQ.1) WRITE(25)INTPA
  970     CONTINUE
  980  CONTINUE
       IF ((NUTB .NE. 0 ) .AND. ( RNFLAG ) )
     +  CALL DOSMIC(CALC_EQUIL_FRACTIONS,NEWWAL,RNPTR,IDIST,NAMES,
     +              DATE_AND_TIME)
  990  RETURN
 9000  FORMAT(8E10.3)
90011  FORMAT('1',T10,'DATE',2X,A)
 9001  FORMAT('0',T3,
     > '***OPTIONS SELECTED FOR DOSE AND INTAKE CALCULATIONS***')
 9002  FORMAT('0',T11,'CALCULATIONS ARE MADE FOR THE MAXIMALLY-EXPOSED I
     >NDIVIDUAL.')
 9003  FORMAT('0',T11,'CALCULATIONS ARE MADE FOR THE POPULATION.')
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(continued)

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 9004 FORMAT('0',T11,'TABLES FOR EACH NUCLIDE LISTING DOSES BY ORGAN',
     > ' AND PATHWAY')
90004 FORMAT(' ',T11,'AT EACH ENVIRONMENTAL LOCATION ARE OMITTED.')
 9009 FORMAT('0',T11,'WORKING LEVELS ARE CALCULATED FOR RN-222 IF')
90009 FORMAT(' ',T11,'IT IS IN THE SOURCE TERM.')
19010 FORMAT('0',T11,'ORGAN NAMES ARE INPUT.')
 9010 FORMAT('0',T11,'EFFECTIVE SURFACE DENSITY OF SOIL',
     > 'KG/SQ. M, DRY WEIGHT.')
90110 FORMAT(T11,'(ASSUMES 15 CM PLOW LAYER)',T71,E10.2)
 9011 FORMAT('0',T6,'PERIOD OF LONG-TERM BUILDUP FOR ',
     > 'ACTIVITY IN SOIL (YEARS)',T71,E10.2)
 9012 FORMAT('0',T6,'TIME DELAY--INGESTION OF PASTURE GRASS BY ',
     > 'ANIMALS (HR)',T71,E10.2)
 9013 FORMAT('0',T6,'TIME DELAY--INGESTION OF STORED FEED BY ',
     > 'ANIMALS (HR)',T71,E10.2)
 9014 FORMAT('0',T6,'TIME DELAY--INGESTION OF LEAFY VEGETABLES ',
     > 'BY MAN (HR)' ,T71,E10.2)
 9015 FORMAT('0',T6,'TIME DELAY--INGESTION OF PRODUCE BY ',  'MAN (HR)',
     > T71,E10.2)
 9016 FORMAT('0',T6,'REMOVAL RATE CONSTANT FOR PHYSICAL LOSS BY')
90116 FORMAT(T11,'WEATHERING (PER HOUR)',T71,E10.2)
 9017 FORMAT('0',T6,'PERIOD OF EXPOSURE DURING GROWING SEASON--',
     > 'PASTURE GRASS (HR)',T71,E10.2)
 9018 FORMAT('0',T6,'PERIOD OF EXPOSURE DURING GROWING SEASON--')
90118 FORMAT(T11,'CROPS OR LEAFY VEGETABLES (HR)',T71,E10.2)
 9019 FORMAT('0',T6,'AGRICULTURAL PRODUCTIVITY BY UNIT AREA')
90119 FORMAT(T11,'(GRASS-COW-MILK-MAN PATHWAY (KG/SQ. METER))',
     > T71,E10.2)
 9020 FORMAT('0',T6,'AGRICULTURAL PRODUCTIVITY BY UNIT AREA')
90220 FORMAT(T11,'(PRODUCE OR LEAFY VEG INGESTED BY MAN (KG/SQ METER))',
     > T71,E10.2)
 9021 FORMAT('0',T6,'FRACTION OF YEAR ANIMALS GRAZE ON PASTURE ',T71,
     > E10.2)
 9022 FORMAT('0',T6,'FRACTION OF DAILY FEED THAT IS PASTURE GRASS')
90222 FORMAT(T11,'WHEN ANIMAL GRAZES ON PASTURE',T71,E10.2)
 9023 FORMAT('0',T6,'CONSUMPTION RATE OF CONTAMINATED FEED OR FORAGE')
90223 FORMAT(T11,'BY AN ANIMAL IN KG/DAY (DRY WEIGHT)',T71,E10.2)
 9024 FORMAT('0',T6,'TRANSPORT TIME FROM ANIMAL FEED-MILK-MAN (DAY)',
     > T71,E10.2)
 9025 FORMAT('0',T6,'RATE OF INGESTION OF PRODUCE BY MAN (KG/YR)',
     > T71,E10.2)
 9026 FORMAT('0',T6,'RATE OF INGESTION OF MILK BY MAN (LITERS/YR)',
     > T71,E10.2)
 9027 FORMAT('0',T6,'RATE OF INGESTION OF MEAT BY MAN (KG/YR)', T71,
     > E10.2)
 9028 FORMAT('0',T6,'RATE OF INGESTION OF LEAFY VEGETABLES BY MAN ',
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     > '(KG/YR)',T71,E10.2)
 9029 FORMAT('0',T6,'AVERAGE TIME FROM SLAUGHTER OF MEAT ANIMAL TO')
90229 FORMAT(T11,'CONSUMPTION (DAY)',T71,E10.2)
 9030 FORMAT('0',T6,'FRACTION OF PRODUCE INGESTED GROWN IN GARDEN ',
     > 'OF INTEREST',T71,E10.2)
 9031 FORMAT('0',T6,'FRACTION OF LEAFY VEGETABLES GROWN IN GARDEN ',
     > 'OF INTEREST',T71,E10.2)
 9032 FORMAT(5I4,5E10.3)
 9033 FORMAT(T11,A1,T15,E10.3,T27,E10.3)
 9034 FORMAT(A8,T10,E10.3)
 9035 FORMAT(T11,E10.3)
 9036 FORMAT('0',T6,'AVERAGE FRACTION OF ANIMAL''S DAILY INTAKE OF ',
     >'NUCLIDE')
90336 FORMAT(T10, 'WHICH APPEARS IN EACH L OF MILK (DAYS/L)',T71,E10.2)
 9037 FORMAT('0',T6,'FRACTION OF ANIMAL''S DAILY INTAKE OF NUCLIDE')
90337 FORMAT(T10,'WHICH APPEARS IN EACH KG OF FLESH (DAYS/KG)',
     > T71,E10.2)
 9038 FORMAT('0',T6,'CONCENTRATION FACTOR FOR UPTAKE OF NUCLIDE FROM ',
     >'SOIL FOR')
90338 FORMAT(T10,'PASTURE AND FORAGE',T71,E10.2)
 9039 FORMAT(' ',T10,'(IN PCI/KG DRY WEIGHT PER PCI/KG DRY SOIL)')
 9040 FORMAT('0',T6,'CONCENTRATION FACTOR FOR UPTAKE OF NUCLIDE FROM ',
     >'SOIL BY')
90440 FORMAT(T10,'EDIBLE PARTS OF CROPS',T71,E10.2)
 9041 FORMAT(' ',T10,'(IN PCI/KG WET WEIGHT PER PCI/KG DRY SOIL)')
