EPA-520/1-74-004

AIREM PROGRAM MANUAL

A COMPUTER CODE FOR CALCULATING DOSES, POPULATION DOSES, AND GROUND DEPOSITIONS DUE TO ATMOSPHERIC EMISSIONS OF RADIONUCLIDES

U.S. ENVIRONMENTAL PROTECTION AGENCY

ffice of Radiation Programs

A COMPUTER CODE FOR CALCULATING DOSES, POPULATION DOSES, AND GROUND DEPOSITIONS DUE TO ATMOSPHERIC EMISSIONS OF RADIONUCLIDES

J. A. Martin, Jr.
C. B. Nelson
P. A. Cuny

May 1974

U. S. ENVIRONMENTAL PROTECTION AGENCY
Office of Radiation Programs
Field Operations Division
Washington, D.C. 20460

FOREWORD

The Office of Radiation Programs carries out a national program designed to evaluate the exposure of man to ionizing and nonionizing radiation, and to promote the development of controls necessary to protect the public health and safety and assure environmental quality.

Office of Radiation Programs technical reports allow comprehensive and rapid publishing of the results of intramural and contract projects. The reports are distributed to State and local radiological health offices, Office of Radiation Programs technical and advisory committees, universities, laboratories, schools, the press, and other interested groups and individuals. These reports are also included in the collections of the Library of Congress and the National Technical Information Service.

I encourage readers of these reports to inform the Office of Radiation Programs of any omissions or errors. Your additional comments or requests for further information are also solicited.

W. D. Rowe, Ph.D.
Deputy Assistant Administrator
for Radiation Programs

PREFACE

As part of the Office of Radiation Programs' responsibilities to evaluate the radiation exposure of man and his environs, the Field Operations Division is developing a Comprehensive Dose Computational System (CDCS) that will provide an up-to-date measure of population dose related to sources. To achieve this goal, a large amount of data will be organized, collated, and summarized using automated data processing techniques.

Discharges of radioactivity to the environment from facilities in the nuclear fuel cycle contribute to the radiation dose received by the general population. Atmospheric diffusion is a primary pathway for the transportation of radionuclide emissions through the troposphere to man. Members of the general population may be exposed to radiation from radionuclides deposited from the atmosphere onto crops and animal forage, as well as from the airborne radionuclides directly. In some cases airborne emissions of radionuclides can be detected worldwide; more often this is not the case and the consequences of a given airborne release cannot be detected using even highly sophisticated and sensitive nuclear instrumentation. In these latter instances, radionuclide concentrations in the environment must be calculated in lieu of measurements.

As a first step toward the automated CDCS, this AIREM computer code has been developed and is presently being used as a working tool to analyze atmospheric radionuclide emissions from the nuclear fuel cycle. The results of studies performed using this code will normally be published in this Division's monthly publication, *Radiation Data and Reports*.

Charles L. Weaver
Director
Field Operations Division

ACKNOWLEDGEMENT

The authors wish to express their gratitude to Dorothy Mitchell for her assistance in preparing this manuscript, to Mary Martin for typing early drafts, and to Harold Peterson and Charles Weaver for their support of our efforts.

CONTENTS

APPENDIXES

TABLES

FIGURES

ABSTRACT

A computer code useful for the calculation of doses to the general population due to atmospheric emissions of radionuclides is presented and discussed. The code is written in Fortran IV, requires 188k storage, and runs in about 20 seconds on an IBM 370 system. A standard sector-averaged gaussian-diffusion equation is solved repeatedly for each radionuclide, wind sector, stability class and downwind distance. Radionuclide contributions to doses to up to four critical organs are summed and printed by sector and downwind distance. Population doses (person-rem) are also calculated.

The code accounts for the following physical processes: cloud diffusion, ground and inversion-lid reflections, radionuclide decay by time of flight, first daughter-product buildup, ground deposition of particulates and halogens (independently), cloud depletion, in-plant holdup and decontamination factors, and sector-to-sector contributions to external gamma dose.

The code is dose model independent in the sense that dose conversion factors, provided as input data, are used for calculations of dose that are proportional to radionuclide concentrations in the cloud, and dose conversion tables obtained from a model that considers the finite extent of the overhead cloud, also required as input data, are used for calculations of whole body dose due to external gamma emitters in the cloud. A set of dose tables obtained using one finite cloud model (EGAD) are provided in this manual.

The code is extensively annotated and simply written, hopefully facilitating its use. All significant parameters are fully dimensioned and stored during a problem run. Thus, it is normally a simple matter for the user to write out various combinations and collations of data as desired.

A COMPUTER CODE FOR CALCULATING DOSES, POPULATION DOSES, AND GROUND DEPOSITIONS DUE TO ATMOSPHERIC EMISSIONS OF RADIONUCLIDES

1. INTRODUCTION

The Office of Radiation Programs is developing a Comprehensive Dose Computational System (CDCS) for the analysis of emissions and effluents from the nuclear fuel cycle. The AIREM code described in this program manual represents an initial, interim version of a code being used to calculate doses to populations due to the emission of radionuclides to the air. The code uses a sector-averaged gaussian-diffusion equation (1,2) to determine radionuclide concentrations from which doses[1] (rem) and population doses (person-rem) are calculated for up to 16 wind sectors and 12 downwind distances (192 sector-segments). Ground deposition, cloud depletion, and first daughter product ingrowth are considered in the calculations. In-plant holdup time and in-plant radionuclide decontamination factors may be provided as input data if desired. Radionuclide dose contributions are calculated for up to four critical organs.

The code is dose model independent. It requires dose conversion factors for each radionuclide, organ, and population group as input data. Suggestions for deriving these factors are given in the annotations to the code in appendix A. AIREM is also independent of a finite cloud dose model; however, dose conversion tables obtained from one finite cloud model, (EGAD), are included in appendix B. Any other finite cloud model with a compatible output format can be used at the users' discretion.

As presently written the printout of the program includes: the input data, ground deposition in picocuries per square meter (if a deposition calculation is requested by the user), organ doses and population doses in sector-segments, and total man-rem by radionuclide. A typical problem involving 20 radionuclides, 16 wind sectors, 12 downwind distances, and 6 atmospheric stability classes runs about 20 seconds on an IBM 370/155 and about 90 seconds on an IBM 360/50.

The code is composed of two basic parts: a diffusion calculation and a dose calculation. These will be discussed generally, then specifically.

---

[1]Corresponding to common practice, dose = dose equivalent herein.

2. DIFFUSION GEOMETRY - GENERAL

The geometry of the code is similar to a cartwheel. The geometry is illustrated in figure 1. The release height can be either elevated or at ground level. Winds blow the emissions down pie-shaped sectors from the apex. The concentration of radionuclides in the sectors is assumed to have a gaussian distribution in the vertical direction, centered always at the effective release height (stack of vent height plus plume rise less ground elevation), and a uniform distribution in the horizontal direction across each sector. The standard deviation (σ_z) of the vertical distribution of the concentration increases monotonically with downwind distance (figure 2) until σ_z is set equal to a fraction of the inversion layer height (3) at which point no further diffusion of the cloud in the vertical direction is allowed. As illustrated in figure 2, the extent of vertical diffusion is defined by the stability classes; the stability classes are defined by the meteorology data in table 1. The portion of the cloud that would have existed below the air-ground interface (if the interface were absent) is mirror reflected and added to the concentration above the ground which doubles the unreflected ground level concentration.

The geometry introduces a discontinuity at the edges of the sectors since wind frequencies and stability classes may be significantly different in adjacent sectors. These discontinuities can be reduced by using a large number of wind sectors in the calculations. In AIREM, up to 16 sectors may be used. With 16 sectors large discontinuities are rare.

Table 1. Classification of atmospheric stability

Stability classification	Pasquill categories	σ_θ[a] (degrees)	Temperature change with height (°C/100 m)
Extremely unstable	A	25.0	<-1.9
Moderately unstable	B	20.0	-1.9 to -1.7
Slightly unstable	C	15.0	-1.7 to -1.5
Neutral	D	10.0	-1.5 to -0.5
Slightly stable	E	5.0	-0.5 to 1.5
Moderately stable	F	2.5	1.5 to >4.0

[a]Standard deviation of horizontal wind direction fluctuation over a period of 15 minutes to 1 hour. The values shown are averages for each stability classification.

Reference: AEC Safety Guide 23.

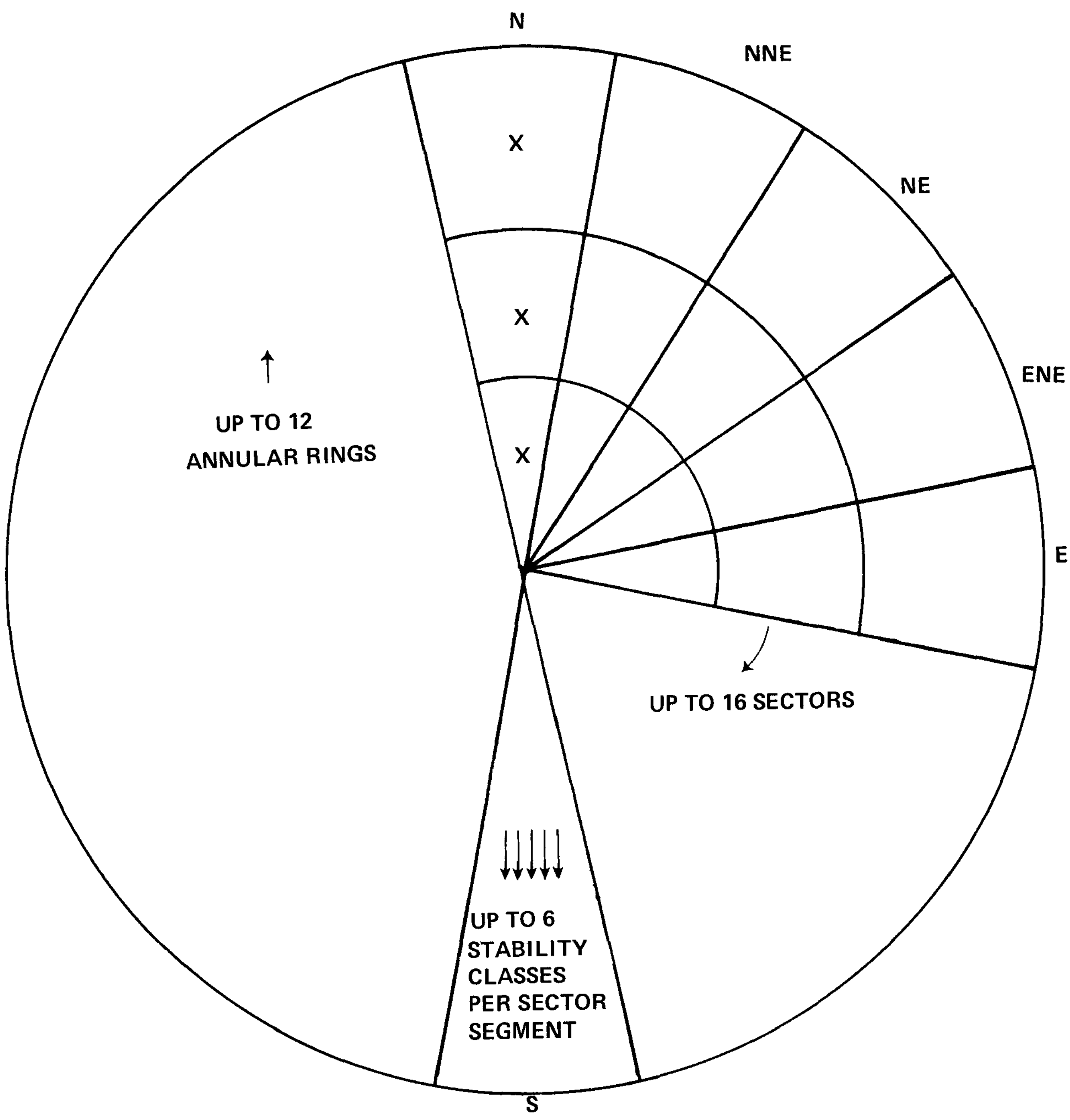


Figure 1. Geometry of AIREM - plan view

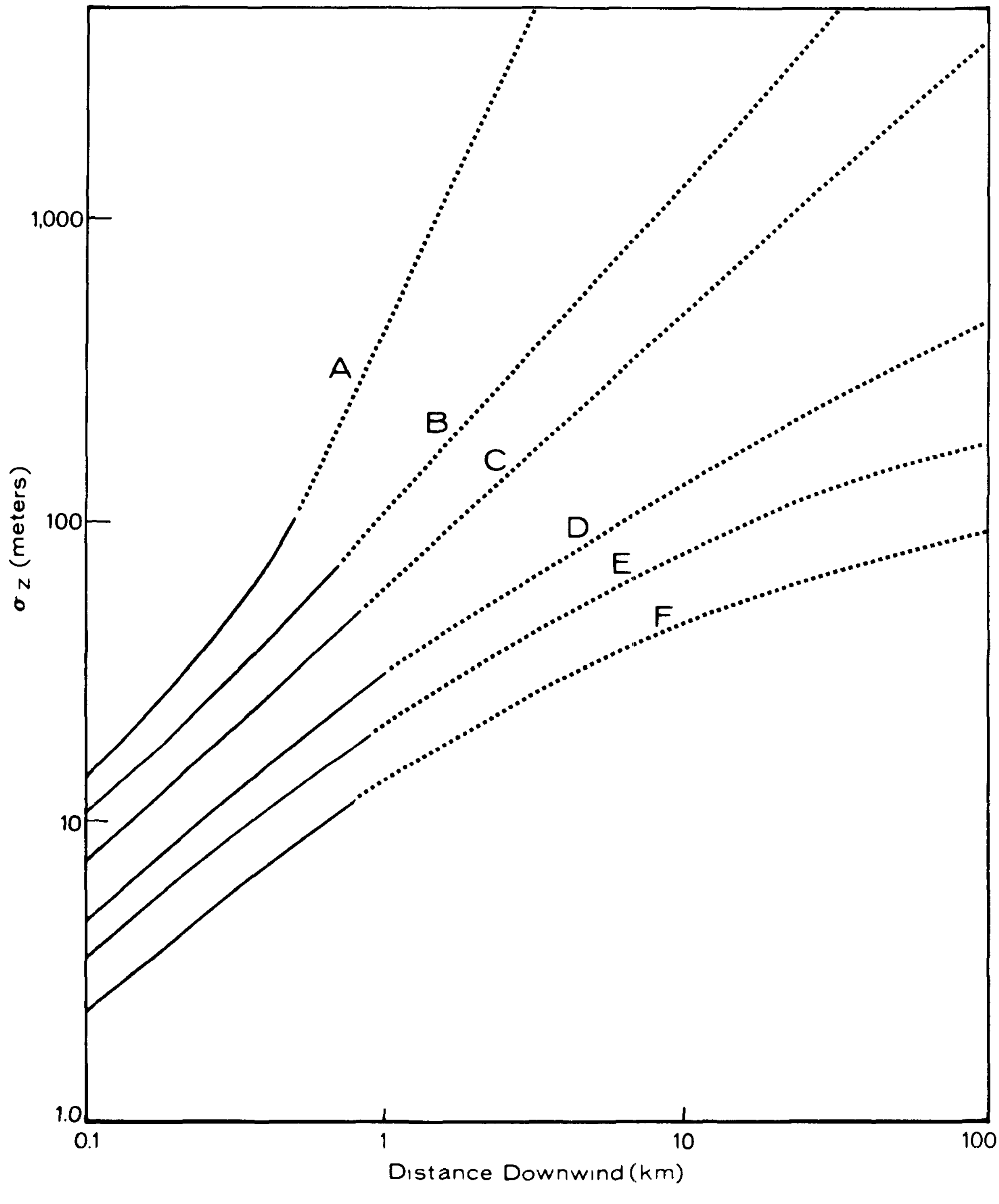


Figure 2. Vertical dispersion coefficient as function of downwind distance from the source (1)

2.1 Diffusion Equation

The basic diffusion equation used in AIREM is a standard sector-averaged equation (1,2) modified to include radionuclide decay by time of flight:

$$\frac{\chi}{Q'} = \frac{\Psi}{Q} = \left(\frac{2}{\pi}\right)^{\frac{1}{2}} \frac{f \exp\left(-\frac{h^2}{2\sigma_z^2}\right) \exp(-\lambda t)}{\bar{u}\,\sigma_z\, 2\pi\frac{r}{n}} \qquad (1)$$

where:

χ = ground level airborne concentration in Ci/m^3,

Ψ = time integrated ground level concentration-exposure in Ci-sec/m^3,

Q' = source release rate in Ci/s,

Q = time integrated release in Ci (i.e., total release),

f = fractional wind frequency in a sector,

r = distance from the stack in meters,

h = effective stack height in meters,

n = number of sectors,

$2\pi\frac{r}{n}$ = sector width at distance r in meters,

σ_z = standard deviation of the vertical distribution of an assumed gaussian cloud, in meters,

$\bar{u}$ = average wind speed in the sector in m/s,

λ = decay constant of radionuclide in sec^{-1}, and

t = transit time from the stack to distance r, in seconds $\left(t = \frac{r}{\bar{u}}\right)$.

AIREM calculates and prints the σ_z's for each downwind distance and stability class. Equation 1 is solved for each radionuclide, each stability class within each sector, and each downwind distance. Undecayed (χ/Q')'s summed over stability classes are printed out. Decayed (χ/Q')'s are not printed out because of the fact that there could be as many as 19,200 in a problem.

2.2 Dry Deposition

Ground dry depositions are calculated using the relation (2);

$$\omega = \frac{\chi}{Q'} \cdot Q \cdot v_d \cdot \left(1-e^{-\lambda P}\right)/\lambda P \tag{2}$$

where:

- ω = Ci/m^2 deposited on the ground at end of P,
- λ = decay constant in inverse seconds,
- v_d = deposition velocity in m/sec, and
- P = period of release (or one year if release period is not specified).

Deposition velocities for each stability class are derived by the code using the relation:

$$v_d = a_0 + a_1 \bar{u} + a_2 \bar{u}^2 + a_3 \bar{u}^3 \tag{3}$$

where the a's are user-supplied deposition velocity coefficients. Constant, linear, quadratic, and/or cubic polynomial fits to experimental deposition velocity data are easily accommodated.

2.3 Wet Deposition

Ground deposition and cloud depletion by below cloud washout is included as an option to the user. This option is exercised by providing the fraction of the time it rains (RAINF) and a washout factor (WASHCO) in inverse seconds as input data. If either of these parameters is zero, washout will not be calculated.

Ground level activity density is calculated using the relationship:

$$\omega(r) = \Lambda \int_0^\infty \chi(z)d(z) = \frac{ff_r \Lambda Q}{u\left(2\pi\frac{r}{n}\right)} \tag{4}$$

where f_r = rainfall frequency (fraction) Λ is the washout factor and z is the vertical coordinate. Upwind depletion of the cloud is calculated using:

$$Q(r) = Q_0 \exp\left(-\Lambda \frac{r}{u}\right) . \tag{5}$$

The AIREM output lists total activity deposited within radii and deposition density at the end of the release period (or one year if the release period is not specified). The latter is calculated by multiplying deposited activity by the relation $(1 - \exp(-\lambda P)/\lambda P)$ where P is the release period.

This formulation includes washout from the cloud from the time of release throughout its travel. It does not include washout from an already established cloud.

3. DOSE CALCULATIONS - GENERAL

Two general classes of dose calculations are treated explicitly by the code. These are: doses that are directly proportional to the ground level air concentration of radionuclides, and whole body doses due to gamma rays emitted by nuclides in the overhead cloud (cloud gamma doses).

Doses from inhalation, external beta, and transpiration dose modes are directly proportional to ground level radionuclide concentrations. For these dose modes AIREM uses "dose conversion factors" (DCF's) that relate dose rate to concentrations. The units for the DCF's used as input must be millirem per second per curie per cubic meter. DCF's may be derived from any appropriate model. Two simple models are discussed in the annotations to the code in appendix A.

Cloud gamma doses are calculated using dose tables obtained from a model that considers the finite extent of the cloud in the vertical direction. The calculation requires two data sets: the energies and abundances of the gamma rays emitted by the radionuclide, and a set of dose tables which are functions of gamma energies, σ_z's, lid height, and stack height. The annotations to the code listing provide references for the gamma ray groups.

Doses to up to four organs can be calculated in a single AIREM run. The total dose to a single organ from all contributing radionuclides is calculated and printed out. If a given radionuclide contributes to doses for two organs, it is entered twice in the input data using different DCF's and is counted twice in the isotope card queue. A maximum of 20 radionuclides can be processed in a single problem. One of the input cards is a count of radionuclides contributing to the dose to a single organ. The total of these counts cannot exceed 20.

For a parent-daughter radionuclide combination, it is possible to obtain both the cloud gamma and inhalation doses in a single problem run. Daughter nuclides must follow their parents in the nuclide queue. To obtain all combinations of dose modes by radionuclide, two or more problem runs must be made.

In general, contributions to dose are first summed over stability class, then radionuclide, before printout commences.

4. CALCULATIONS

The general flow of the calculations is illustrated in figure 3. Detailed discussions of the calculations follow.

4.1 Vertical Dispersion Coefficients (σ_z's)

The σ_z's are calculated using the FUNCTION SIGZ.[2] The equations for six stability classes, 1 through 6, corresponding to Pasquill (1,2) stability classes A through F, respectively, are solved for each σ_z. The functions are polynomial fits to the σ_z curves in figure 2. The σ_z's are written out by downwind distance and stability class. The σ_z's are also limited to a maximum value of 10,000 meters in the FUNCTION SIGZ subprogram unless limited to a lower value by the user by assignment of a value to SIGMAX[2] in the input data (2,3). Details of calculating SIGMAX values are covered in section 6.1.

4.2 In-plant Holdup and Decontamination

If the input datum HOLDUP[2] is greater than zero, all parent nuclides are decayed in-plant before release from the stack, and user-supplied decontamination factors are applied to each radionuclide before release. Daughter products are grown-in during holdup. Input holdup time and input decay constants are in days and seconds respectively. All parent inventories are decayed by the equation:

$$Q_p(\text{HOLDUP}) = Q_p(0) \cdot \exp - (\lambda_p \cdot \text{HOLDUP} \cdot 8.64 \cdot 10^4) \tag{6}$$

First daughter products Q_d are grown-in using the standard equation:[2]

$$Q_d(t) = Q_d(0) \cdot \frac{\lambda_d}{\lambda_d - \lambda_p} \cdot \frac{\left(e^{-\lambda_p t} - e^{-\lambda_d t}\right)}{\text{DECON}} \tag{7}$$

where t = HOLDUP · 8.64 · 10^4 and DECON[2] is an isotope-dependent in-plant decontamination factor greater than 1. If the resultant (Q)'s are less than one microcurie they are set equal to zero.

4.3 Diffusion Equation

Diffusion is calculated using the sector-averaged gaussian diffusion equation (reference 2, eq. 3.144). The assumption is made that within a stability class in a sector there is equal probability of the cloud being found at any cross-wind (horizontal) location in the sector. Except for the gaussian cloud expansion, no cross-wind components of

---

[2]See Glossary in appendix A for definition of terms.

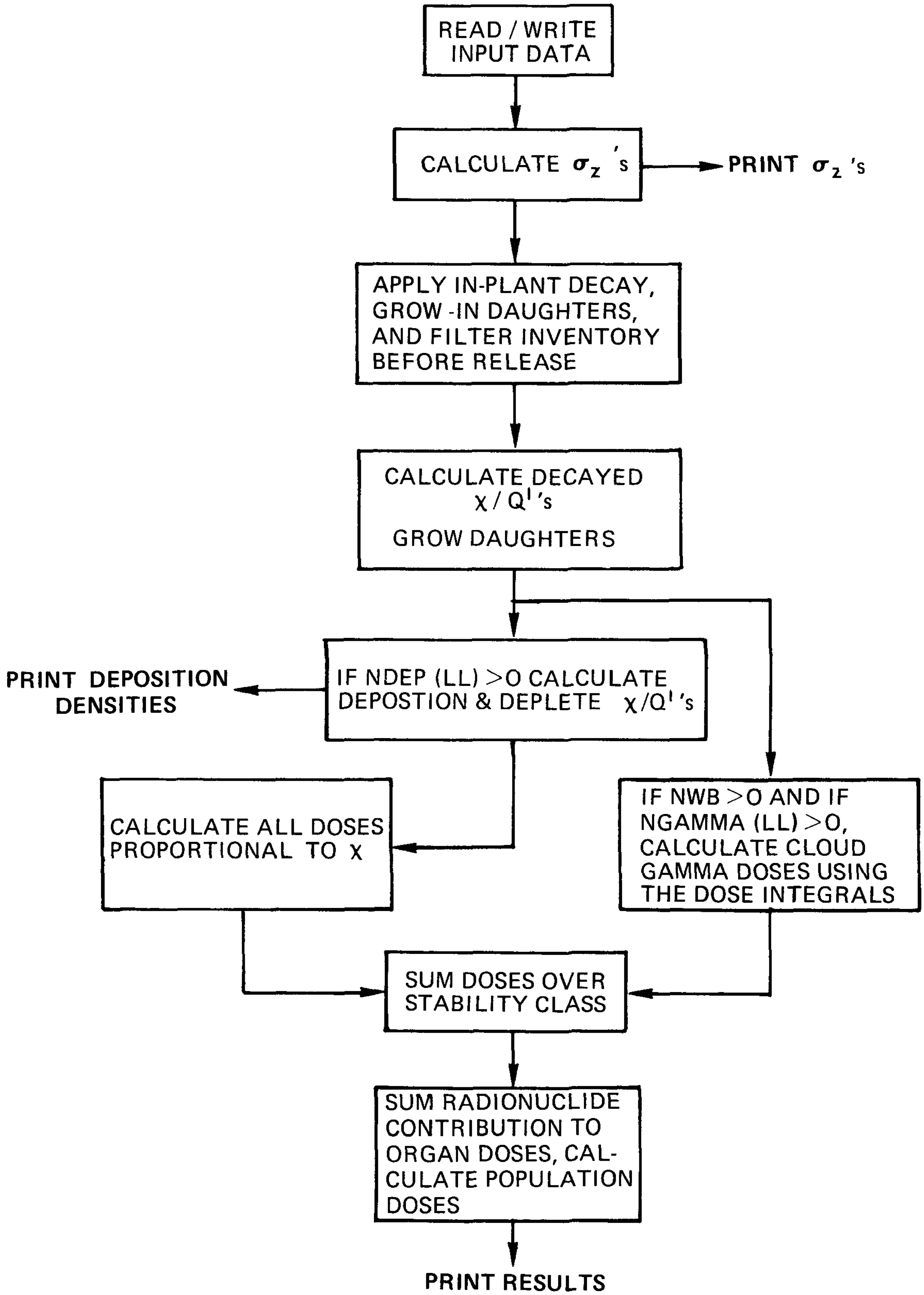


Figure 3. Simplified AIREM flow diagram

the velocity vector, either horizontally or vertically, are allowed by this model. This is a typical working assumption used in state-of-the-art deterministic models used in the air pollution field.

The ratio of the ground level volume concentration χ (Ci/m^3) of pollutant per curie per second release rate (Q') in a cloud at a downwind range MM, for radionuclide LL, for a release height H, for stability class JJ, in sector II, is calculated by the code. The format of the printout is normally for a 16-sector problem, but reformatting for fewer sectors can be done for an AIREM run. However, the code assumes that the sectors span 360 degrees.

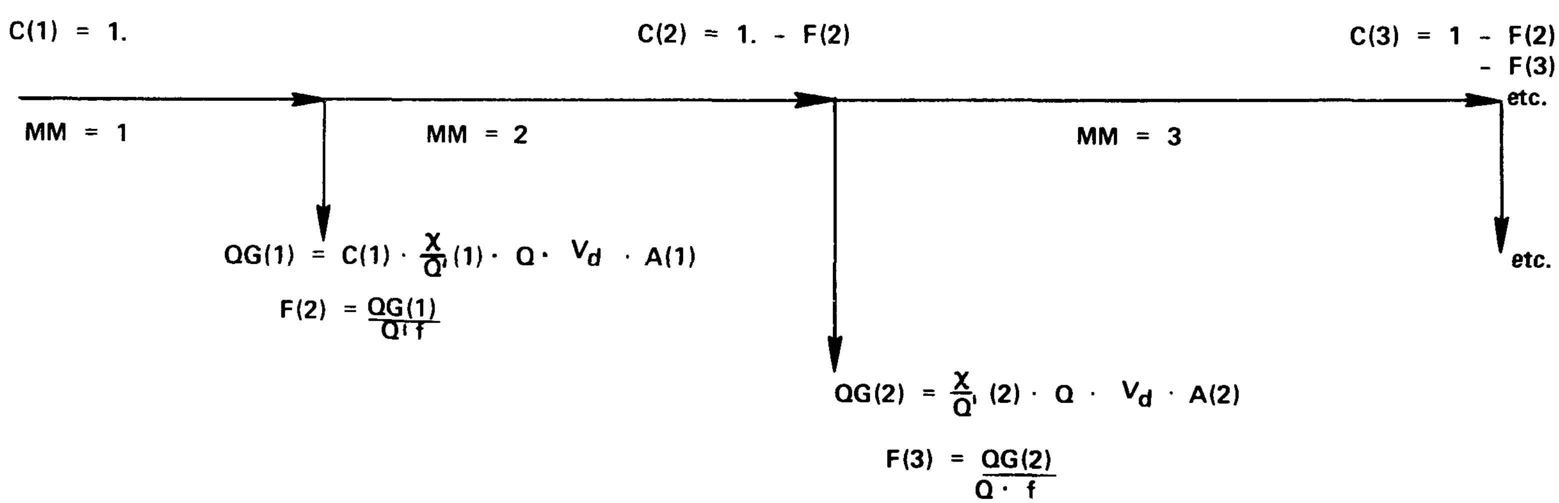
The formulation of the χ/Q' calculations include decay during time of flight from the emission point and only in this regard does it differ from common practice. (The user can insert a Fortran write statement before the dose calculation program steps to obtain a listing of the individual (χ/Q')'s. However, a large amount of printout will result.) Undecayed (χ/Q')'s summed over stability class are printed out.

4.4 Dry Deposition and Cloud Depletion

Deposition velocities for each stability class are calculated using equation 3. The areas of each sector-segment are calculated before the deposition and cloud depletion routine is entered. Daughter products are grown-in during time of flight and added to the decayed initial daughter product inventory. At any distance, if the activity deposited on the ground within a given stability class is less than 10^{-12} curie it is set equal to zero.

Cloud deposition and depletion are treated using a physical model. Deposition starts at the first (inner) radius for the first stability class (figure 4). The total activity deposited on the ground in the first sector-segment is calculated as well as the fraction of the total release deposited on the ground in that sector-segment. χ/Q' at the second radius is depleted by one minus the fraction on the ground at the first radius. This process of deposition and depletion continues outward to the last radius in the sector. (The routine is essentially the same as that indicated by equations 5.44 through 5.46 in reference 2.) For each stability class in a sector, ground deposition and cloud depletion are calculated using the following set of recursion formulas:

$$\begin{aligned} F(1) &= 1. \\ C &= 2. - \sum_{MM=1}^{M} F(MM) \\ QG(MM) &= \frac{\chi}{Q'}(MM) \cdot C \cdot Q \cdot v_d \cdot A(MM) \\ F(MM+1) &= QG(MM)/(Q \cdot f) \;. \end{aligned} \tag{8}$$



NOTE: IF C(MM) $\leq$ 0., $\frac{X}{Q'}$ (MM) AND QG(MM) ARE SET EQUAL TO ZERO.

Figure 4. Simplified illustration of deposition and depletion routine used in AIREM

Where QG(MM) is the activity deposited on the ground in the sector-segment at distance MM, f is the wind frequency, A is the area and indexes II, JJ, and LL have been suppressed for legibility. The calculations are performed for a single nuclide (LL), for a single stability class (JJ), and in a single sector (II) at a time. At each downwind distance (MM), C is tested before the deposition calculation; if C is less than or equal to zero, χ/Q' at that MM and at further downwind distances is set to zero. If QG(MM) is less than or equal to 10^{-12} curie, QG(MM) is set equal to zero.

Advantage is taken of the fact that previously calculated (χ/Q')'s include depletion by time of flight decay. The recursion equations are solved repeatedly for each stability class in each sector. The second recursion relation assures that the total activity deposited on the ground does not exceed that originally blown into the sector within the stability class. (If the area of the outer sector segments are very large and the wind speed is small the code may calculate more deposited material than released. In this case, the user must adjust the geometry of the problem to avoid this type of error.)