 9042 FORMAT('0',T6,'GI UPTAKE FRACTION (INHALATION)',T71,E10.2)
 9043 FORMAT('0',T6,'GI UPTAKE FRACTION (INGESTION)' ,T71,E10.2)
 9044 FORMAT('0',T6,'PARTICLE SIZE (MICRONS)',T71,E10.2)
 9045 FORMAT('0',T6,'SOLUBILITY CLASS',T71,A1)
 9046 FORMAT('0',T20,'CONCENTRATIONS ON GROUND AND WATER INCLUDE CONTRIB
     >UTIONS RESULTING FROM ')
 9047 FORMAT(' ',T20,'DECAY OF THE FOLLOWING PARENT NUCLIDES AFTER DEPOS
     >ITION--')
 9048 FORMAT('0',T40,'NUCLIDE',T67,'BUILDUP FACTOR')
 9049 FORMAT('0',T41,A8,T69,E10.3)
 9050 FORMAT(' ',T41,A8,T69,E10.3)
 9059 FORMAT(' ',T6,I2,T18,I7,T45,E10.3,T68,E10.3,T92,E10.3,T118,E10.3)
 9061 FORMAT(6I10)
 9062 FORMAT(16I5)
 9063 FORMAT(16I5)
 9064 FORMAT(8E10.3)
 9065 FORMAT(8F10.1)
 9066 FORMAT(40I2)
 9067 FORMAT(I10)
 9068 FORMAT(6F10.3)
 9069 FORMAT(6F10.3)
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AIRDOS-EPA (AIRDOS2.FOR) Program File
(continued)

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 9070 FORMAT (10F8.4)
 9072 FORMAT('0')
 9079 FORMAT('0',T21,'*VALUES FOR RADIONUCLIDE-INDEPENDENT VARIABLES*')
 9080 FORMAT('0',T6,'NUMBER OF NUCLIDES CONSIDERED',T71,I10)
 9081 FORMAT('0',T6,'VEGETABLE INGESTION RATIO-IMMEDIATE')
90881 FORMAT(T11,'SURROUNDING AREA/TOTAL WITHIN AREA',T71,E10.2)
 9082 FORMAT('0',T6,'MEAT INGESTION RATIO-IMMEDIATE')
90882 FORMAT(T11,'SURROUNDING AREA/TOTAL WITHIN AREA',T71,E10.2)
 9083 FORMAT('0',T6,'MILK INGESTION RATIO-IMMEDIATE')
90883 FORMAT(T11,'SURROUNDING AREA/TOTAL WITHIN AREA',T71,E10.2)
 9084 FORMAT(' ',T6,'MINIMUM FRACTIONS OF FOOD TYPES FROM OUTSIDE AREA')
90884 FORMAT(T10,'LISTED BELOW ARE ACTUAL FIXED VALUES')
 9085 FORMAT(' ',T15,'**ACTUAL FRACTIONS OF FOOD TYPES FROM OUTSIDE',
     > ' AREA CAN BE GREATER')
90885 FORMAT(T26,'THAN THE MINIMUM FRACTIONS LISTED BELOW**')
 9086 FORMAT('0',T6,
     > 'MINIMUM FRACTION VEGETABLES INGESTED FROM OUTSIDE AREA',T71,
     > E10.2)
 9087 FORMAT('0',T6,'MINIMUM FRACTION MEAT INGESTED FROM OUTSIDE AREA',
     >  T71,E10.2)
 9088 FORMAT('0',T6,'MINIMUM FRACTION MILK INGESTED FROM OUTSIDE AREA',
     >  T71,E10.2)
 9089 FORMAT('0',T6,'INHALATION RATE OF MAN (CUBIC CENTIMETERS/HR)',
     > T71,E10.2)
 9090 FORMAT('0',T6,'BUILDUP TIME FOR RADIONUCLIDES DEPOSITED')
90990 FORMAT(T11,'ON GROUND AND WATER (DAYS)',T71,E10.2)
 9091 FORMAT('0',T6,'DILUTION FACTOR FOR WATER FOR SWIMMING (CM)',T71,
     >  E10.2)
 9092 FORMAT('0',T6,'FRACTION OF TIME SPENT SWIMMING',T71,E10.2)
 9093 FORMAT('0',T6,'MUSCLE MASS OF ANIMAL AT SLAUGHTER (KG)',T71,
     > E10.2)
 9094 FORMAT('0',T6,'FALLOUT INTERCEPTION FRACTION-VEGETABLES', T71,
     > E10.2)
 9095 FORMAT('0',T6,'FALLOUT INTERCEPTION FRACTION-PASTURE',T71,E10.2)
 9096 FORMAT('0',T6,'FRACTION OF ANIMAL HERD SLAUGHTERED PER DAY',T71,
     >  E10.2)
 9097 FORMAT('0',T6,'MILK PRODUCTION OF COW (LITERS/DAY)',T71,E10.2)
 9098 FORMAT('0',T6,'FRACTION OF RADIOACTIVITY RETAINED ON LEAFY')
90998 FORMAT(T11,'VEGETABLES AND PRODUCE AFTER WASHING',T71,E10.2)
 9099 FORMAT('0',T21,'*COMPUTED VALUES FOR THE AREA*')
 9100 FORMAT('0',T6,'TOTAL POPULATION',T71,F12.1)
 9101 FORMAT('0',T6,'TOTAL NUMBER OF MEAT ANIMALS',T71,I12)
 9102 FORMAT('0',T6,'TOTAL NUMBER OF MILK CATTLE',T71,I12)
 9103 FORMAT('0',T6,
     > 'TOTAL AREA OF VEGETABLE FOOD CROPS (SQUARE METERS)',T71,E10.2)
 9104 FORMAT('0',T6,'TOTAL MEAT CONSUMPTION (KG PER YEAR)',T71,E10.2)
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AIRDOS-EPA (AIRDOS2.FOR) Program File
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0        1         2         3         4         5         6         7
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 9105 FORMAT('0',T6,'TOTAL MEAT PRODUCTION (KG PER YEAR)',T71,E10.2)
 9106 FORMAT('0',T6,'TOTAL MILK CONSUMPTION (LITERS/YEAR)',T71,E10.2)
 9107 FORMAT('0',T6,'TOTAL MILK PRODUCTION (LITERS/YEAR)',T71,E10.2)
 9108 FORMAT('0',T6,'TOTAL VEGETABLE FOOD CONSUMPTION (KG PER YEAR)',
     > T71,E10.2)
 9109 FORMAT('0',T6,'TOTAL VEGETABLE FOOD PRODUCED (KG PER YEAR)',T71,
     >  E10.2)
 9110 FORMAT(8X,I2,4E10.3,I10,2E10.3)
 9111 FORMAT(11F5.3)
 9112 FORMAT (2E10.3,I1,6F8.4)
 9113 FORMAT('1',T42,'RESULTS OF DOSE COMPUTATIONS FOR NUCLIDE ',A8)
 9114 FORMAT('0',T15,'AREA',T26,'ORGAN',T60,
     > 'DOSE THROUGH EACH PATHWAY (REMS/YEAR)')