Activity deposited within areas is then summed over sectors and stability classes. Activity density at the end of the release period is printed out by the code for each sector-segment. This activity is calculated by applying the factor $(1 - \exp(-\lambda P)/\lambda P)$, where P is the period of release and λ is the decay constant of the radionuclide.

The accuracy of the deposition calculations is affected by the size of the problem grid. The smaller the intervals between downwind ranges, the more accurate will be the calculation. In test problems, excellent results have been observed for 1 m/s wind speeds and 1 cm/s deposition velocities, using range intervals as large as 15 kilometers. (See figure 5 and reference 2.)

Cloud depletion becomes less significant at higher wind speeds. At normal wind speeds averaging 5 m/s, and for a normal mix of stability classes, most of the emissions are blown outside a 50-mile radius, even at release heights as low as 20 meters.

4.5 Organ Dose Calculations

Radionuclide contributions to up to any four organs are summarized in the output. Should one of the organ doses be the whole body dose calculated using finite cloud model dose integrals, (i.e., the cloud gamma dose), the contributing radionuclides must be presented first in the isotope card queue, and NGAMMA[2] for all such isotopes must be greater than zero. In such cases, the cloud gamma doses will be calculated using the listed dose integrals. If NGAMMA is zero, or if the organ is not the first, the dose will be calculated using the semi-infinite cloud assumption (4,5) that dose rate is directly proportional to ground level concentration:

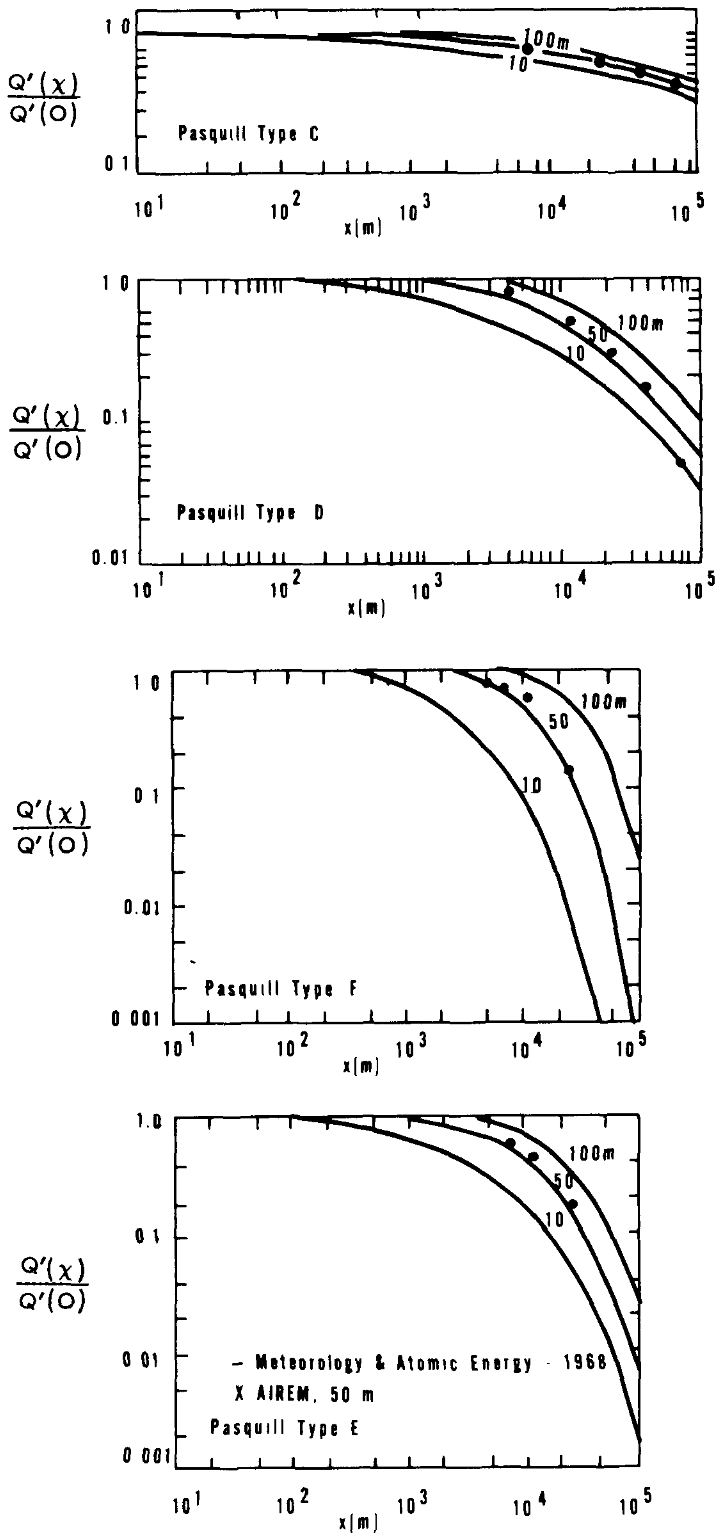


Figure 5. Source-depletion fraction for source heights from 10 to 100 m above the ground and for various stability categories

$$\text{Dose} = \frac{\chi}{Q'} \cdot Q \cdot (\text{DCF}) \tag{9}$$

where the units of the dose conversion factor (DCF) are mrem/s per Ci/m^3, Q is in curies, χ/Q' is in s/m^3, and the dose is in millirems. Methods for obtaining the DCF's are suggested in the AIREM program listing in appendix A. The sample problem in appendix A presents DCF's for several radionuclides, for several organs.

Doses are calculated for each radionuclide, each sector, each stability class, and each downwind distance. These doses are available in storage for printout, but, as presently constituted, AIREM does not print them all. Rather, in each sector-segment the doses are first summed over all stability classes, then over the radionuclides contributing dose to the same organ. The resulting total doses in each sector-segment are printed by AIREM. (Even though some or all of the cloud gamma doses may be calculated using the finite cloud dose integrals, the DCF's are all printed out in the summary tables of radionuclides contributing to the organ dose.)

4.6 Population-Dose Calculations

For population-dose calculations use is made of the doses already summed over stability classes and contributing radionuclides in each sector-segment. The contribution to the total population dose from each sector-segment is merely the product of the dose and the population in the sector-segment. Population doses are added within each annular ring and the accumulated (running total) population dose vs. distance is calculated. Both sector-segment and running total population dose are printed by the code. This procedure is repeated for each of the remaining organs if more than one organ dose is calculated.

Finally, a table of radionuclide contributions to the population dose is generated and printed out.

4.7 Problem Summary

At the end of the last tabular dose listing, a few key parameters identifying the problem run are printed out. These, plus the listing of the radionuclides contributing to the doses should highlight any gross errors in the input data. The input data is also listed to identify the total problem being run. The authors believe the latter to be highly desirable because of the large amount of data required to run the program. For the same reason, the technique of writing out input data immediately after reading it in (not normally done) has proved useful in debugging input data.

5. INPUT REQUIREMENTS AND DATA FORMAT

Some 200 lines of input data are required to run AIREM. Through coding, a variety of options are available to the user. Because of

Table 2. AIREM input card sequence and data format

Card sequence	Columns	Title	Format
1 card	2-20	Facility name	5A4
	21-25	No. months of data	F5.0
	27-30	Beginning month	1X,A4
	31-35	Beginning year	I5
	37-40	Ending month	1X,A4
	41-45	Ending year	I5
	46-55	Thermal energy generated (MWD)	F10
1 card	2- 5	No. sectors (I) (16 max.)	I5
	6-10	No. classes (J) (6 always)	I5
	11-15	No. radii (M) (12 max.)	I5
	16-20	No. isotopes (L) (20 max.)	I5
	21-30	Stack height (m)	F10
	31-40	SIGMAX[a] (m)	F10
	41-50	In-plant holdup time (d)	E10
	51-60	Rainfall frequency (fraction)	E10
	61-70	Washout factor (1/s)	E10
I cards	1-60	Wind frequencies by stability class (%), 10 columns each	6F10
I cards	1-60	Wind speeds by stability class (m/s), 10 columns each	6F10
M cards (I<8) 2M cards (I>8)	1-80	Annular ring population, 8 sectors to a card, 10 columns each	8F10
M cards	1-30	Midpoint, lower and upper radii (m), 10 columns each	3F10
4 cards	1-60	"Particulate" deposition velocity coefficients, 10 columns each	6E10
4 cards	1-60	"Halogen" deposition velocity coefficients, 10 columns each	6E10
1 card	1-20	Number of sets of isotopes per organ (up to 4 organs and 20 nuclides), 5 columns each	4I5

See footnote at end of table.

Table 2. AIREM input card sequence and data format--continued

Card sequence	Columns	Title	Format
L sets of isotope cards (two to four cards per nuclide):			
1st card	2- 5	Isotope symbol	1X,A4
	7-10	Atomic weight	1X,A4
	11-15	Critical organ	1X,A4
	16-25	Dose conversion factor (mrem/s per Ci/m^3)	F10
	26-35	Decay constant (s^{-1})	E10
	36-40	Deposition call code 0 for gases 1 for particulates >2 for halogens	I5
	41-45	Finite cloud call code: 0 for semi-infinite cloud approximation; <10 for finite cloud calculation using the dose integrals; used only when NWB>0.	I5
	46-50	Daughter call code: 0 for parent; 1 if parent is preceding set of isotope cards.	I5
2nd card or 2nd & 3rd cards	1-72	If NGAMMA[a] >0, NGAMMA pairs of lines (MeV) and abundances, up to 10 pairs, 6 columns per item	12F6
2nd, 3rd, or 4th card(s)	1-10	Curies of isotope LL in inventory	F10
	11-20	In-plant decontamination factor (greater than or equal to 1); a blank defaults to 1.	E10

[a]See Glossary in appendix A for definition of terms.

Note: After the full queue (up to 20 sets of isotope cards), add dose integrals title card and dose integrals to rear of data deck if finite cloud gamma doses are to be calculated, otherwise add 8 blank cards.

these factors a detailed discussion of the input data deck is presented here. However, the information given in table 2 and the input data format illustrated in the sample problem printout in appendix A should suffice for most applications.

5.1 First Card

The thermal-energy-generated datum is obviously meant for nuclear power plant applications. No calculations are made using this number; it is merely printed out in the problem summary (it may be left blank).

5.2 Second Card

No. classes refers to the number of stability classes; this should always be 6. Stability classes are defined by the σ_z's used in the diffusion calculation; these are displayed in figure 2. Stability classes A through F are numbered 1 to 6, respectively. *No. radii* refers to the number of downwind distances for which calculations are desired. This cannot be greater than 12. SIGMAX should be 0.8 times the height of the inversion layer (3). Section 6.2 includes a further discussion of this parameter.

5.3 Wind Rose Data

Wind frequencies (%) and *wind speeds* (m/s) are entered in a clockwise direction beginning with the north sector. For a 16-sector problem, 16 frequency and 16 speed cards are required. Note that most meteorological summaries list wind roses as directions *from which* the wind blows while the direction *blown to* is required here. Each card in the frequency and speed queues may contain up to six numbers--one for each of up to six stability classes, for each sector. Any of these data may be left blank by the user.

Calculations derived from data on the first cards in these queues will be printed under the north headings. Since the printout formats presume a 16-sector problem, some shifting of data with respect to column headings will occur if fewer sectors are run. (Since AIREM assumes 360 degree geometry, sectors will be 22.5 degrees for 16 sectors, 45 degrees for 8 sectors, etc.)

5.4 Population Data and Radii Limits

Population data are entered clockwise starting in the north sector and within the inner ring. For a 16-sector, 10-radii problem, 32 cards are required.

The definition of the midpoint, lower and upper bounds of the sector-segments establish the radial grid for the problem (see figure 1). For a 10-radii problem, 10 cards are required. The minimum midpoint radius that can be used is 100 meters.

5.5 Deposition Velocities

Deposition velocity coefficients are entered as 24 numbers for each of two types of deposition (particulate and halogen).

Deposition velocity coefficients, v_d, are assumed to be of the form:

$$v_{d,j} = \sum_{n=1}^{KOF} a_{n,j} \left(\bar{u}_{i,j}\right)^n , \tag{10}$$

where $\bar{u}_{i,j}$ is the (average) wind speed in stability class j in sector i; $a_{n,j}$'s are KOF expansion coefficients for stability class j; and $v_{d,j}$ is the deposition velocity (m/s) for stability class j. In AIREM n_{max} = KOF = 4.

The input data format is simple. All constant terms appear on the first card, linear terms on the second card, quadratic on the third, and cubic on the fourth. Eight cards are required. The first four are for particulate expansion coefficients and the second four for halogen expansion coefficients. Thus, if only the constant value 0.01 m/s is applied for all cases, 0.01 appears six times on the first and fifth of eight cards. The other six cards are blank in this case. The program listing in appendix A contains a further description of how v_d's are used.

5.6 Radionuclide Cards

The four numbers on the "number of sets of organs" card are used to count isotopes. Their use is best described by an example. If the number of sets of organs card lists the numbers 8, 3, 1, and 1, the calculated doses from the first eight nuclides in the isotope card queue will be summed in the printout and doses from the radionuclides at positions 9, 10, and 11 in the isotope card queue will similarly be summed, etc. *Finite cloud whole body dose calculations are performed for only the first set of organ cards in the queue.* A glance at the input data listing in the example problem in appendix A should clarify the function of this number of sets of organs card; it merely establishes a counting and summing sequence in the code.

The format of the isotope cards provides several options to the user: (1) a cloud gamma dose calculation using finite cloud dose integrals (for which the gamma energies and abundances must be provided), or a semi-infinite cloud approximation, (2) including ground depositions and cloud depletion, or not, and (3) ingrowth of a single daughter product or not. *Ingrowth is added to the initial daughter product release.*

No calculations are performed on the isotope symbol, atomic weight, and critical organ descriptions. Since only four spaces are provided to describe the critical organ, either numbers or cryptic symbols must be used. For example, the dose to an adult thyroid due to inhalation could be cryptically described by IATY, or a number, at the user's choice. XBS could cryptically describe the skin dose due to external beta particles in a cloud. The dose conversion factor (DCF) must pertain to the desired organ dose and sample population. The units of the dose conversion factor are mrem/s per Ci/m^3.

Two to four cards per radionuclide are required. Only two cards are required if the semi-infinite cloud approximation is appropriate for the dose calculation. For finite cloud whole body dose calculations three or four cards are required. The second or second and third card(s) contain NGAMMA energy and abundance pairs. Two gamma energy and abundance cards are required if NGAMMA exceeds 6. NGAMMA cannot exceed 10.

5.7 User Options

The numbers in columns 36-40, 41-45, and 46-50 on the first card of a radionuclide card set must be right-adjusted. Columns 36-40 may be left blank if deposition is not requested. If a 1 appears in column 40, the "particulate" deposition velocity coefficients will be used to calculate dry depositions; if the number is greater than 1, the "halogen" deposition velocity coefficients will be used. If columns 41-45 are blank or zero, the dose conversion factor in columns 16-25 will be used for the dose calculation. If the isotope card belongs to the first organ set in the queue, and if a number NGAMMA between 1 and 10 appears in columns 41-45 on an isotope card, doses will be calculated using the finite cloud dose integrals. NGAMMA is the number of gamma lines to be used in the finite cloud gamma dose calculation for this particular radionuclide. If NGAMMA is not zero, the gamma lines (MeV) and their abundances (gammas per disintegration) are read in pairs on the next, or next two cards (two cards are required if NGAMMA is greater than 6).

5.8 Radionuclide Inventory and Pre-Release Filtering

The last card in each of the sets of two to four isotope cards contains the total activity (curies) in inventory and an in-plant decontamination factor. The decontamination factor is a number equal to or greater than 1. If DECON is zero or blank, DECON will automatically default to 1.

5.9 Dose Integrals

Following the isotope card queue is the set of finite cloud dose integral cards, beginning with a title card. If only semi-infinite cloud calculations are performed, these may be skipped and eight blank cards substituted. The format for the dose integral cards is explained in appendix B.

Last are the job control cards /* and //, announcing the end of the data deck.

6. BACKGROUND INFORMATION AND AIDS TO THE USER

As an aid to the user, several examples and suggestions regarding the use of the AIREM code are presented in this section.