 9115 FORMAT('0',T11,'COLUMN',T20,'ROW')
 9116 FORMAT('0',T40,'INHALATION',T55,'SUBMERSION',T70,'SURFACE',T85,
     > 'INGESTION',T100,'SUBMERSION',T117,'TOTAL')
 9117 FORMAT(' ',T57,'IN AIR',T69,'EXPOSURE',T102,'IN WATER')
 9118 FORMAT(' ',T13,I2,T20,I2,T25,A8,T40,E10.3,T55,E10.3,T70,E10.3,T85,
     >  E10.3,T100,E10.3,T115,E10.3)
 9119 FORMAT('0',T21,'*LIST OF INPUT DATA FOR NUCLIDE ',A8,'*')
 9120 FORMAT('0',T13,'FLAG ERROR')
 9121 FORMAT('0',T6,'FALLOUT INTERCEPTION FRACTION-VEGETABLES', T71,
     > E10.2)
 9122 FORMAT('0',T6,'FALLOUT INTERCEPTION FRACTION-PASTURE',T71,E10.2)
 9123 FORMAT ('0',T6, 'FALLOUT INTERCEPTION FRACTION(DRY)-VEGETABLES',
     > T71, E10.2)
 9124 FORMAT ('0',T6, 'FALLOUT INTERCEPTION FRACTION(WET)-VEGETABLES',
     > T71, E10.2)
 9125 FORMAT('0',T6,'FALLOUT INTERCEPTION FRACTION(DRY)-PASTURE', T71,
     > E10.2)
 9126 FORMAT('0',T6,'FALLOUT INTERCEPTION FRACTION(WET)-PASTURE', T71,
     > E10.2)
 9127 FORMAT('0',T6,'RADIOACTIVE DECAY CONSTANT (PER DAY)',T71,E10.2)
 9128 FORMAT('0',T25,'RADIOACTIVE DECAY FOR SURFACE EXPOSURE AND FOR WAT
     >ER IMMERSION PROCEEDS IN ACCORDANCE WITH THE')
 9129 FORMAT(' ',T25,'EFFECTIVE DECAY CONSTANT IN THE PLUME INSTEAD OF T
     >HE ABOVE VALUE')
 9130 FORMAT('0',T6,'ENVIRONMENTAL DECAY CONSTANT--SURFACE (PER DAY)',
     > T71,E10.2)
 9131 FORMAT('0',T6,'ENVIRONMENTAL DECAY CONSTANT--WATER (PER DAY)',
     > T71,E10.2)
 9132 FORMAT('0',T6,'DOSE CONVERSION FACTOR FOR FOOD INGESTION (REM-CC/
     >PCI-YEAR)',T71,E10.2)
 9133 FORMAT('0',T6,'DOSE CONVERSION FACTOR FOR WATER INGESTION (REM-CC
     >/PCI-YEAR)',T71,E10.2)
C9134 FORMAT('0',T55,'DOSE CONVERSION FACTORS')
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C9135 FORMAT('0',T5,'ORGAN',T20,'INHALATION',T38,'INGESTION',T58,
C     > 'SUBMERSION IN AIR',T83,'SURFACE EXPOSURE',T107,
C     > 'SUBMERSION IN WATER')
C9136 FORMAT(' ',T17,'(REMS/MICROCURIE)',T34,'(REMS/MICROCURIE)',T59,
C     > '(REMS-CUBIC CM/',T83,'(REMS-SQUARE CM/',T109,'(REMS-CUBIC CM/')
C9137 FORMAT(' ',T60,'MICROCURIE-HR)',T84,'MICROCURIE-HR)',T110,
C     > 'MICROCURIE-HR)')
C9138 FORMAT(' ',T4,A8,T21,E10.3,T38,E10.3,T61,E10.3,T86,E10.3,T111,
C     > E10.3)
 9139 FORMAT(10A8)
 9150 FORMAT(8I10)
 9155 FORMAT(8(1PE10.3))
 9160 FORMAT(A8)
      END
C*****************************************************************
20620032
      SUBROUTINE DOSMIC(CALC_EQUIL_FRACTIONS,NEWWAL,RNPTR,IDIST,NAMES,
     +                  DATE_AND_TIME)
C
      REAL CALC_EQUIL_FRACTIONS(20),NEWWAL(20,20)
      INTEGER*2 RNPTR
      INTEGER IDIST(20)
      CHARACTER*8 NAMES(11)
      CHARACTER*36 DATE_AND_TIME
      CHARACTER*8 NAMNUC,WORD
      CHARACTER*3 DIRECTION(16)
      COMMON /OCOM/ NNUCS,ANLAM(36),RR,SQSD, ACON(36,20,
20710032
     >  20),GCON(36,20,20),LIPO,NOMM(36,11),NRMM(36,11),
ORMODI(36,12,8)20720032
     > , VD(36),VDCOEF(20,20),NOL,NOU,NRL,NRU
20730032
      COMMON /NCOM/ NOML(11),NRML(11)
      COMMON /FCOM/ FEQWL,INTPA(20,20)
      COMMON /OCOMCHAR/ NAMNUC(36),WORD
      REAL INTPA,NEWCWL
      DIMENSION WL(20,20)
      DATA DIRECTION/'N  ','NNW','NW ','WNW','W  ','WSW','SW ','SSW',
     > 'S  ','SSE','SE ','ESE','E  ','ENE','NE ','NNE'/
      ALI = LIPO
      IF (FEQWL .EQ. 0.) FEQWL = 0.7
      CWL = 0
      NEWCWL = 0
      DO 510 NO=NOL,NOU
         DO 500 NR=NRL,NRU
            WL(NO,NR) = FEQWL * 10. * ACON(RNPTR,NO,NR) *
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AIRDOS-EPA (AIRDOS2.FOR) Program File
(continued)

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0        1         2         3         4         5         6         7
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     +                  ( ALI * ( INTPA(NO,NR) - 1. ) + 1. )
           CWL=CWL+WL(NO,NR)
           NEWCWL=NEWCWL+NEWWAL(NO,NR)
  500      CONTINUE
  510    CONTINUE
       WRITE(51,90277) DATE_AND_TIME
       WRITE(51,9027)
       WRITE(51,90227)
C      WRITE(51,9038)FEQWL
       WRITE(51,9003)
       WRITE(51,9028)
       WRITE(51,9040)
       WRITE(51,9019)
       WRITE(51,9029)
       WRITE(51,9030)
       WRITE(51,9003)
       WRITE(51,9032) ((DIRECTION(NO),IDIST(NR),WL(NO,NR),
      +                 CALC_EQUIL_FRACTIONS(NR),
      +                 NEWWAL(NO,NR),NR=NRL,NRU),NO=NOL,NOU)
   560 CONTINUE
       IF (LIPO.EQ.1) GO TO 569
       WRITE(51,90277) DATE_AND_TIME
       WRITE(51,9034)
       WRITE(51,9035)
       WRITE(51,9036)
       WRITE(51,936)
       WRITE(51,9019)
       WRITE(51,9037)(NAMES(J),NOML(J),NRML(J),WL(NOML(J),NRML(J)),
      >               CALC_EQUIL_FRACTIONS(J),NEWWAL(NOML(J),NRML(J)),
      +               J = 1,11)
 CC 569  IF(LIPO.EQ.1) WRITE(51,9039)CWL,NEWCWL
  569  IF(LIPO.EQ.1) WRITE(51,9039)NEWCWL

   570 CONTINUE
       RETURN
  9000 FORMAT('1',T36,'PERCENT OF ',A8,' DOSE BY EACH PATHWAY')
  9003 FORMAT('0')
  9019 FORMAT(' ')
 90277 FORMAT('1',T10,'DATE',2X,A)
  9027 FORMAT('0',T20,'EXPOSURE LEVELS FOR SHORT-LIFE PROGENY OF RN-222')
 90227 FORMAT(T27,'AT VARIOUS LOCATIONS IN THE ENVIRONMENT')
  9028 FORMAT(' ',T8,'AREA',T25,'EXPOSURE LEVEL(.7 EQF)',T52,'ADJUSTED'
     +       ,T70,'ADJUSTED')
  9029 FORMAT(' ',T3,'WIND',T12,'DISTANCE')
  9030 FORMAT(' ',T2,'TOWARD',T12,'(METERS)')
  9032 FORMAT(' ',T3,A3,T10,I7,T33,1PE7.1,T52,0PF7.2,T68,1PE7.1)
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AIRDOS-EPA (AIRDOS2.FOR) Program File
(continued)

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 9034 FORMAT('0',T10,'EXPOSURE LEVEL FOR SHORT-LIFE PROGENY OR RN-222',
     +                ' AT LOCATION OF MAXIMUM')
 9035 FORMAT(' ',T23,'INDIVIDUAL DOSE FROM ALL PATHWAYS FOR EACH ORGAN')
 9036 FORMAT('0',T2,'ORGAN',T15,'LOCATION OF' ,T29,
     > 'EXPOSURE LEVEL(.7 EQF)',T56,'ADJUSTED',T70,'ADJUSTED')
 936  FORMAT(' ',T15,'MAXIMUM DOSE',T54,'EQUIL. FRACT.',T70,'EXPOSURE'
     +       ,/,T71, 'LEVELS')
 9037 FORMAT(' ',T1,A8,T20,I2,T27,I2,T33,1PE7.1,T52,1PE7.1,T68,1PE7.1)
C9038 FORMAT(' ',T32,'(FRACTION OF EQUILIBRIUM ASSUMED FOR WORKING LEVEL
C    > CALCULATIONS=',F5.3,')')
 9039 FORMAT('0',T29,'COLLECTIVE EXPOSURE LEVELS => ',T67,E10.3)
 9040 FORMAT(' ',T30,'(PERSON .WL)',T50,'EQUIL. FRACT.',T70,'EXPOSURE'
     +       ,/,T71,'LEVELS')
      END
C*******************************************************************
C*******************************************************************
      SUBROUTINE QX(BND,X,U,UD,HS,VD,VG,INDEX1,QXR)
C
C-----NUMERICAL INTEGRATION BY SIMPSON'S RULE
C-----ROUTINE CHANGED BY D.P.STEWART 7/76
C
      REAL AB(7,4,2)
      INTEGER AC(5,4)
C               1       2       3       4       5       6       7
      DATA AB/ 1.0000, 1.0000, .9540, .8061, .8600, .8823, .8257,
     > 99.9999,99.9999, .8330, .6715, .6290, .6321, .6547, 99.9999,
     > 99.9999, .5524, .5099, .4054, .3710, .3818, 99.9999,99.9999,
     > 99.9999, .5251, .1110, .1106, .1106, 5.0200, 8.3500,10.0150,
     > 7.4800,15.5000,34.7000,61.2500, 99.9999,99.9999, 4.4000, 2.9500,
     > 3.1500, 6.1320,18.8000, 99.9999,99.9999, .3320, .8100, .5240,
     > .7640, 2.1150, 99.9999,99.9999,99.9999, .9300, .0349, .0694,
     > .1739/
C               1     2     3     4     5
      DATA AC/ 0, 0,99999, 1000, 1000, 1000, 1000, 0,10000, 3000, 10000,
     >  3000, 0,99999,10000, 0,10000, 0, 0,99999/
      FUNC(D,F,HH,X)=F*EXP(-(HH**2*F**2)/(2.*X**(2*D)))/X**D
      IF (INDEX1-3) 10,20,30
C-----SET UP BOUNDS OF INTEGRATION
C-----INDEX3 GIVES COLUMN OF AC CONTAINING LOWER BOUNDS
C-----INDEX4 GIVES COLUMN WITH UPPER BOUND
C-----LIM1 AND LIM2 DETERMINE  THE ROWS OF AC USED
C-----THEY ALSO DETERMINE WHICH VALUES OF D AND F SHOULD BE USED
   10 INDEX3=1
      INDEX4=3
      LIM2=1
      LIM1=1
```

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0         1         2         3         4         5         6         7
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      GO TO 40
   20 INDEX3=1
      INDEX4=4
      LIM2=3
      LIM1=1
      IF (BND.GE.1000.) LIM1=2
      IF (BND.GE.10000) LIM1=3
      GO TO 40
   30 INDEX3=2
      INDEX4=5
      LIM2=4
      LIM1=1
      IF (BND.GE.1000) LIM1=2
      IF (BND.GE.3000) LIM1=3
      IF (BND.GE.10000) LIM1=4
   40 QXR=0
      STOR1=AC(INDEX3,LIM1)
      AC(INDEX3,LIM1)=BND
      AC(INDEX4,LIM2)=X
      EPS=.1
C-----THIS LOOP SPLITS THE INTEGRATION ACCORDING TO CHANGES IN D AND F
      DO 90 INDEX2=LIM1,LIM2
         D=AB(INDEX1,INDEX2,1)
         F=AB(INDEX1,INDEX2,2)
         B=AC(INDEX4,INDEX2)
         IF (X.LT.B) B=X
         A=AC(INDEX3,INDEX2)
         WIDTH=(B-A)/2.