6.1 Plume Rise - Determination of Effective Release Height

Of a variety of plume rise equations to be found in the literature, those of Briggs (6,7) are the most extensive and exhaustive. Briggs' formulation accounts for plume rise as a function of downwind distance, stability class, and height of inversion layers. Estimates of plume rise based upon Briggs' equations, for operating boiling water nuclear power reactors, are presented in reference 8. Dose integrals are included in appendix B for H_{eff}'s of 0, 10, 50, 75, 100, 120, 150, and 200 m. Alternatively a new set of dose integrals can be generated by the user using the modified version of EGAD listed in appendix B.

6.2 Annual Average Mixing Layer Heights

An estimate of the annual average height of the mixing layer (H_{lid}) at a given locale may be obtained using figures 6 and 7 taken from reference 3. SIGMAX in AIREM should be set at approximately 0.8 H_{lid}, consistent with the available dose integral sets.

An estimate of H_{lid} can be obtained from:

$$H_{lid} = \frac{2 \cdot H_{am} \cdot H_{pm}}{H_{am} + H_{pm}} , \qquad (11)$$

where H_{am} and H_{pm} are the mean annual morning and afternoon mixing heights obtained from figures 6 and 7.

The value used for SIGMAX based on a daytime lid will normally exceed 500 meters. Since classes D through F have σ_z's which are less than 500 meters at distances up to 100 kilometers, only stability classes A through C are normally affected by a lid. At night an inversion extends down to the ground for E and F stabilities. Under these conditions there is no lid, but since SIGMAX will be greater than any σ_z calculated for these stabilities it is not necessary to treat them separately. In short, the daytime lid provides a reasonable bound for the conditions which are affected by a lid and does not disturb those which are not. For a mixture of stability classes the dose calculations are not very sensitive to the presence or absence of a lid.

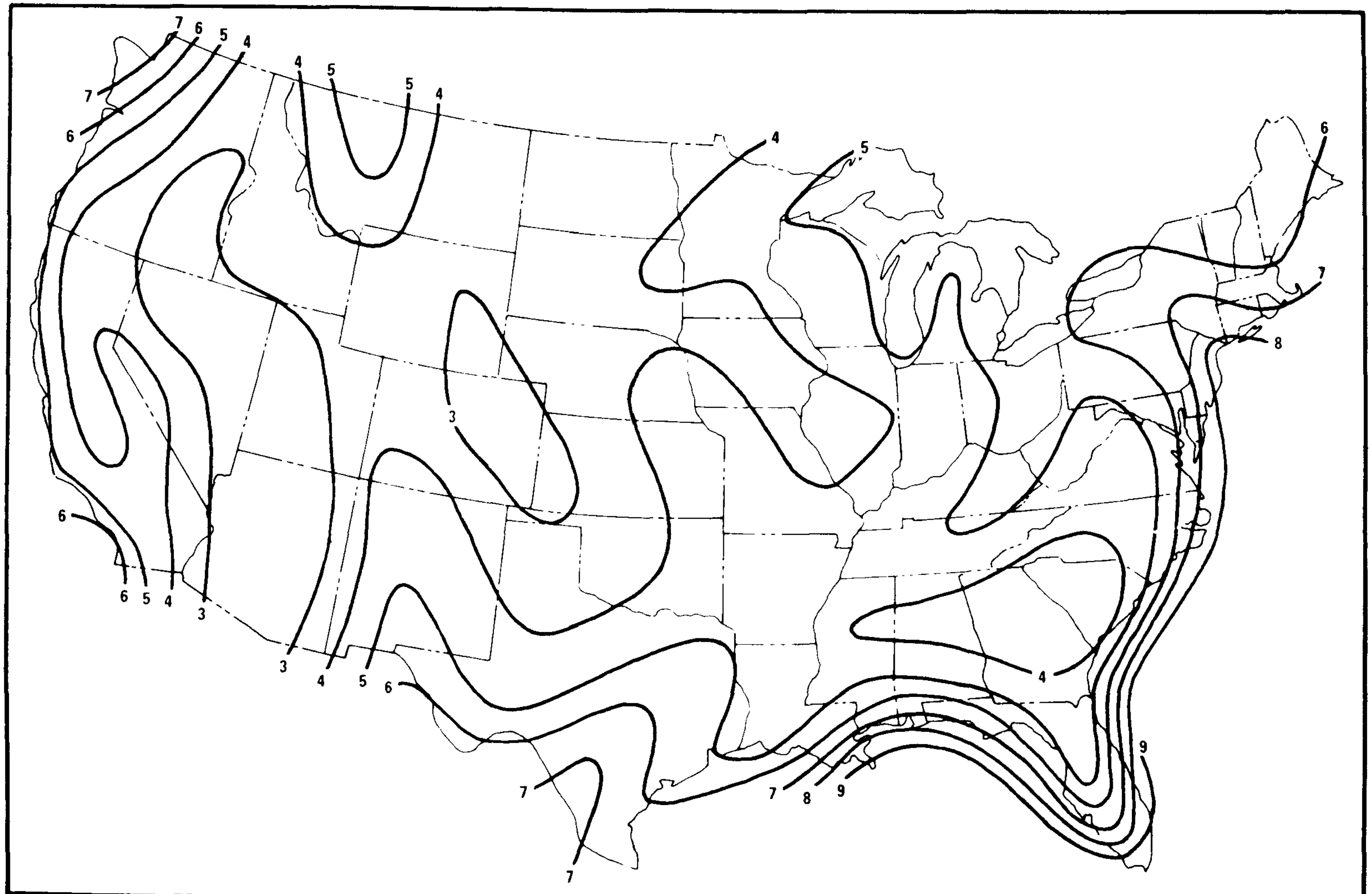


Figure 6. Isopleths (m x 10^2) of mean <u>annual morning</u> mixing heights (<u>3</u>)

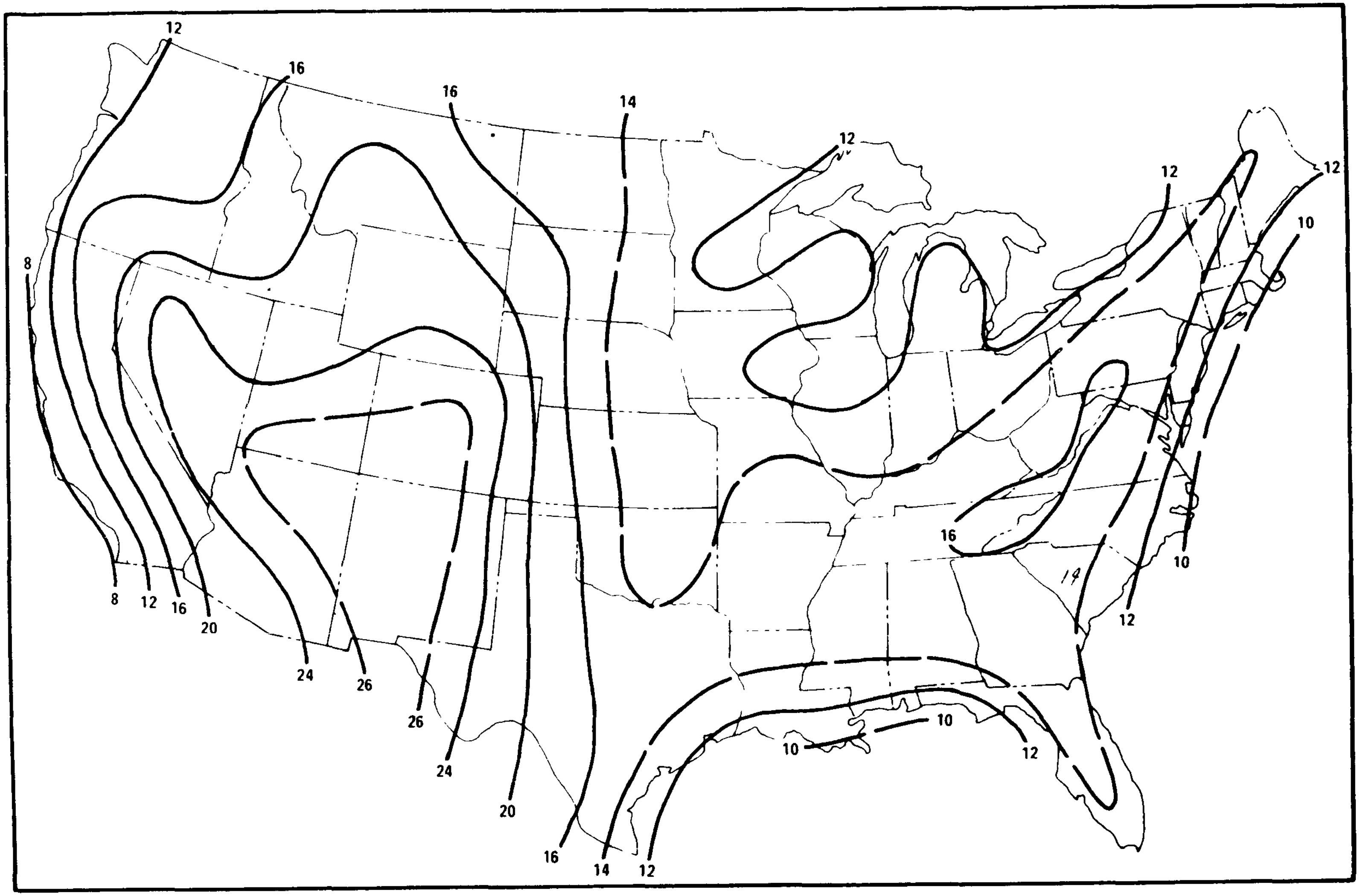


Figure 7. Isopleths (m x 10^2) of mean annual afternoon mixing heights (3)

6.3 Finite Cloud vs. Semi-Infinite Cloud Dose Calculations

The assumption of a semi-infinite cloud (2,4,5) has been used to calculate cloud gamma doses. For comparison, the difference between doses calculated using EGAD finite cloud dose model and doses calculated using the semi-infinite cloud assumption is displayed in figure 8. As expected, the difference is small at large distances from the release point since by then the cloud has expanded considerably. At intermediate ranges, the semi-infinite cloud assumption overestimates the dose since it assumes that the concentration everywhere is identical to the ground level concentration, whereas the concentration actually diminishes with height. At close distances the semi-infinite cloud assumption results in a very low ground level concentration and gross underestimates of doses since it ignores gamma rays emanating aloft.

6.4 Sector-Averaged vs. Single Plume Dose Calculations

Since AIREM utilizes a sector-average diffusion equation, it cannot be used to obtain accurate results for a single plume. The differences between results calculated using sector-averaged and single plume models are illustrated in figure 9. At large ranges, the sector-averaged diffusion equation (assuming a 22.5 degree sector) leads to calculated doses that are lower than for the single plume. This is because the sector-averaged diffusion equation spreads the activity (pollutant) fully and equally across the sector at all heights. Conversely, the single plume model restricts the crosswind horizontal spread of the plume. Thus, the single plume model results in higher centerline doses.

At close distances, the EGAD assumption that concentration varies only in the z direction results in a higher calculated dose.

6.5 Wind Speed Dependences

As with many codes, AIREM uses an average wind speed in the diffusion equation. This poses a difficulty since the diffusion equation, which includes radionuclide decay by time of flight, is a transcendental function with five variables: (1) radionuclide (half-life), (2) downwind distance, (3) sector, (4) stability class, and (5) wind speed group within a stability class (e.g., 0-1, 1-3, 3-5, etc., m/s intervals). Since the full equation is not linear in u or 1/u, it is not possible to compute an average wind speed which provides the exact decay correction. In practice, the average wind speed for stability class j in sector i is obtained using the equation:

$$\frac{1}{\bar{u}_{i,j}} = \frac{\sum_k f_{i,j,k}/u_k}{\sum_k f_{i,j,k}} \qquad (12)$$

where k is the index for the wind speed groups.

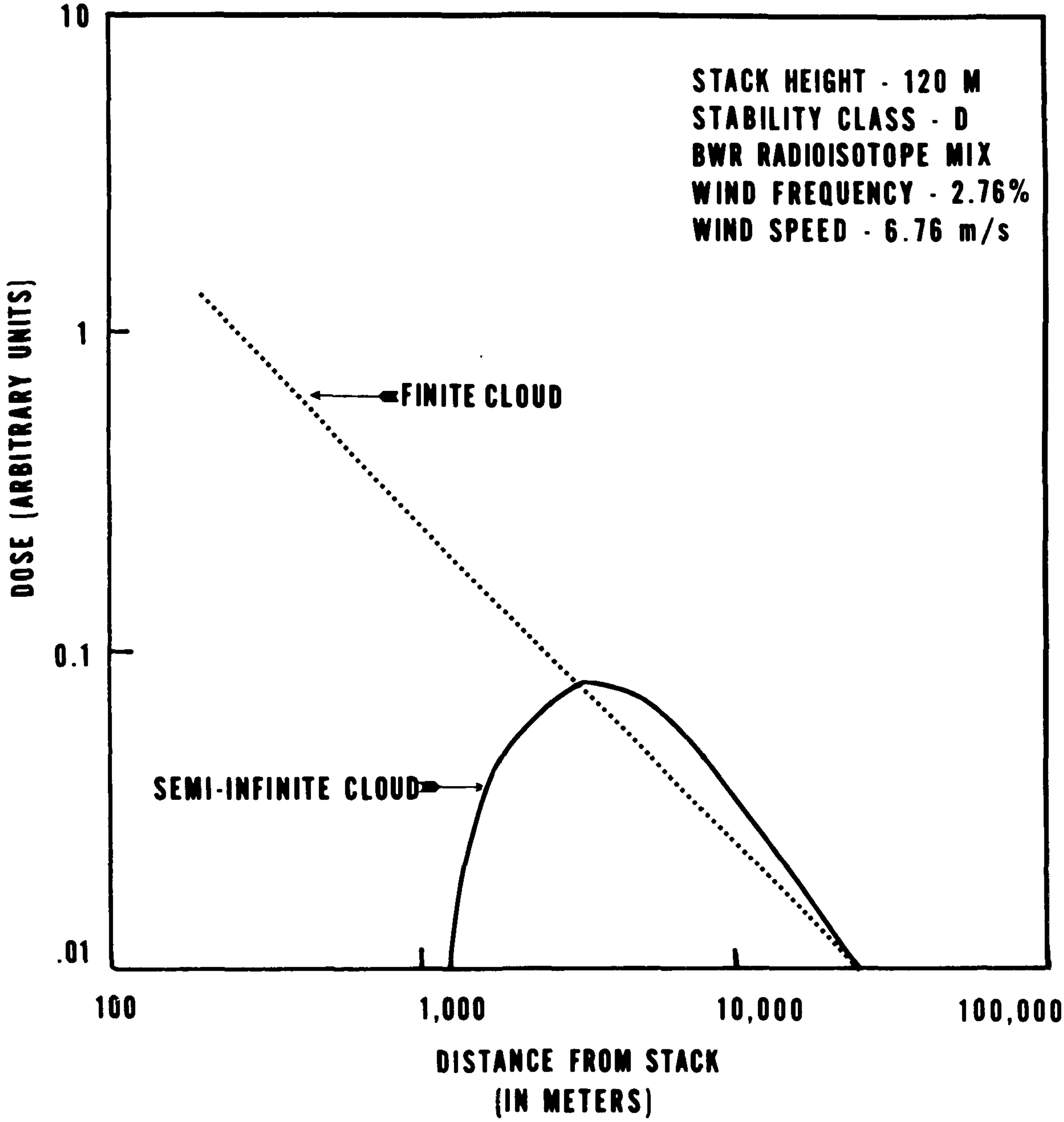


Figure 8. Comparison of external gamma whole body dose calculated using finite and semi-infinite cloud dose models