         JLIM=1
C-----FOFA AND FOFB ARE THE FUNCTION VALUES AT ENDPOINTS OF INTERVAL
         FOFA=0.0
         IF (A.EQ.0.0) GO TO 50
         HA=HS-VG*A/UD
         IF (HA.LT.1.0) HA=1.0
         FOFA=FUNC(D,F,HA,A)
   50    HB=HS-VG*B/UD
         IF (HB.LT.1.0) HB=1.0
         FOFB=FUNC(D,F,HB,B)
         X1=A+WIDTH
         H1=HS-VG*X1/UD
         IF (H1.LT.1.0) H1=1.0
C-----COMPUTE FIRST APPROXIMATION OF SIMP
         SIMP=(FOFA+4*FUNC(D,F,H1,X1)+FOFB)*WIDTH/3.
C-----THIS SECTION IS REPEATED UNTIL THE CHANGE IN SIMP IS LESS THAN EPS
   60    FUNC1=0.0
         FUNC2=0.0
```

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         WIDTH=WIDTH/2
         JLIM=JLIM*2
         OLDS=SIMP
         JLESS=JLIM-1
         DO 70 J=1,JLESS
            X1=A+(2*J-1.)*WIDTH
            H1=HS-VG*X1/UD
            IF (H1.LT.1.0) H1=1.0
            FUNC1=FUNC1+FUNC(D,F,H1,X1)
            X2=A+2*J*WIDTH
            H2=HS-VG*X2/UD
            IF (H2.LT.1.0) H2=1.0
            FUNC2=FUNC2+FUNC(D,F,H2,X2)
   70       CONTINUE
         X1=A+2*JLIM*WIDTH
         H1=HS-VG*X1/UD
         IF (H1.LT.1.0) H1=1.0
         FUNC1=FUNC1+FUNC(D,F,H1,X1)
         SIMP=(FOFA+4*FUNC1+2*FUNC2+FOFB)*WIDTH/3
         IF (ABS(SIMP-OLDS).GT.EPS) GO TO 60
C-----END SIMP APPROXIMATION LOOP
   80    QXR=QXR+SIMP
         IF (X.LT.AC(INDEX4,INDEX2)) GO TO 100
   90    CONTINUE
  100 QXR=EXP(-.79788*QXR*VD/UD)
      AC(INDEX3,LIM1)=STOR1
      RETURN
      END
C*****************************************************************
C*****************************************************************
      SUBROUTINE QY(BND,X,U,UD,HS,VD,VG,INDEX1,QXR)
C
C       R. E. MOORE   HEALTH AND SAFETY RESEARCH DIV.,  ORNL  3-1-78
C
C       A TABLE CALLOUT SUBROUTINE FOR DETERMINING DEPLETION FRACTIONS F
C       DEPOSITION FOR CONSTANT DEPOSITION VELOCITY AND FOR ZERO GRAVITA
C       EFFECT.
C
C       TABULATED VALUES IN DATA STATEMENT WERE DERIVED THROUGH THE USE
C       SUBROUTINE QX, A SIMPSON'S RULE SUBROUTINE WRITTEN ORIGINALLY BY
C       D. E. DUNNING, MODIFIED BY J. F. HULL, AND LATER CHANGED BY
C       D. P. STEWART.
C
      COMMON /QCOM/ REFA(34,7,20)
      DIMENSION XIDI(20),KP(34)
      REAL KP
```

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0        1         2         3         4         5         6         7
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      INTEGER IDOM
      DATA XIDI/35.,65.,100.,150.,200.,300.,400.,500.,650.,800.,1000.,
     > 1500.,2000.,4000.,7000.,10000.,25000.,60000.,90000.,200000./
      DATA KP/1.,1.5,2.,3.,4.,5.,6.,7.,8.,9.,10.,12.5,15.,17.5,20.,25.,
     > 30.,35.,40.,50.,60.,70.,80.,90.,100.,120.,140.,160.,180.,200.,
     > 240.,260.,300.,400./
      IF (IDOM.EQ.121) GO TO 20
   10 CALL QY1
      CALL QY2
      CALL QY3
      IDOM=121
   20 JH=INDEX1
      H1=HS
      DO 30 ID=1,20
         IF (X.LT.XIDI(ID)) GO TO 50
   30    CONTINUE
   40 ID2=35
      GO TO 60
   50 ID1=ID
      ID2=ID-1
   60 DO 70 KR=1,34
         IF (H1.LT.KP(KR)) GO TO 90
   70    CONTINUE
   80 KP2=21
      GO TO 100
   90 KP1=KR
      KP2=KR-1
  100 IF (KP2.EQ.0.AND.ID2.EQ.0) GO TO 140
      IF (KP2.EQ.0) GO TO 150
      IF (ID2.EQ.0) GO TO 170
      IF (X.GE.200000.) GO TO 110
      IF (H1.GE.400.) GO TO 130
      CUX1=REFA(KP1,JH,ID2)-((REFA(KP1,JH,ID2)-REFA(KP1,JH,ID1))* ((X-
     > XIDI(ID2))/(XIDI(ID1)-XIDI(ID2))))
      CUX2=REFA(KP2,JH,ID2)-((REFA(KP2,JH,ID2)-REFA(KP2,JH,ID1))* ((X-
     > XIDI(ID2))/(XIDI(ID1)-XIDI(ID2))))
      CUXA=CUX1-(((CUX1-CUX2)*(KP(KP1)-H1))/(KP(KP1)-KP(KP2)))
      GO TO 190
  110 IF (H1.GT.400.) GO TO 120
      CUX1=X*((REFA(KP1,JH,20)-REFA(KP1,JH,19))/110000.)+ (REFA(KP1,JH,
     > 19)-.8181818*(REFA(KP1,JH,20)-REFA(KP1,JH,19)))
      CUX2=X*((REFA(KP2,JH,20)-REFA(KP2,JH,19))/110000.)+ (REFA(KP2,JH,
     > 19)-.8181818*(REFA(KP2,JH,20)-REFA(KP2,JH,19)))
      CUXA=CUX1-(((CUX1-CUX2)*(KP(KP1)-H1))/(KP(KP1)-KP(KP2)))
      GO TO 190
  120 CUM1=H1*((REFA(34,JH,20)-REFA(33,JH,20))/100.)+4.*REFA(33,JH,20)-
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0         1         2         3         4         5         6         7
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     > 3.*REFA(34,JH,20)
      CUM2=H1*((REFA(34,JH,19)-REFA(33,JH,19))/100.)+4.*REFA(33,JH,19)-
     > 3.*REFA(34,JH,19)
      CUXA=((CUM1-CUM2)/110000.)*X+CUM1-1.8181818*(CUM1-CUM2)