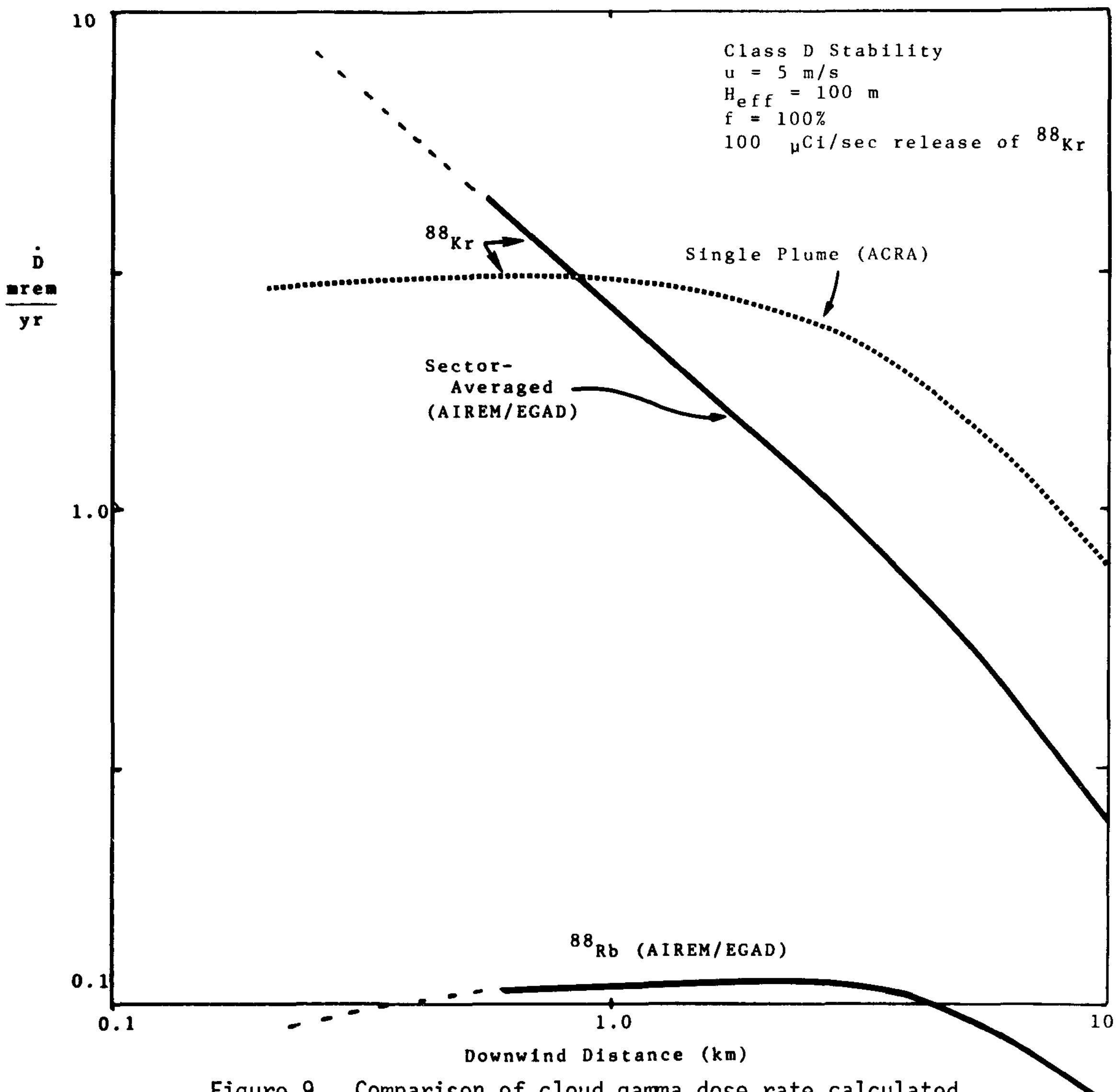


Figure 9. Comparison of cloud gamma dose rate calculated using single plume (ACRA) and sector-averaged (AIREM/EGAD) diffusion models

The sample problem in appendix A illustrates the sensitivity of calculated doses to wind speed. The dependence is almost hyperbolic for a normal BWR radionuclide mix for normal wind speed variations (4 to 8 m/s), at short ranges. This is an artifact of the sample problem, because the lower wind speeds, although providing less ventilation, provide more time for short half-lived radionuclides to decay and vice versa. For the long half-lived radionuclides the diffusion equation is not transcendental and the average as defined above is mathematically correct.

6.6 Doses Due to Deposited Radionuclides

Doses due to radionuclides deposited on the ground may be of particular interest to users of this code. AIREM prints out the activity density (pCi/m^2) on the ground at the end of the release period. This can be the starting point for dose calculations for the milk, food crop, and direct radiation pathways. The treatment of these pathways is beyond the scope of this manual. As an aid to the user, table 3 (9) lists some dose conversion factors for skin and whole body doses due to standing in a radionuclide-contaminated field. Reference 9 also includes a detailed discussion of food pathways.

6.7 Sample Problem Description

The sample problem was devised to illustrate the effects of stability class and wind speed variations on doses, population doses, and ground depositions. A 100-meter effective stack height was assumed. Populations were assumed to be distributed in direct proportion to the areas of the sector-segments. A wind frequency of one percent for all sectors, with only one stability class in each sector, was used. An illustrative set of radionuclides was chosen and released in equal quantities without holdup inplant. Two daughter products were grown-in during time of flight. Cloud gamma and skin doses were calculated to illustrate the finite cloud and semi-infinite cloud dose model assumptions. Table 4 illustrates the major parameters used. Included in appendix A is a coded input data form.

Certain table captions and footnotes require some explanation. The activity density on the ground is the activity density at the end of the release period or one year if the release period is not specified. For dry deposition, the total activity dispersed is the activity presented as input times the sum of the wind frequencies. For wet deposition, the total activity dispersed is the input activity times the sum of the wind frequencies, times the rainfall frequency. In the dose printout tables the DCF's are printed out even if the dose integrals are used. In these tables, the activities listed are input activities modified by in-plant decay or growth during holdup and in-plant filter decontamination factors. Recognition of these factors can be a debugging aid.

Table 3. Dose rate conversion factors for exposure while standing on contaminated ground (9) (mrem/h per pCi/m^3)

Nuclide	Skin	Total body	Nuclide	Skin	Total body
^{3}H	0	0			
^{14}C	0	0	^{103}Ru[a]	4.2 E-9	3.6 E-9
^{22}Na	1.8 E-8	1.6 E-8	^{106}Ru[a]	1.8 E-9	1.5 E-9
^{24}Na	2.9 E-8	2.5 E-8	^{132}Te	2.0 E-9	1.7 E-9
^{51}Cr	2.6 E-10	2.2 E-10	^{129}I	9.6 E-12	7.0 E-12
^{54}Mn	6.8 E-9	5.8 E-9	^{131}I[a]	3.4 E-9	2.8 E-9
^{55}Fe	0	0	^{132}I	2.0 E-8	1.7 E-8
^{59}Fe	9.4 E-9	8.0 E-9	^{133}I	4.5 E-9	3.7 E-9
^{58}Co	8.2 E-9	7.0 E-9	^{135}I	1.4 E-8	1.2 E-8
^{60}Co	2.0 E-8	1.7 E-8	^{138}Cs	2.4 E-8	2.1 E-8
^{63}Ni	0	0	^{134}Cs	1.4 E-8	1.2 E-8
^{64}Cu	1.7 E-9	1.5 E-9	^{137}Cs	4.9 E-9	4.1 E-9
^{65}Zn	4.6 E-9	4.0 E-9	^{140}Ba	2.4 E-9	2.1 E-9
^{88}Rb	4.0 E-9	3.5 E-9	^{140}La	1.7 E-8	1.5 E-8
^{89}Sr	6.5 E-13	5.6 E-13	^{141}Ce	6.2 E-10	5.5 E-10
^{90}Sr	0	0	^{144}Ce	1.4 E-10	1.2 E-10
^{95}Zr	6.2 E-9	5.9 E-9	(^{144}Pr)	(2.3 E-10)	(2.0 E-10)
^{95}Nb	6.8 E-9	5.8 E-9	(^{144}Ce + ^{144}Pr)[b]	(3.7 E-10)	(3.2 E-10)

[a]Includes daughter radiations.
[b]Use these factors for ^{144}Ce unless ^{144}Pr daughter concentration is given separately.

Table 4. Short sample problem description

Sector number	Sector	Stability class	$\bar{u}$ (m/s)
1	N	A	2
2	NNE	B	2
3	NE	C	2
4	ENE	D	2
5	E	E	2
6	ESE	F	2
7	SE	B	5
8	SSE	C	5
9	S	D	5
10	SSW	E	5
11	SW	F	5
12	WSW	B	10
13	W	C	10
14	WNW	D	10
15	NW	E	10
16	NNW	F	10

Notes:
1. Class A = 1, B = 2, etc. Class A is most highly diffused.
2. Sector is direction wind blows *to*.
3. All frequencies are 1 percent.
4. Deposition velocities = 0.5 and 2 (for comparative illustration).
5. Rainfall frequency = 5 percent; washout factor = 2×10^{-4}/s.

6.8 Accident Problems

AIREM can be used to study the approximate effects of an accidental release of radioactivity. Releases can be propagated down a single 22.5 degree sector, for example. Since AIREM always assumes a 360 degree problem, the number of sectors (L) must be 16 in such a case. Given a single release inventory, several sets of meteorological conditions and populations may be analyzed in different sectors in one run, making certain parametric studies rather simple to do. For a short term or puff release, calculated doses will be low relative to doses calculated using a single plume model that restricts the cross-wind horizontal spread of the cloud. This is because the diffusion equation in AIREM spreads the activity uniformly across a sector. However, if an accidental release occurs over a long time period (e.g., over several hours), AIREM calculations may be more realistic since the wind would probably meander during the release period. A single plume model would calculate doses that would be too high in this case. For the case of a strong wind shift during the release period, wind direction invarient codes (such as AIREM) are inapplicable.

Since the printout format was devised for routine releases, which are orders of magnitude less than for accident cases, the accident radionuclide inventories may cause overflows in the printout. Accident problems should be scaled down if AIREM is used for such analyses.

REFERENCES

(1) TURNER, D. BRUCE. Workbook of atmospheric dispersion estimates, Publication No. AP-26. U.S. Environmental Protection Agency, Office of Air Programs, Research Triangle Park, N.C. 27711 (July 1971).

(2) SLADE, D. H., Editor. Meteorology and atomic energy, 1968, TID-24190. National Technical Information Service, Springfield, Va. 22151 (July 1968).

(3) HOLZWORTH, G. C. Mixing heights, wind speeds and potential for urban air pollution throughout the contiguous United States, Publication No. AP-101. U.S. Environmental Protection Agency, Office of Air Programs, Research Triangle Park, N.C. 27711.

(4) U.S. ATOMIC ENERGY COMMISSION. Safety guide 3, Assumptions used for evaluating the potential radiological consequences of a loss of coolant accident for boiling water reactors, November 2, 1970. (Re-issued as Regulatory Guide 1.3, June 27, 1973.)

(5) INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION. Report of ICRP Committee II on permissible dose for internal radiation, ICRP Publication No. 2. Pergamon Press, New York, N.Y. (1959), (cf. Publication No. 6. also).

(6) BRIGGS, G. A. Plume rise, TID-25075. U.S. Atomic Energy Commission Critical Review Series. National Technical Information Service, Springfield, Va. 22151 (November 1969).

(7) BRIGGS, G. A. Some recent analyses of plume rise observations. NOAA Research Laboratories, Oak Ridge, Tenn. (December 1970).

(8) MARTIN, J. A. and C. B. NELSON. Calculations of doses and population dose in the general environment due to boiling water nuclear power reactor radionuclide emissions in the United States in 1971. To be published in Radiation Data and Reports.

(9) FLETCHER, J. F. and W. L. DOTSON. Hermes--a digital computer code for estimating regional radiological effects from the nuclear power industry, HEDL-TME-71-168, UC-80. Hanford Engineering Development Laboratory, Richland, Wash. (December 1971).

APPENDIX A

AIREM Glossary, Sample Problem, and Program Listing

GLOSSARY

Term	Definition
ABUN(LL,NL)	Absolute abundance of line NL for nuclide LL
AGAM(LL,NL)	Gamma energy in MeV of line NL for nuclide LL
AREA(MM)	Area of sector-segment MM in square meters
BONDOS(MM,II)[a]	Bone dose at radius MM, in sector II, summed over all contributing nuclides and stability classes
CHIOQ(MM,II,JJ,LL)	Ratio of concentration to release rate
CRTORG(LL)	Critical organ
DCF(LL)	Dose or dose commitment conversion factor
DECON(LL)	Inplant filter decontamination factor. If DECON = 0 it is set to unity (DECON >1.).
DI	Interpolated dose integral
DISUM	DI · ABUN(LL,NL)
DMIJL(MM,II,JJ,LL)	Dose at radius MM in sector II and stability class JJ, due to radionuclide LL
DMIL	DMIJL summed over stability classes
DOSEI	Dose integral (rad $m^2 \cdot Ci^{-1} \cdot s^{-1}$)
DPBON(MM,II)	Bone man-rem at radius MM, in sector II
DPBONM(MM)	Sum of bone man-rem within radius MM
DPL(LL)	Population dose due to radionuclide LL

---

[a] See footnote at end of Glossary.

Term	Description
DPSKN(MM,II)	Skin man-rem at radius MM in sector II
DPSKNM(MM)	Sum of skin man-rem within radius MM
DPTHY(MM,II)	Thyroid man-rem at radius MM in sector II
DPWB(MM,II)	Whole body man-rem at radius MM in sector II
DPWBM(MM)	Whole body man-rem within radius MM
ETHERM	Thermal energy generated
F(MM)	Fraction of curies deposited on the ground in a sector-segment within one stability class. (Only the last set calculated will be in storage at the end of the run.)
FACIL-FACIL5	Facility description (name, etc.)
FREQ(II,JJ)	Frequency that the wind blows in sector II in stability class JJ (*not* direction from)
GAMEN(NG)	Gamma energy in MeV corresponding to DOSEI(NG, NS)
H	Height of release in meters
HDEPV(II,JJ)	"Halogen" deposition velocity in m/s
HOLDUP	Holdup time in days
HV(JJ,KOF)	Halogen deposition velocity expansion coefficient
I	Indicator of number of wind sectors
II	Sector index (1 = N, 2 = NNE, etc.)
ISO(LL)	Isotope symbol
J	Indicator of number of stability classes used (must be 6)
JJ	Index for stability class (1 = A, 2 = B, etc.)

See footnote at end of Glossary.

Term	Description
KKOF	Number of terms (=4) in the polynomial expansion of deposition velocities as a function of windspeed and stability class
KOF	Index for KKOF
L	Indicator of number of radionuclides considered (20 max.)
LATWT(LL)	Atomic weight
LL	Index used for radionuclide
M	Indicator of radial distances considered (12 max.)
MM	Index for M
MONTHS	Number of months of operation
MONTH1	Beginning month of operation
MONTH2	Ending month of operation
NBON	Number of cards in the isotope card queue for which doses will be summed for bone
NDEP(LL)	Deposition code for gases, particulates and halogens (0, 1, 2, respectively)
NDTR(LL)	Equals 0 if nuclide is a parent and equals 1 if nuclide is a daughter of the preceding nuclide
NG	Index for GAMEN
NGAM	Maximum value of NG
NGAMMA(LL)	Number of gamma lines considered for each nuclide in a finite cloud gamma dose calculation. If NGAMMA = 0 the DCF will be used (NGAMMA <10.).
PDEPV(II,JJ)	"Particulate" deposition velocity in m/s

See footnote at end of Glossary.

Term	Description
POP(MM,II)	Population in a given wind sector and distance
PV(JJ,KOF)	Particulate deposition velocity expansion coefficient
QG(MM,JJ)	Curies deposited on the ground in a sector-segment for a given stability class
QGAIML(II,MM,LL)	Picocuries per square meter of nuclide LL deposited on the ground at radius MM
QL(LL)	Curies of radionuclide LL in inventory before HOLDUP and DECON(LL) are applied
SIGMAX	Maximum value of SIGMZ for χ/Q' calculation
SIGMZ(JJ,MM)	Vertical dispersion parameters (meters)
SIGZ	FUNCTION subprogram that calculates the SIGMZ (JJ,MM)'s
SKNDOS(MM,II)[a]	Skin doses summed at radius MM in sector II
THYDOS(MM,II)[a]	Thyroid dose at radius MM in sector II summed over all contributing nuclides and stability classes
TOTFREQ	Total of wind frequencies
TOTPOP	Total population
TQG	Total curies on the ground within upper radius
TQM(MM)	Total curies per square meter deposited on the ground within XUP(MM)
UBAR(II,JJ)	Average wind speed in sector II for stability class JJ (m/s)
WBDOS(MM,II)[a]	Whole body dose at radius MM in sector II, summed over all contributing nuclides and stability classes
X(MM)	Radial distance from the release point to the midpoint of an annulus (meters)

See footnote at end of Glossary.