      GO TO 190
  130 CUX1=H1*((REFA(34,JH,ID1)-REFA(33,JH,ID1))/100.)+4.*REFA(33,JH,
     > ID1)-3.*REFA(34,JH,ID1)
      CUX2=H1*((REFA(34,JH,ID2)-REFA(33,JH,ID2))/100.)+4.*REFA(33,JH,
     > ID2)-3.*REFA(34,JH,ID2)
      CUXA=((CUX2-CUX1)/(XIDI(ID2)-XIDI(ID1)))*(X-XIDI(ID1))+CUX1
      GO TO 190
  140 CUXA=1.-(1.-REFA(1,JH,1)*(X/XIDI(1)))
      GO TO 190
  150 IF (X.GE.200000.) GO TO 160
      CUXA=REFA(1,JH,ID2)-((REFA(1,JH,ID2)-REFA(1,JH,ID1))* ((X-
     > XIDI(ID2))/(XIDI(ID1)-XIDI(ID2))))
      GO TO 190
  160 CUXA=((REFA(1,JH,20)-REFA(1,JH,19))/110000.)*X+REFA(1,JH,20)-
     > 1.8181818*(REFA(1,JH,20)-REFA(1,JH,19))
      GO TO 190
  170 IF (H1.GT.400.) GO TO 180
      CUX1=1.-(1.-REFA(KP1,JH,1)*(X/XIDI(1)))
      CUX2=1.-(1.-REFA(KP2,JH,1)*(X/XIDI(1)))
      CUXA=CUX1-(((CUX1-CUX2)*(KP(KP1)-H1))/(KP(KP1)-KP(KP2)))
      GO TO 190
  180 CUX1=1.-((1.-REFA(33,JH,1))*(X/XIDI(1)))
      CUX2=1.-((1.-REFA(34,JH,1))*(X/XIDI(1)))
      CUXA=((CUX2-CUX1)/100.)*H1+CUX1-3.*(CUX2-CUX1)
  190 QXR=CUXA**((100.*VD)/UD)
      RETURN
      END
C*******************************************************************
C*******************************************************************
      SUBROUTINE QY1
      COMMON /QCOM/ REFA(34,7,20)
      DIMENSION SEFA(34,7,20)
      DIMENSION AA(114),AB(114),AC(114),AD(114),AE(114),AF(114),AG(114),
     > AH(114),AI(114),AJ(114),AK(114),AL(114),AM(114),AN(114),AO(70)
      EQUIVALENCE (SEFA( 1,1, 1),AA(1)),(SEFA(13,4, 1),AB(1)),(SEFA(25,
     > 7, 1),AC(1)),(SEFA( 3,4, 2),AD(1)),(SEFA(15,7, 2),AE(1)),
     > (SEFA(27,3, 3),AF(1)),(SEFA( 5,7, 3),AG(1)),(SEFA(17,3, 4),AH(1))
     > ,(SEFA(29,6, 4),AI(1)),(SEFA( 7,3, 5),AJ(1)),(SEFA(19,6, 5),AK(1)
     > ),(SEFA(31,2, 6),AL(1)),(SEFA( 9,6, 6),AM(1)),(SEFA(21,2, 7),
     > AN(1)),(SEFA(33,5, 7),AO(1))
      DATA AA/ .9229E 00,.9370E 00,.9483E 00,.9639E 00,.9728E 00,.9798E
     > 00, .9851E 00,.9882E 00,.9919E 00,.9941E 00,.9957E 00,.9982E 00,
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     > .9448E 00,.9665E 00,.9790E 00,.9878E 00,.9929E 00,.9959E 00,
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     > .9874E 00,.9943E 00,.9976E 00,.9990E 00,.9990E 00,.9996E 00,
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     > .8839E 00,.9234E 00,.9494E 00,.9791E 00,.9922E 00,.9974E 00,
     > .9992E 00,.9994E 00,.9999E 00,.1000E 01,.1000E 01,.1000E 01/
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     > .9256E 00,.9408E 00,.9510E 00,.9590E 00,.9655E 00,.9708E 00,
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     > .9994E 00,.9999E 00,.1000E 01,.1000E 01,.1000E 01,.1000E 01/
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     > .5547E 00,.6084E 00,.6516E 00,.7197E 00,.7728E 00,.8157E 00,
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     > .6001E 00,.7257E 00,.8180E 00,.8833E 00,.9280E 00,.9574E 00/
      DATA AM/ .9758E 00,.9866E 00,.9929E 00,.9986E 00,.9993E 00,.9999E
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     > .1000E 01,.1000E 01,.3527E 00,.5497E 00,.7144E 00,.9105E 00,
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     > .9391E 00,.9500E 00,.9597E 00,.9676E 00,.9739E 00,.9832E 00/
      DATA AN/ .9893E 00,.9933E 00,.9959E 00,.9976E 00,.9986E 00,.9988E
     > 00, .9996E 00,.9999E 00,.1000E 01,.1000E 01,.1000E 01,.1000E 01,
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0        1         2         3         4         5         6         7
12345678901234567890123456789012345678901234567890123456789012345678901234567890123456789012

      DO 30 L=1,7
         DO 20 K=1,7
            DO 10 I=1,34
   10          REFA(I,K,L)=SEFA(I,K,L)
   20       CONTINUE
   30    CONTINUE
      RETURN
      END
C*******************************************************************************
C*******************************************************************************
      SUBROUTINE QY2
      COMMON /QCOM/ REFA(34,7,20)
      DIMENSION SEFA(34,7,20)
      DIMENSION BQ(98),BC(114),BD(114),BE(114),BF(114),BG(114),BH(114),
     > BI(114),BJ(114),BK(114),BL(114),BM(114),BN(114),BO(114),BP(86)
      EQUIVALENCE (SEFA( 1,1,14),BQ(1)),(SEFA(31,3,14),BC(1)),(SEFA( 9,
     > 7,14),BD(1)),(SEFA(21,3,15),BE(1)),(SEFA(33,6,15),BF(1)),
     > (SEFA(11,3,16),BG(1)),(SEFA(23,6,16),BH(1)),(SEFA( 1,3,17),BI(1))
     > ,(SEFA(13,6,17),BJ(1)),(SEFA(25,2,18),BK(1)),(SEFA( 3,6,18),BL(1)