Term	Description
XLMDA(LL)	Decay constant for parent and daughters in s^{-1}. XLMDA for parent and daughter must not be equal.
XLOW(MM)	Lower limit to radial bin MM
XUP(MM)	Upper limit to radial bin MM

---

[a]The prefixes BON, SKN, THY, and WB are cryptic only; they may represent *any* four critical organs, all alike if desired.

FORTRAN Coding Form

GX28-7327-6 U/M 050**
Printed in U.S.A.

TABLE
SAMPLE PROBLEM INPUT DATA

PUNCHING INSTRUCTIONS	GRAPHIC / PUNCH	PAGE 1 OF 7
		CARD ELECTRO NUMBER*

DATE

FORTRAN STATEMENT

```
   SAMPLE PROBLEM         12  JAN 1971  DEC 1971    [illegible]
   16    6  .12   24      100.      1000.     [illegible]   .5E-01   2.E-04
        1.
                  1.
                            1.
                                      1.
                                                1.
                                                          1.
                  1.
                            1.
                                      1.
                                                1.
                                                          1.
                  1.
                            1.
                                      1.
                                                1.
                                                          1.
        2.
                  2.
                            2.
                                      2.
                                                2.
                                                          2.
```

*A standard card form, IBM electro 888157, is available for punching statements from this form

**Number of forms per pad may vary slightly

FORTRAN Coding Form

GX28-7327-6 U/M 050**
Printed in U.S.A.

PUNCHING INSTRUCTIONS	GRAPHIC		PAGE 2 OF 7
	PUNCH		CARD ELECTRO NUMBER*

DATE

COMM.	STATEMENT NUMBER	CONT.	FORTRAN STATEMENT	IDENTIFICATION SEQUENCE

```
                  5.
                            5.
                                      5.
                                                5.
                                                          5.
                 10.
                           10.
                                     10.
                                               10.
                                                         10.
        0.
        0.
       10.       10.       10.       10.       10.       10        10.       10.
       10.       10.       10.       10-       10        10        10.       10
       30.       30.       30.       30.       30        30        30.       30
       30.       30.       30.       30.       30        30        30.       30
      120.      120.      120.      120.      120       120       120.      120
      120.      120.      120.      120.      120       120       120.      120
      200.      200.      200.      200.      200       200       200.      200
      200.      200.      200.      200.      200       200       200.      200
      280.      280.      280.      280.      280       280       280.      280
      280.      280.      280.      280.      280       280       280.      280
      360.      360.      360.      360.      360       360       360.      360
      360.      360.      360.      360.      360       360       360.      360
```

*A standard card form, IBM electro 888157, is available for punching statements from this form

**Number of forms per pad may vary slightly

FORTRAN Coding Form

GX28-7327-6 U/M 050**
Printed in U.S.A.

	DATE	PUNCHING INSTRUCTIONS	GRAPHIC	PAGE 3 OF 7
			PUNCH	CARD ELECTRO NUMBER*

STATEMENT NUMBER	FORTRAN STATEMENT (7–15)	(16–25)	(26–35)	(36–45)	(46–55)	(56–65)	(66–72)	IDENTIFICATION SEQUENCE (73–80)
	360.	360.	[illegible]	[illegible]	360.	360.	360.	360.
	360.	360.	[illegible]	[illegible]	360.	360.	360.	360.
	3000.	[illegible]	[illegible]	[illegible]	[illegible]	3000.	3000.	3000.
	3000.	3000.	3000.	3000.	3000.	3000.	3000.	3000.
	12000.	12000.	12000.	12000.	12000.	12000.	12000.	12000.
	12000.	12000.	12000.	12000.	12000.	12000.	12000.	12000.
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20000.	20000.
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20000.	20000.
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25000.	25000.
	25000.	25000.	25000.	25000.	25000.	25000.	25000.	25000.
	36000.	36000.	36000.	36000.	36000.	36000.	36000.	36000.
	36000.	36000.	36000.	36000.	36000.	36000.	36000.	36000.
	850.	[illegible]	800.					
	600.	[illegible]	1165.					
	1265.	[illegible]	1610.					
	2410.	1610.	3220.					
	4020.	3220.	4830.					
	5630.	4830.	6440.					
	7250.	6400.	8050.					
	12000.	8050.	16100.					
	24000.	16100.	32200.					
	40000.	32200.	48300.					
	56000.	48300.	64400.					
	72400.	64400.	80500.					

*A standard card form, IBM electro 888157, is available for punching statements from this form

**Number of forms per pad may vary slightly

FORTRAN Coding Form

GX28-7327-6 U/M 050**
Printed in U.S.A.

PUNCHING INSTRUCTIONS	GRAPHIC		PAGE 4 OF 7
DATE	PUNCH		CARD ELECTRO NUMBER*

```
      .5E-02   .[illegible]E-02 [illegible] [illegible] [illegible] [illegible]


      .2E-01    .2E-01    .2E-01    .2E-01    .2E-01    .2E-01



    9    9    1    1
   KR   85M   WB      46.   .45E-04   0   2   0
 .151   .796   .305   .204
  100000.    .0E-00
   KR   85   WB   [illegible]
 .514   .044
  100000.    .0E-00
   KR   87   WB      370.   .15E-03   0   7   0
 .403   .048   .674   .016   .845   .073  1.263   .021  1.741   .016  2.471   .144  3.31
 .005
  100000.    .0E-00
   KR   88   WB   [illegible]   .[illegible]E-[illegible]   0   16   0
 .[illegible]   .[illegible]   .[illegible]   [illegible]   .367   .47[illegible]   [illegible]   .787   .004
 .856   .155  1.185   .051  1.533   .131
  100000.    .0E-00
   RB   88   WB     166.   .65E-03   1   4   1
```

*A standard card form, IBM electro 888157, is available for punching statements from this form

**Number of forms per pad may vary slightly

FORTRAN Coding Form

GX28-7327-6 U/M 050**
Printed in U.S.A.

PUNCHING INSTRUCTIONS	GRAPHIC		PAGE 5 OF 7
	PUNCH		CARD ELECTRO NUMBER*

DATE

STATEMENT NUMBER	CONT.	FORTRAN STATEMENT	IDENTIFICATION SEQUENCE

```
  .997 [illegible]
  [illegible]
   XE  .159 [illegible]
  .Ø81 1.Ø1Ø    .16Ø   .ØØ1   .328   .ØØ2
   1ØØØØØ.      .ØE-ØØ
   XE  .135  WB        65.    .21E-Ø4   Ø  3  Ø
  .25Ø  .97Ø [illegible]
   1ØØØØØ.     [illegible]
   XE  .177  WB [illegible]
 ..358 1.ØØØ    .434   .48Ø 1.769    .39Ø
   1ØØØØØ.      .ØE-ØØ
   CS  .138  WB       535.    .36E-Ø3   1  1Ø  1
  .139 [illegible]
  .37? 1.153 [illegible]
   [illegible]
   KR  TSM  SKN        55.    .45E-Ø4   Ø  Ø  Ø
   1ØØØØØ.      .ØE-ØØ
   KR   85  SKN        67.    .2ØE-Ø6   Ø  Ø  1
   1ØØØØØ.      .ØE-ØØ
   KR   87  SKN       33Ø.    .15E-Ø3   Ø  Ø  Ø
   1ØØØØØ.      .ØE-ØØ
   KR   88  SKN        92.    .69E-Ø4   Ø  Ø  Ø
   1ØØØØØ.      .ØE-ØØ
   RB   88  SKN        77.    .65E-Ø3   1  Ø  1
```

*A standard card form, IBM electro 888157, is available for punching statements from this form

**Number of forms per pad may vary slightly

FORTRAN Coding Form

GX28-7327-6 U/M 050**
Printed in U.S.A.

DATE	PUNCHING INSTRUCTIONS	GRAPHIC / PUNCH	PAGE 6 OF 7 / CARD ELECTRO NUMBER*

FORTRAN STATEMENT

```
        0.0     .0E-00
  XE  135.  SKN          31.5     .15E-05    0    0    0
  1000000.      .0E-00
  XE  135   SKN          76.6     .21E-04    0    0    0
  1000000.      .0E-00
  XE  138   SKN          240.     .68E-03    0    0    0
  1000000.      .0E-00
  CS  137   SKN          22.5     .36E-03    1    0    1
        0.      .0E-00
   I  131   IIAT    105000.       .10E-05    1    0    0
     100.       .0E-00
   I  131   IIAT    105000.       .10E-05    2    0    0
     100.       .0E-00
EGAD FOR: WS= 100.M  AL= 1000.M  SGMX= 3000.M  RHO=1293.GM/M**3  NG=22  WS=28
  22  28
0.1000E-010.1500E-010.2000E-010.3000E-010.4000E-010.5000E-010.6000E-010.8000E-01
0.1000E+000.1500E+000.2000E+000.3000E+000.4000E+000.5000E+000.6000E+000.8000E+00
0.1000E+010.1500E+010.2000E+010.3000E+010.4000E+010.5000E+01
0.1000E+010.1500E+010.2000E+010.3000E+010.4000E+010.5000E+010.6000E+010.8000E+01
0.1000E+020.1500E+020.2000E+020.3000E+020.4000E+020.5000E+020.6000E+020.8000E+02
0.1000E+030.1500E+030.2000E+030.3000E+030.4000E+030.5000E+030.6000E+030.8000E+03
0.1000E+040.1500E+040.2000E+040.3000E+04
0.0       0.0       0.0       0.0       0.0       0.0       0.0       0.0
0.0       0.0       0.4775E-130.1658E-060.1275E-050.2859E-050.4416E-050.4417E-05
```

*A standard card form, IBM electro 888157, is available for punching statements from this form

**Number of forms per pad may vary slightly

IBM System/360 Assembler Coding Form

GX28-6509-6 U/M 050*
Printed in U.S.A.

PUNCHING INSTRUCTIONS	GRAPHIC		PAGE 7 OF 7
DATE	PUNCH		CARD ELECTRO NUMBER

STATEMENT — Name (1–8), Operation (10–14), Operand (16–), Comments (–71); Identification-Sequence (73–80)

```
ϕ.372ϕE-ϕ5ϕ.L[illegible]E-ϕ5ϕ.[illegible]
ϕ.1776E-ϕ6ϕ.L753E-ϕ6ϕ.1753E-ϕ6ϕ.L753E-ϕ6
ϕ.24L9E-L2ϕ.33[illegible]
ϕ.75L3E-LLϕ.93ϕ2E-Lϕϕ.L7L9E-ϕ5ϕ.38ϕ9E-ϕ6ϕ.287CE-ϕ5ϕ.C729E-ϕ5ϕ.LϕϕLE-ϕ4ϕ.L3L5E-ϕ4
ϕ.L337E-ϕ4ϕ.1ϕ43E-ϕ4ϕ.76L1E-ϕ5ϕ.5Lϕ6E-ϕ5ϕ.3924E-ϕ5ϕ.3178E-ϕ5ϕ.2686E-ϕ5ϕ.2194E-ϕ5

                                etc. [illegible]

/*
```

* A standard card form, IBM electro 6509, is available for punching source statements from this form. Instructions for using this form are in any IBM System/360 assembler language reference manual. Address comments concerning this form to IBM Nordic Laboratory, Publications Development, Box 962, S-181 09 Lidingö 9, Sweden.

* No of forms per pad may vary slightly.

```
C                             PROGRAM AIREM04
C                              JANUARY 1974
C
C                               ABSTRACT
C
C       A PROGRAM TO CALCULATE AIRBORNE PATHWAY RADIATION DOSES
C
C           A SECTOR AVERAGED GAUSSIAN DIFFUSION MODEL IS USED.  A
C     SINGLE DIFFUSION EQUATION IS EVALUATED REPEATEDLY FOR EACH
C     SECTOR(16), RADIUS(12), STABILITY CLASS(6), AND RADIONUCLIDE(20)
C     (NUMBERS IN PARENTHESES ARE MAXIMUM NUMBERS).  RADIONUCLIDE
C     DECAY DURING TIME OF FLIGHT,FIRST DAUGHTER PRODUCT INGROWTH,
C     WET AND DRY DEPOSITION AND DEPLETION ARE CALCULATED.DOSES WHICH
C     ARE PROPORTIONAL TO GROUND LEVEL CONCENTRATION ARE CALCULATED
C     AS THE PRODUCT OF THE GROUND LEVEL CONCENTRATION AND A DOSE
C     CONVERSION FACTOR. THESE INCLUDE INHALATION AND SKIN EXTERNAL
C     BETA DOSES. EXTERNAL GAMMA WHOLE BODY DOSES ARE CALCULATED USING
C     DOSE INTEGRALS CALCULATED WITH A CORRECTED AND SLIGHTLY MODIFIED
C     VERSION OF R.E.COOPER'S EGAD CODE (R.E.COOPER, 'EGAD - A COMPUTER
C     PROGRAM TO COMPUTE DOSE INTEGRALS FROM EXTERNAL GAMMA EMITTERS',
C     TID-4500 UC-32,SAVANNAH RIVER LABORATORY, AIKEN, SOUTH CAROLINA,
C     SEPT 1972). A TABLE OF DOSE INTEGRALS GENERATED FOR EACH FACILITY
C     ACCORDING TO THE EFFECTIVE RELEASE HEIGHT, LID HEIGHT, GAMMA
C     ENERGY, AND SIGMA Z (THE VERTICAL DISPERSION PARAMETER) IS USED.
C     THIS TABLE IS INTERPOLATED ACCORDING TO ENERGY AND SIGMA Z.
C
C
C     TYPICAL CPU TIMES ARE 15 SEC. COMPILATION AND 20 SEC. EXECUTION
C     ON AN IBM 370/155.
C     CORE REQUIREMENT IS 190K.
C
C                ENVIRONMENTAL PROTECTION AGENCY
C                OFFICE OF RADIATION PROGRAMS
C                FIELD OPERATIONS DIVISION (HM-561)
C                WATERSIDE MALL
C                401 M ST.,S.W.
C                WASHINGTON, D.C.,20460
C                          J.A. MARTIN, JR.          1/73
C                          C.B. NELSON               3/73
C                          P.A. CUNY
C
C
C                       GLOSSARY OF TERMS
C
C
C
C     FACIL                   NAME OF FACILITY (TWENTY SPACES).
C     PERIOD                  MONTHS OF RELEASES
C     MONTH1,NYR1             BEGINNING OF RELEASE PERIOD
C     MONTH2,NYR2             END OF RELEASE PERIOD
C     ETHERM                  THERMAL ENERGY GENERATED DURING PERIOD
C     DECON(LL)       PLANT DECONTAMINATION FACTOR BY NUCLIDE
C        IF DECON EQUALS ZERO, IT IS SET TO ONE.
C     HOLDUP     HOLDUP TIME IN DAYS.
C
C     NS,NG       INDICES FOR SIGZM AND GAMEN, RESPECTIVELY.
C     GAMEN(NG)      GAMMA ENERGY IN MEV CORRESPONDING TO DOSEI(NG,NS)
C     SIGZM(NS)      SIGMA Z IN METERS CORRESPONDING TO DOSEI(NG,NS)
```

```
C     DOSEI(NG,NS)  DOSE INTEGRAL CALCULATED BY EGAD
C        DOSE(NG,NS)      DOSE INTEGRAL CALCULATED BY EGAD, OR OTHER,
C                          FINITE CLOUD DOSE MODEL.
C     NGAM           MAXIMUM VALUE OF NG
C     NSIG           MAXIMUM VALUE OF NS
C     AGAM(LL,NL)    GAMMA ENERGY IN MEV OF LINE NL FOR NUCLIDE LL
C     ABUN(LL,NL)    ABSOLUTE ABUNDANCE OF LINE NL FOR NUCLIDE LL.
C        UP TO TEN AGAM, ABUN PAIRS ARE ALLOWED.
C     NGAMMA(LL)     NUMBER OF GAMMA LINES ASSOCIATED WITH ISOTOPE.
C        IF NGAM(LL) EQ.0 THE SEMI-INFINITE CLOUD APPROXIMATION
C        IS USED TO CALCULATE THE CLOUD GAMMA DOSE.
C     NDTR(LL)       EQ 0    IF ISOTOPE IS A PARENT.
C                    EQ 1    IF THE ISOTOPE IS THE DAUGHTER OF THE
C                            PRECEEDING ISOTOPE.
C      FIRST DAUGHTER PRODUCTS ARE INCLUDED IN WHICH CASE
C     NDTR(LL).EQ.1. THE INGROWTH FROM THE PARENT NUCLIDE IS ADDED
C     TO THE RELEASED AMOUNT OF THE DAUGHTER. THE DAUGHTER
C     NUCLIDE MUST IMMEDIATELY FOLLOW ITS PARENT
C     NDEP(LL)      DEPOSITION CALL CODE: 0,1,2 FOR GASES,
C                   PARTICULATES AND HALOGENS, RESPECTIVELY.
C
C
C     SIGMZ    VERTICAL DISPERSION PARAMETER (METERS)
C     Y        DISTANCE (KILOMETERS)
C     SIGZ     FUNCTION WHICH COMPUTES VALUE OF SIGMZ
C     I        INDICATOR OF NUMBER OF WIND SECTORS USED (USUALLY 16)
C     II       INDEX USED FOR WIND SECTORS
C     J        INDICATOR OF NUMBER OF STABILITY CLASSES USED (6 OR LESS)
C     JJ       INDEX USED FOR STABILITY CLASSES
C     M        INDICATOR OF RADIAL DISTANCES CONSIDERED
C     MM       INDEX USED FOR RADIAL DISTANCES
C     DPWBM          SUM OF WHOLE BODY MAN-REM WITHIN OUTER RADIUS M.
C     DPTHYM         DITTO FOR THYROID
C     DPBONM         DITTO FOR BONE
C     DPSKNM         DITTO FOR SKIN
C     TDPWB          TOTAL WHOLE BODY MAN-REM.
C     TDPTHY         DITTO FOR THYROID.
C     TDPBON         DITTO FOR BONE.
C     TDPSKN         DITTO FOR SKIN.
C     TOTPOP         TOTAL POPULATION.
C     TOTFRQ         TOTAL OF WIND FREQUENCIES.
C
C     NWB     NUMBER OF WHOLE BODY ORGAN CARDS (READ FIRST BELOW).
C     NTHY    NUMBER OF THYROID ORGAN CARDS
C     NBON    NUMBER OF BONE ORGAN CARDS
C     NSKN    NUMBER OF SKIN ORGAN CARDS (READ LAST BELOW).
C
C
C      ***********************************************************
C                    NWB + NTHY + NBON + NSKN MUST EQUAL L.
C     THE NUMBERS NWB, NTHY, NBON, NSKN ARE  USED FOR  COUNTING PURPOSES
C     THE NAMES WHOLE BODY, BONE, ETC. ARE ALSO ONLY CRYPTIC.
C    THEY CAN REPRESENT ANY FOUR CRITICAL ORGANS, ALL IDENTICAL IF DESIRED
C      ***********************************************************
C
C
C     ISO            ISOTOPE.
C     LATWT          ATOMIC WEIGHT.
```

```
C      CRTORG        CRITICAL ORGAN.
C      DCF           DOSE COMMITTMENT CONVERSION FACTOR
C                    IN MILLIREM PER CURIE-SEC/M**3.
C      XLMDA         DECAY CONSTANT IN INVERSE SECONDS
C         IF DECAY CONSTANTS FOR PARENT AND DAUGHTER ARE EQUAL,
C         THE SOLUTION BLOWS UP.
C      DEPV          DEPOSITION VELOCITY FOR AIRBORNE
C                    PARTICULATES IN CM/SEC.
C      QL            QUANTITY OF RADIONUCLIDE RELEASED IN CUPIES
C         IN THE PRINTOUT, THE INPUT CURIES DATA WILL BE THE INITIAL INVENTORY
C         THE OUTPUT DATA WILL BE THE THE DECAYED (BY HOLDUP) AND
C         FILTERED STACK RELEASE.
C      DMIJL         DOSE AT RADIUS M, IN SECTOR I, FOR STABILITY
C                    CLASS J AND ISOTOPE L; QL BEING DECAYED IN TRANSIT.
C      DMIL          DMIJL SUMMED OVER STABILITY CLASSES.
C      WBDOS(MM,II)  WHOLE BODY DMIL'S SUMMED AT RADIUS M IN SECTOR I.
C      THYDOS(MM,II)    THYROID          DITTO
C      BONDOS(MM,II)       BONE          DITTO
C      SKNDOS(MM,II)       SKIN          DITTO
C      DPWB(MM,II)   WHOLE BODY MAN-REM AT RADIUS M IN SECTOR I.
C      DPTHY(MM,II)     THYROID          DITTO
C      DPBON(MM,II)        BONE          DITTO
C      DPSKN(MM,II)        SKIN          DITTO
C      L         INDICATOR OF NUMBER OF RADIONUCLIDES(20 OR LESS);
C      LL        INDEX USED FOR RADIONUCLIDES
C      H         HEIGHT OF RELEASE (METERS)
C      FREQ      FREQUENCY THAT THE WIND BLOWS TOWARD A DIRECTION AND IS
C                OF A GIVEN STABILITY CLASS (%)
C      UBAR      AVERAGE WIND SPEED FOR A STABILITY CLASS (METERS/SECOND)
C      POP       POPULATION IN THE WIND SECTOR DIRECTION AND AT THE RADIAL
C                DISTANCE (PEOPLE)
C      X         RADIAL DISTANCE FROM THE RELEASE POINT TO THE MIDPOINT OF
C                AN ANNULUS (METERS)
C      XLOW      LOWER LIMIT OF RADIAL BIN IN METERS.
C      XUP       UPPER LIMIT OF RADIAL BIN IN METERS.
C
C
C      PV     PARTICULATE DEPOSITION VELOCITY EXPANSION COEFFICIENT.
C      HV     HALOGEN          DITTO
C      KKCOF               NUMBER OF TERMS IN THE POLYNOMIAL EXPANSION OF
C                          TION VELOCITIES AS A FUNCTION OF WIND SPEED AND
C                          ITY CLASS.
C                          KKCOF MUST BE 4 IN THIS PROGRAM
C      HDEPV(II,JJ)        HALOGEN DEPOSITION VELOCITY, IN  M/SEC.
C      PDEPV(II,JJ)        PARTICULATE DEPOSITION VELOCITY, IN  M/SEC.
C      NDEP(LL)            CALL CODE FOR DEPOSITION AND CLOUD DEPLETION
C                          CALCULATION. USE 0, 1, OR 2 TO DENOTE A GAS, A
C                          PARTICULATE, OR A HALOGEN RESPECTIVELY. FOR THE
C                          LATTER TWO, DEPOSITION AND CLOUD DEPLETION WILL
C                          BE CALCULATED AND PRINTED.
C      AREA(MM)            AREA OF A SECTOR SEGMENT IN SQ. METERS.
C      DCHIOQ              DEPLETED CHI OVER Q
C      QG(II,JJ,MM,LL)     CURIES DEPOSITED ON THE GROUND IN A SECTOR-
C                          SEGMENT (FOUR DIMENSIONAL)
C      F(MM)               1.0 - FRACTION OF CURIES DEPOSITED ON THE
C                          GROUND IN A SECTOR SEGMENT, WITHIN ONE STABIL-
C                          ITY CLASS.
C      QGAIML(II,MM,LL)     PICOCURIES PER SQ. METER DEPOSITED ON
```

```
              C                    THE GROUND.
              C      TQG           TOTAL CURIES ON THE GROUND WITHIN UPPER RADIUS.
              C
              C      W---(--,....)     * PRECEEDING Q IN DEPOSITION ROUTINES REFERS TO
              C                    WASHOUT (WET DEPOSITION).
              C      RAINF         RAINFALL FREQUENCY.
              C      WASHCO        WASHOUT COEFFICIENT IN INVERSE SECONDS.
              C
              C
              C
 0001                DIMENSION FREQ(16,6),UBAR(16,6),SIGMZ(6,12),X(12),FACIL(5),
                    1          QL(20),ISO(20),DCF(20),XLMDA(20),DMIL(12,16,20),
                    2          THYDOS(12,16),BONDOS(12,16),SKNDOS(12,16),DPWB(12,16),
                    3          DPTHY(12,16),DPBON(12,16),DPSKN(12,16),DPWBM(12),
                    4          DPSKNM(12),WBDOS(12,16),DECON(20),
                    5          DPTHYM(12),XLOW(12),XUP(12),Y(13),POP(12,16),
                    6          DMIJL(12,16,6,20),CHIOQ(12,16,6,20),DPBONM(12),PV(6,4),
                    7          TQM(13),AREA(12),QGMI(12,16),QGAMI(12,16),HV(6,4),
                    8          QG(12,6),PDEPV(16,6),HDEPV(16,6),F(13),
                    9          LATWT(20),CRTORG(20),NDEP(20)
 0002                DIMENSION NGAMMA(20),NDTR(20),AGAM(20,10),ABUN(20,10)
 0003                DIMENSION GAMEN(32),SIGZM(32),DOSEI(32,32),ETITLE(20)
 0004                DIMENSION DIR(16),CHIOQS(12)
 0005                DIMENSION WTQGM(13),WQG(12,6),WQGAMI(12,16),WQGMI(12,16)
              C
 0006                REAL MONTHS
              C
 0007                DATA DIR/'N   ','NNE ','NE  ','ENE ','E   ','ESE ','SE  ','SSE ',
                    *         'S   ','SSW ','SW  ','WSW ','W   ','WNW ','NW  ','NNW '/
              C
 0008                EQUIVALENCE(CHIOQ(1,1,1,1),DMIJL(1,1,1,1))
              C      EQUIVALENCE(WBDOS(1,1),THYDOS(1,1),SKNDOS(1,1),BONDOS(1,1),
              C     1QGMI(1,1))
              C      EQUIVALENCE(DPWB(1,1),DPTHY(1,1),DPBON(1,1),DPSKN(1,1),QGAMI(1,1))
              C      EQUIVALENCE(DPWBM(1),DPTHYM(1),DPBONM(1),DPSKNM(1))
 0009                EQUIVALENCE(Y(1),F(1),TQM(1))
              C
 0010                PI=3.141593
              C
              C      READ VARIABLE INPUT DATA
              C
              C
 0011                WRITE(3,100)
 0012            100 FORMAT(1H1,T32,'PROGRAM AIREM04'//
                    *        1X,T12,'FOR INFORMATION REGARDING THIS PROGRAM,',
                    *                ' CONTACT:'//
                    *        1X,T20,'ENVIRONMENTAL PROTECTION AGENCY'/
                    *        1X,T20,'OFFICE OF RADIATION PROGRAMS'/
                    *        1X,T20,'FIELD OPERATIONS DIVISION'/
                    *        1X,T20,'401 M ST SW'/
                    *        1X,T20,'WASHINGTON, DC'/
                    *        1X,T20,'20460')
 0013                WRITE(3,380)
 0014                READ(1,110)(FACIL,MONTHS,MONTH1,NYR1,MONTH2,NYR2,ETHERM)
 0015                WRITE(3,390)
 0016                WRITE(3,112)(FACIL,MONTHS,MONTH1,NYR1,MONTH2,NYR2,ETHERM)
 0017            110 FORMAT(5A4,F5.0,1X,A4,I5,1X,A4,I5,F10.0)
 0018            112 FORMAT(1X,5A4,F5.2,1X,A4,I5,1X,A4,I5,F10.0)
```

```
  120 READ(1,300) I,J,M,L,H,SIGMAX,HOLDUP,RAINF,WASHCO
      WRITE(3,400)
      WRITE(3,300) I,J,M,L,H,SIGMAX,HOLDUP,RAINF,WASHCO
C
C     READ/WRITE WIND FREQUENCY (%) BY STABILITY CLASS. FIRST LINE
C     IS NORTH, SECOND IS NNF, ETC.
C
      READ(1,310)((FREQ(II,JJ),JJ=1,J),II=1,I)
      WRITE(3,410)
      TOTFRQ=0.
      DO 122 II=1,I
      C1=0.
      DO 121 JJ=1,J
  121 C1=C1+FREQ(II,JJ)
      TOTFRQ=TOTFRQ+C1
  122 WRITE(3,124) (DIR(II),(FREQ(II,JJ),JJ=1,J),C1)
  124 FORMAT(1X,A4,7F10.2)
C
C     READ/WRITE WIND SPEEDS BY STABILITY CLASS. FIRST LINE IS N,
C     SECOND IS NNE, ETC.
C
      READ(1,310)((UBAR(II,JJ),JJ=1,J),II=1,I)
      WRITE(3,420)
      WRITE(3,126)(DIR(II),(UBAR(II,JJ),JJ=1,J),II=1,I)
  126 FORMAT(1X,A4,6F10.2)
C
C     READ/WRITE POPULATIONS CLOCKWISE BY SECTOR
C     FIRST LINE IS POPULATION IN FIRST 8 SECTORS IN
C     INNER ANNULUS.
C
      DO 130 MM=1,M
  130 READ(1,320) (POP(MM,II),II=1,I)
      WRITE(3,430)
      DO 140 MM=1,M
      WRITE(3,132) MM,(POP(MM,II),II=1,I)
  132 FORMAT(1X,I2,(T5,8F10.0))
      C1=0.
      DO 139 II=1,I
  139 C1=C1+POP(MM,II)
  140 WRITE(3,141) C1
  141 FORMAT(1X,T5,F10.0)
      READ(1,330)((X(MM),XLOW(MM),XUP(MM)),MM=1,M)
      WRITE(3,440)
      WRITE(3,142)(MM,(X(MM),XLOW(MM),XUP(MM)),MM=1,M)
  142 FORMAT(1X,I2,1X,3F10.0)
C
C     READ EXPANSION COEFFICIENTS FOR PARTICULATES (P) AND HALOGENS (H).
C