     > ),(SEFA(15,2,19),BM(1)),(SEFA(27,5,19),BN(1)),(SEFA( 5,2,20),
     > BO(1)),(SEFA(17,5,20),BP(1))
      DATA BQ/ .7636E 00,.7761E 00, .7850E 00,.7979E 00,.8071E 00,
     > .8143E 00,.8204E 00,.8254E 00, .8298E 00,.8306E 00,.8372E 00,
     > .8448E 00,.8509E 00,.8562E 00, .8607E 00,.8685E 00,.8749E 00,
     > .8803E 00,.8850E 00,.8930E 00, .8995E 00,.9050E 00,.9098E 00,
     > .9141E 00,.9180E 00,.9246E 00, .9303E 00,.9352E 00,.9399E 00,
     > .9436E 00,.9501E 00,.9518E 00, .9581E 00,.9683E 00,.6605E 00,
     > .6785E 00,.6915E 00,.7105E 00, .7242E 00,.7351E 00,.7440E 00,
     > .7517E 00,.7585E 00,.7644E 00, .7698E 00,.7813E 00,.7909E 00,
     > .7990E 00,.8061E 00,.8182E 00, .8283E 00,.8367E 00,.8442E 00,
     > .8568E 00,.8673E 00,.8761E 00, .8838E 00,.8906E 00,.8952E 00,
     > .9075E 00,.9166E 00,.9243E 00, .9312E 00,.9391E 00,.9477E 00,
     > .9521E 00,.9597E 00,.9739E 00, .5360E 00,.5569E 00,.5725E 00,
     > .5956E 00,.6084E 00,.6267E 00, .6384E 00,.6485E 00,.6535E 00,
     > .6656E 00,.6733E 00,.6889E 00, .7024E 00,.7141E 00,.7246E 00,
     > .7402E 00,.7575E 00,.7707E 00, .7824E 00,.8028E 00,.8199E 00,
     > .8348E 00,.8483E 00,.8604E 00, .8714E 00,.8912E 00,.9076E 00,
     > .9219E 00,.9343E 00,.9441E 00/
      DATA BC/ .9600E 00,.9662E 00,.9781E 00,.9923E 00,.3404E 00,.3582E
     > 00, .3726E 00,.3958E 00,.4146E 00,.4309E 00,.4453E 00,.4585E 00,
     > .4706E 00,.4819E 00,.4925E 00,.5167E 00,.5369E 00,.5585E 00,
     > .5771E 00,.6110E 00,.6417E 00,.6700E 00,.6964E 00,.7441E 00,
     > .7871E 00,.8225E 00,.8547E 00,.8820E 00,.9051E 00,.9409E 00,
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     > .3028E 00,.3229E 00,.3409E 00,.3574E 00,.3737E 00,.3873E 00,
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     > .4011E 00,.4330E 00,.4622E 00,.4896E 00,.5157E 00,.5642E 00,
     > .6101E 00,.6527E 00,.6928E 00,.7648E 00,.8252E 00,.8741E 00,
     > .9116E 00,.9401E 00,.9605E 00,.9840E 00,.9940E 00,.9978E 00,
     > .9994E 00,.9998E 00,.1000E 01,.1000E 01,.1000E 01,.1000E 01,
     > .6861E-01,.8460E-01,.9887E-01,.1246E 00,.1481E 00,.1703E 00,
     > .1917E 00,.2126E 00,.2331E 00,.2535E 00,.2738E 00,.3243E 00,
     > .3750E 00,.4260E 00,.4769E 00,.5765E 00,.6685E 00,.7496E 00,
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     > .9995E 00,.1000E 01,.1000E 01,.1000E 01,.1000E 01,.1000E 01,
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     > .1064E-01,.2151E-01,.3705E-01,.5805E-01,.8520E-01,.1190E 00/
      DATA BD/ .1596E 00,.2075E 00,.2597E 00,.4086E 00,.5628E 00,.6993E
     > 00, .8076E 00,.9341E 00,.9816E 00,.9953E 00,.9990E 00,.1000E 01,
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     > .7864E 00,.7963E 00,.8020E 00,.8071E 00,.8085E 00,.8152E 00,
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     > .6019E 00,.6131E 00,.6201E 00,.6346E 00,.6470E 00,.6578E 00,
     > .6675E 00,.6820E 00,.6980E 00,.7103E 00,.7212E 00,.7403E 00/
      DATA BE/ .7566E 00,.7708E 00,.7838E 00,.7957E 00,.8066E 00,.8265E
     > 00, .8438E 00,.8593E 00,.8733E 00,.8889E 00,.9075E 00,.9173E 00,
     > .9332E 00,.9617E 00,.2670E 00,.2811E 00,.2923E 00,.3106E 00,
     > .3254E 00,.3382E 00,.3496E 00,.3599E 00,.3695E 00,.3785E 00,
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     > .1454E 00,.1597E 00,.1714E 00,.1905E 00,.2062E 00,.2200E 00,
     > .2324E 00,.2439E 00,.2552E 00,.2647E 00,.2744E 00,.2970E 00,
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     > .9999E 00,.1000E 01,.1000E 01,.1000E 01,.1000E 01,.1000E 01/
      DATA BF/ .1000E 01,.1000E 01,.5537E-03,.1017E-02,.1627E-02,.3389E-
     > 02, .6080E-02,.1002E-01,.1563E-01,.2338E-01,.3384E-01,.4774E-01,
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     > .3488E 00,.3634E 00,.3761E 00,.3999E 00,.4222E 00,.4431E 00,
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     > .2602E 00,.3299E 00,.4059E 00,.5647E 00,.7102E 00,.8240E 00/
      DATA BH/ .9016E 00,.9489E 00,.9753E 00,.9951E 00,.9987E 00,.9998E
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     > .3561E-02,.5560E-02,.8440E-02,.1255E-01,.1809E-01,.4159E-01,
     > .8444E-01,.1521E 00,.2460E 00,.4827E 00,.7077E 00,.8603E 00,
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     > .1000E 01,.1000E 01,.1000E 01,.1000E 01,.7105E 00,.7221E 00,
     > .7294E 00,.7414E 00,.7500E 00,.7567E 00,.7623E 00,.7641E 00,
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     > .8261E 00,.8318E 00,.8419E 00,.8464E 00,.8544E 00,.8709E 00/
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      DATA BJ/ .7439E-02,.9372E-02,.1178E-01,.1852E-01,.2885E-01,.4429E-
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     > .1494E-04,.2677E-04,.4723E-04,.1902E-03,.7132E-03,.2424E-02,
     > .7350E-02,.4533E-01,.1642E 00,.3761E 00,.6127E 00,.9074E 00,
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     > .1000E 01,.1000E 01/
      DO 30 L=14,20
         DO 20 K=1,7
            DO 10 I=1,34
   10          REFA(I,K,L)=SEFA(I,K,L)
   20       CONTINUE
   30    CONTINUE
      RETURN
      END
C*******************************************************************************
C*******************************************************************************
      SUBROUTINE QY3
      COMMON /QCOM/ REFA(34,7,20)
      DIMENSION SEFA(34,7,20)
      DIMENSION CA(44),AP(114),AQ(114),AR(114),AS(114),AT(114),AU(114),
     > AV(114),AW(114),AX(114),AY(114),AZ(114),BA(114),BB(16)
      EQUIVALENCE (SEFA( 1,1, 8),CA(1)), (SEFA(11,2, 8),AP(1)),(SEFA(23,
     > 5, 8),AQ(1)),(SEFA( 1,2, 9),AR(1)),(SEFA(13,5, 9),AS(1)),
     > (SEFA(25,1,10),AT(1)),(SEFA( 3,5,10),AU(1)),(SEFA(15,1,11),AV(1))
     > ,(SEFA(27,4,11),AW(1)),(SEFA( 5,1,12),AX(1)),(SEFA(17,4,12),AY(1)
     > ),(SEFA(29,7,12),AZ(1)),(SEFA( 7,4,13),BA(1)),(SEFA(19,7,13),
     > BB(1))
      DATA CA/ .8298E 00,.8434E 00, .8531E 00,.8672E 00,.8771E 00,
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     > .9204E 00,.9661E 00,.9875E 00,.9984E 00,.9998E 00,.1000E 01/
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     > 01, .1000E 01,.1000E 01,.1000E 01,.1000E 01,.1000E 01,.1000E 01,
     > .1000E 01,.1000E 01,.1000E 01,.1000E 01/
      DO 30 L=8,13
         DO 20 K=1,7
            DO 10 I=1,34
   10          REFA(I,K,L)=SEFA(I,K,L)
   20       CONTINUE
   30    CONTINUE
      RETURN
      END
C*******************************************************************************
C*******************************************************************************
      SUBROUTINE RVALUE (IFLAG,MODE,I,NO,NR,R)
      COMMON /RVAL/ S1,S3,SD1,SD3,ACN,GCN,SW1,SW3
      COMMON /OCOM/ NNUCS,ANLAM(36),RR,SQSD,ACON(36,20,
     > 20),GCON(36,20,20),LIPO,NOMM(36,11),NRMM(36,11),ORMODI(36,12,8),
     > VD(36),VDCOEF(20,20),NOL,NOU,NRL,NRU
      COMMON /OCOMCHAR/ NAMNUC(36),WORD
      CHARACTER*8 NAMNUC,WORD
C THIS SUBROUTINE ASSIGNS A VALUE TO THE PARAMETER
C    R = THE FRACTION OF DEPOSITED ACTIVITY RETAINED ON CROPS (DIMENSION
C AS FOLLOWS..
C (1) IF THE VALUES USED FOR S1 AND S3 ARE NOT NUCLIDE-SPECIFIC (NORMAL
C     IFLAG=0), THEN
C           R = S1 FOR VEGETABLES (MODE=1)
C           R = S3 FOR PASTURE    (MODE=2)
C (2) IF VALUES FOR S1 AND S3 ARE NUCLIDE-SPECIFIC, AND DEPOSITION RATES
C     ARE NOT SPECIFIED SEPARATELY FOR WET AND DRY DEPOSITION (SPECIAL R
C     IFLAG=1), THEN
C           R = SD1 FOR VEGETABLES (MODE=1)
C           R = SD3 FOR PASTURE    (MODE=2)
C (3) IF VALUES FOR S1 AND S3 ARE NUCLIDE-SPECIFIC, AND DEPOSITION RATES
C     ARE SPECIFIED SEPARATELY FOR WET AND DRY DEPOSITION (IFLAG=2), THE
C     R IS CALCULATED BY AVERAGING DRY AND WET DEPOSITION RATES AS FOLLO
C
C     R =(SD1*DRY DEP RATE  +  SW1*WET DEP RATE) /(DRY DEP RATE+WET DEP
C   FOR VEGETABLES (MODE = 1).
C
C R=(SD3*DRY DEP RATE + SW3*WET DEP RATE)/ (DRY DEP RATE + WET DEP RATE)
C   FOR PASTURE (MODE = 2)
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      IF (IFLAG.EQ.0.AND.MODE.EQ.1) R=S1
      IF (IFLAG.EQ.0.AND.MODE.EQ.2) R=S3
      IF (IFLAG.EQ.1.AND.MODE.EQ.1) R=SD1
      IF (IFLAG.EQ.1.AND.MODE.EQ.2) R=SD3
C CALCULATE DRY AND WET DEPOSITION RATES.
      DRYDEP = ACN*VD(I)*VDCOEF(NO,NR)
      WETDEP = GCN - DRYDEP
C THE SUM OF THESE DEPOSITION RATES IS GIVEN BY GCN.
      IF (IFLAG.EQ.2.AND.MODE.EQ.1) R= (SD1*DRYDEP+SW1*WETDEP)/ GCN
      IF (IFLAG.EQ.2.AND.MODE.EQ.2) R= (SD3*DRYDEP+SW3*WETDEP)/ GCN
C PRINT ERROR MESSAGE IF NONE OF THESE CONDITIONS IS MET.
      IF (MODE.NE.1.AND.MODE.NE.2) WRITE(6,9000)
      IF (IFLAG.NE.0.AND.IFLAG.NE.1.AND.IFLAG.NE.2) WRITE(51,9001)
      RETURN
 9000 FORMAT('0ERROR.. MODE SHOULD BE 1 OR 2 IN SUBROUTINE RVALUE')
 9001 FORMAT('0ERROR.. IFLAG SHOULD BE 0,1,OR 2 IN SUBROUTINE RVALUE')
      END
```