C    THE INPUT DATA FORMAT CAN BE USED FOR A DATA FIT UP TO FOUR TERMS.
C     MANY FSAR"S ASSUME THAT PARTICULATE AND HALOGEN DEPOSITIONS ARE
C     DIFFERENT. DATA IN MET. AND AT. ENERGY SHOW A COMPLETE OVERLAP,
C    WITH A LARGE SPREAD IN BOTH SETS OF DATA.
C    MANY FSAR"S ASSUME DEPOSITION VELOCIYY IS PROPORTIONAL TO WIND
C     SPEED. DATA IN MET. AND AT. ENERGY INDICATES THE OPPOSITE TREND.
C     IN THIS LIGHT AND WHEN ACTUAL DATA IS LACKING, A SUGGESTION IS
C     TO USE A CONSTANT 0.01 METER/SEC FOR BOTH HALOGEN AND PARTICU-
C    LATES. (FOLLOWED BY THREE BLANK INPUT CARDS IN EACH CASE).
C
```

```
      C     FORMAT IS AS FOLLOWS
      C
      C         CLASS/ A    B    C    D    E    F
      C      TERM                                              INDICES
      C    CONSTANT     H11  H21  H31  H41  H51  H61          (CLASS,KOF)=(JJ,K
      C    LINEAR       H12  H22  H32  H42   .    .
      C    QUADRATIC    H13  H23  H33   .    .    .
      C    CUBIC        H14  H24   .    .    .   H64
      C                                          H6,KKOF
      C
      C     DEPOSITION VELOCITY IN SECTOR 1 FOR STABILITY CLASS A  IS
      C     DEPV(1,1) = H11 + H12 *UBAR(1,1) + H13 * UBAR(1,1)**2
      C                              + H14 * UBAR(1,1)** 3      (M/SEC)
      C
0051        KKOF = 4
0052        READ(1,370)((PV(JJ,KOF),JJ=1,J),KOF=1,KKOF)
0053        READ(1,370)((HV(JJ,KOF),JJ=1,J),KOF=1,KKOF)
0054        WRITE(3,150)
0055    150 FORMAT(68H0PARTICULATE AND HALOGEN DEPOSITION VELOCITY EXPANSION C
           1OEFFICIENTS.)
0056        WRITE(3,370)((PV(JJ,KOF),JJ=1,J),KOF=1,KKOF)
0057        WRITE(3,370)((HV(JJ,KOF),JJ=1,J),KOF=1,KKOF)
      C
      C     READ NUMBERS OF SETS OF ORGANS.
      C
0058        READ(1,340)NWB,NTHY,NBON,NSKN
0059        WRITE(3,450)
0060        WRITE(3,340)NWB,NTHY,NBON,NSKN
      C
      C
      C     READ AND WRITE ISOTOPE DATA
      C     READ AND WRITE QL'S
      C     THE ISOTOPE CARDS ARE FORMATTED TO CONTAIN DATA TO BE
      C     REQUIRED FOR LATER VERSIONS OF THIS PROGRAM. SUCH ISOTOPE CARDS
      C     NEED BE PUNCHED ONLY ONCE TO COMPILE A LIBRARY OF SAME.
      C     THEREAFTER, ONLY THE QL'S NEED BE PUNCHED FOR EACH PROBLEM.
      C
      C     WHEN USING THE SEMI-INFINITE CLOUD APPXOXIMATION,
      C     THE DCF IS :( THE DOSE COMMITTMENT FACTOR IN MILLIREM/YR)
      C     DIVIDED BY (THE ICRP 2 MPCA TIMES 3.157 E+07 SEC/YR).
      C         FOR EXTERNAL GAMMA WHOLE BODY AND EXTERNAL BETA SKIN
      C     DOSE  DCF = 250 EBAR, WHERE EBAR IS THE AVERAGE GAMMA
      C     OR BETA ENERGY (MEV) PER DISINTEGRATION, RESPECTIVELY. SEE AEC
      C     SAFETY GUIDES 3 AND 4.
      C
      C     GAMMA ENERGIES AND ABUNDANCES ARE READ AND THE FINITE CLOUD
      C      CALCULATION IS PERFORMED IF NGAMMA IS NOT ZERO.
      C      REF. M.E. MEEK AND R.S. GILBERT  SUMMARY OF BETA AND
      C      GAMMA ENERGY AND INTENSITY DATA.  NEDO-12037, JAN 1970.
      C      G.E. VALLECITOS NUCLEAR CENTER, PLEASANTON, CALIF.
      C
0061        WRITE(3,460)
0062        DO 200 LL=1,L
0063        READ(1,160) ISO(LL),LATWT(LL),CRTORG(LL),DCF(LL),XLMDA(LL),
           1            NDEP(LL),NGAMMA(LL),NDTR(LL)
0064        WRITE(3,162) LL,ISO(LL),LATWT(LL),CRTORG(LL),DCF(LL),XLMDA(LL),
           1             NDEP(LL),NGAMMA(LL),NDTR(LL)
0065    160 FORMAT(3(1X,A4),F10.1,F10.2,3I5)
```

```
  162 FORMAT(1X,I2,1X,3(1X,A4),F10.1,E10.2,3I5)
C     READ AND WRITE GAMMA ENERGIES AND ABUNDANCES
      IF(NGAMMA(LL).EQ.0) GO TO 190
      NG=NGAMMA(LL)
      READ(1,170)(AGAM(LL,IG),ABUN(LL,IG),IG=1,NG)
  170 FORMAT(12F6.0)
      WRITE(3,180)(AGAM(LL,IG),ABUN(LL,IG),IG=1,NG)
  180 FORMAT(1X,3X,5(1X,F9.3,F8.4))
  190 READ (1,350) QL(LL),DECON(LL)
  200 WRITE(3,290)  (QL(LL),DECON(LL))
      READ(1,202) ETITLE
  202 FORMAT(20A4)
      WRITE(3,204) ETITLE
  204 FORMAT(1H0,20A4)
      READ (1,210) NGAM,NSIG
  210 FORMAT(20I4)
      WRITE(3,220) NGAM,NSIG
  220 FORMAT(1X,'NGAM,NSIG'/1X,I4,1X,I4)
      READ (1,250)  (GAMEN(IN),IN=1,NGAM)
      WRITE(3,230)  (GAMEN(IN),IN=1,NGAM)
  230 FORMAT(1X,'GAMEN IN MEV'/(1X,8E12.4))
      READ (1,250)  (SIGZM(IN),IN=1,NSIG)
      WRITE(3,240)  (SIGZM(IN),IN=1,NSIG)
  240 FORMAT(1X,'SIGZM IN METERS'/(1X,8E12.4))
  250 FORMAT(8E10.4)
      DO 260 II=1,NGAM
  260 READ (1,250)  (DOSEI(II,JJ),JJ=1,NSIG)
      DO 270 II=1,NGAM
  270 WRITE(3,280) GAMEN(II),(DOSEI(II,JJ),JJ=1,NSIG)
  280 FORMAT(1X,'DOSEI IN RAD METERS**2 PER CURIE SEC AT',F6.3,' MEV'/
     1       (1X,8E12.4))
  290 FORMAT( 1X,4X,
     1         F13.3,3X,7H CURIES,5X,7HDECON= ,E10.3/)
  300 FORMAT(4I5,2F10.2,3F10.2)
  310 FORMAT(6F10.2)
  320 FORMAT(8F10.0)
  330 FORMAT(3F10.0)
  340 FORMAT(4I5)
  350 FORMAT(F10.6,E10.3)
  360 FORMAT(F10.2)
  370 FORMAT(6E10.2)
  380 FORMAT (1H0,30X,'INPUT DATA:')
  390 FORMAT(76H0FACILITY, NO.MONTHS OF DATA, PERIOD, THERMAL ENERGY GEN
     1ERATED DURING PERIOD)
  400 FORMAT(1H0,'NO. SECTORS, STABILITY CLASSES, RADII AND ISOTOPES,',
     1          ' STACK HEIGHT IN METERS, INVERSION LID'/
     2        1X,'HOLDUP IN DAYS,RAINFALL FRACTION,WASHOUT COEFFICIENT',
     3          ' (1/SEC)')
  410 FORMAT(1H0,'WIND FREQUENCY IN PERCENT BY STABILITY CLASS FOR',
     1          ' EACH SECTOR AND TOTAL FREQUENCY FOR SECTOR'/
     2        1X,'DIR',8X,'A',9X,'B',9X,'C',9X,'D',9X,'E',9X,'F',
     3          7X,'TOTAL')
  420 FORMAT(1H0,'WIND SPEED IN METERS PER SECOND BY STABILITY CLASS ',
     1          'FOR EACH COMPASS DIRECTION'/
     2        1X,'DIR',8X,'A',9X,'B',9X,'C',9X,'D',9X,'E',9X,'F')
  430 FORMAT(1H1,'POPULATIONS IN SECTOR SEGMENTS, TWO LINES PER RADIUS',
     *          ' (READ CLOCKWISE), AND TOTAL POPULATION IN ANNULI'/
     *        1X,'MM',1X,'N/S/TOTAL',3X,'NNE/SSW',5X,'NE/SW',3X,
```

```
FORTRAN IV G LEVEL  21                MAIN              DATE = 74052          20/27/29
                   *          'ENE/WSW',7X,'E/W',3X,'ESE/WSW',5X,'SE/NW',3X,
                   *          'SSE/NNW')
 0110          440 FORMAT(1H0,'DISTANCES IN METERS: MIDPOINT, LOWER AND UPPER OF',
                   *          ' BINS'/
                   *       1X,'MM',8X,'X',7X,'XLOW',7X,'XUP')
 0111          450 FORMAT(97H0NUMBER OF ISOTOPES PER SET OF CRITICAL ORGANS. (FOUR SE
                  1TS OF ORGANS, TWENTY ISOTOPES, MAX. TOTAL)
 0112          460 FORMAT(1H0,'ISOTOPE DATA: ISOTOPE, CRITICAL ORGAN, MRAD/SEC PER ',
                   *          'CI/METER**3, DECAY CONSTANT (1/SEC),',
                   *          'NDEP, NGAMMA, NDTR'/
                   *       1X,T16,'AGAM,AHUN: GAMMA ENERGY (MEV) AND ABUNDANCE ',
                   *          '(NGAMMA PAIRS)'/
                   *       1X,T16,'ACTIVITY RELEASED (CURIES) DURING PERIOD,',
                   *          ' NUCLIDE DECONTAMINATION FACTOR'/
                   *       1X,'LL')
             C
             C
 0113              N1=NWB+NTHY+NBON+NSKN-L
 0114              IF(N1) 470,490,470
 0115          470 WRITE(3,480)
 0116          480 FORMAT(1X,'THE NUMBER OF ISOTOPE CARDS MUST MATCH L. IF AN ISOTOPE
                  1 IS ASSOCIATED WITH TWO ORGANS IT IS TO BE COUNTED TWICE.')
 0117              GO TO 1551
 0118          490 IF(J-6)500,520,500
 0119          500 WRITE(3,510)
 0120          510 FORMAT(1H1,12H J MUST BE 6)
 0121              GO TO 1551
             C
             C     COMPUTE VALUES OF SIGMZ
             C
 0122          520 DO 530 JJ=1,J
 0123              DO 530 MM=1,M
 0124              Y(MM)=X(MM)*0.001
 0125          530 SIGMZ(JJ,MM)=SIGZ(JJ,Y(MM))
             C
 0126              WRITE(3,540)
 0127          540 FORMAT(1H1,30X,'OUTPUT DATA:'/
                   *        1H0,2X,'SIGMA ZEE''S BY STABILITY CLASS AND RADIUS'/
                   *       1X,3X,2H A,8X,2H B,8X,2H C,8X,2H D ,8X,2H E,8X,2H F/)
 0128          550 WRITE(3,370)((SIGMZ(JJ,MM),JJ=1,J),MM=1,M)
             C
             C     CALCULATE DECAYED CHI OVER Q IN EACH SECTOR SEGMENT,
             C     FOR EACH STABILITY CLASS AND FOR EACH ISOTOPE AND STORE.
             C   DIFFUSION EQUATION IS EQ. 3.144 IN SLADE,' MET. AND AT. ENERGY.'
             C   (1968) TID-24190, NTIS, US DEPT COMMERCE, SPRINGFIELD, VA, 22151
             C     THIS PROGRAM SETS CHI OVER Q TO ZERO IF FREQ OR UBAR ARE LESS THAN
             C     0.01  .
             C
             C     CONVERT HOLDUP FROM DAYS TO SECONDS.
 0129              HOLD=HOLDUP*8.64E4
             C    CONVERT ORIGINAL CURIE INVENTORY TO STACK RELEASE INVENTORY
             C     BY APPLYING HOLDUP AND DECONTAMINATION.
 0130              DO 560 LL=1,L
             C     GO THROUGH LIST BACKWARDS TO SIMPLIFY INGROWTH CALCULATIONS
 0131              IL=L+1-LL
             C     DECAY ORIGINAL INVENTORY
 0132              QL(IL)=QL(IL)*EXP(-XLMDA(IL)*HOLD)
             C     CHECK FOR AND GROW IN DAUGHTERS
```

```
0133              IF ( NDTR(IL).NE.0) QL(IL)=QL(IL)+QL(IL-1)*XLMDA(IL)/(XLMDA(IL)
                 1                         -XLMDA(IL-1))*(EXP(-XLMDA(IL-1)*HOLD)
                 2                         -EXP(-XLMDA(IL)*HOLD))
            C     APPLY DECONTAMINATION FACTOR
0134              IF (DECON(IL).LT.1.) DECON(IL)=1.0
0135              QL(IL)=QL(IL)/DECON(IL)
            C     SET RELEASES OF LESS THAN ONE MICROCURIE TO ZERO TO
            C     AVOID UNDERFLOWS.
0136              IF (QL(IL).LT.1.E-6) QL(IL)=0.
0137          560 CONTINUE
            C
0138              XI=I*1.0/(16.)
0139              DO 600 LL=1,L
0140              DO 600 II=1,I
0141              DO 600 JJ=1,J
0142              DO 600 MM=1,M
0143              IF(FREQ(II,JJ)-0.01)580,580,570
0144          570 IF(UBAR(II,JJ)-0.01)580,580,590
0145          580 CHIOQ(MM,II,JJ,LL)=0.0
0146              GO TO 600
0147          590 IF(SIGMAX.LT.1.) SIGMAX=1.E+4
0148              SIGMA=SIGMZ(JJ,MM)
0149              IF(SIGMA.GT.SIGMAX) SIGMA=SIGMAX
0150              ARG=H*H/(2.*SIGMA*SIGMA)
0151              IF(ARG.GT.100.) ARG=100.
0152              DENOM=SIGMA*UBAR(II,JJ)*X(MM)
0153              DECAY=EXP((-1.)*(XLMDA(LL))*X(MM)/(UBAR(II,JJ)))
0154              CHIOQ(MM,II,JJ,LL)=(0.0203)*FREQ(II,JJ)*EXP(-ARG)*XI*DECAY/DENOM
0155          600 CONTINUE
            C
            C     ********* WRITE OUT CHI/Q SUMMED OVER STABILITY CLASSES **********
            C
0156              WRITE(3,2110)
0157              WRITE(3,2120) (X(MM),MM=1,M)
0158              DO 2020 II=1,I
0159              DO 2010 MM=1,M
0160              CHIOQS(MM)=0.
0161              DO 2010 JJ=1,J
0162              LL=3
0163              IF(FREQ(II,JJ).LE.0..OR.UBAR(II,JJ).LE.0.) GO TO 2010
0164              CHIOQS(MM)=CHIOQS(MM)+CHIOQ(MM,II,JJ,LL)
                 *              *EXP(XLMDA(LL)*X(MM)/UBAR(II,JJ))
0165         2010 CONTINUE
0166         2020 WRITE(3,2130) DIR(II),(CHIOQS(MM),MM=1,M)
            C
0167         2110 FORMAT(1H0,4X,'CHI/Q SUMMED OVER STABILITY CLASSES')
0168         2120 FORMAT(1H0,56X,'DISTANCE (METERS)'/1X,'DIR',12F10.0/)
0169         2130 FORMAT(1X,A4,12(1PE10.2))
            C
            C     CALCULATE DEPOSITION VELOCITIES AND STORE.
            C
0170              DO 610 II = 1,I
0171              DO 610 JJ = 1,J
0172              HDEPV(II,JJ)=HV(JJ,1) + HV(JJ,2)* UBAR(II,JJ) + HV(JJ,3) * UBAR(
                 1II,JJ) ** 2 + HV(JJ,4)* UBAR(II,JJ) ** 3
0173          610 PDEPV(II,JJ)=PV(JJ,1) + PV(JJ,2)* UBAR(II,JJ) + PV(JJ,3) * UBAR(
                 1II,JJ) ** 2 + PV(JJ,4)* UBAR(II,JJ) ** 3
            C
```

```
               C     CALCULATE AREAS OF SECTOR SEGMENTS AND STORE.
               C
 0174                XXI = (1.0) * I
 0175                DO 640 MM=1,M
 0176                AREA(MM)=(3.1416)* (XUP(MM)**2 - XLOW(MM)**2)/(XXI)
 0177                C=AREA(MM)-1.0
 0178                IF(C) 620,620,640
 0179            620 WRITE(3,630)
 0180            630 FORMAT(51H ONE AREA IS TOO SMALL. CHECK X, XUP,AND XLOW DATA.)
 0181            640 CONTINUE
               C
               C     DO DEPOSITION AND CLOUD DEPLETION.
               C
               C     DRY DEPOSITION:
               C     CLOUD DEPOSITION AND DEPLETION ARE TREATED USING A SIMPLE MODEL.
               C     DEPOSITION STARTS AT THE FIRST (INNER) RADIUS. THE TOTAL ACTIVITY
               C     DEPOSITED ON THE GROUND IS CALCULATED ASSUMING A UNIFORM RATE OF
               C     DEPOSITION OVER THE ENTIRE SECTOR SEGMENT. CHI OVER Q AT THE
               C     SECOND RADIUS IS DEPLETED BY THE FRACTION ON THE GROUND AT THE
               C     FIRST RADIUS. THIS PROCESS OF DEPOSITION AND DEPLETION CONTINUES
               C     OUT TO THE LAST RADIUS IN THE SECTOR.
               C     THIS ROUTINE IS ESSENTIALLY THE SAME AS CALLED FOR BY  EQUATIONS
               C     5.44 THRU 5.48 IN METEOROLOGY AND ATOMIC ENERGY (TID-24190),
               C     EXCEPT HERE THE DEPOSITION AND DEPLETION DO NOT VARY CONTINUOUSLY
               C     WITH DISTANCE AS DOES EQ. 5.48.
               C
 0182                CONTINUE
               C
               C     WET DEPOSITION:
               C     WET DEPOSITION IS TREATED USING THE SECTOR AVERAGED ANALOG OF
               C     EQUATIONS 5.63 TO 5.65 IN MET. AND AT. ENERGY 1968. THIS
               C     IMPLIES THAT WET DEPOSITION IS PROPORTIONAL TO THE ACTIVITY
               C     PER SQUARE METER ABOVE THE GROUND, THE PROPORTIONALITY
               C     CONSTANT BEING CALLED WASHCO HEREIN. SINCE WET DEPOSITION
               C     IS A FIRST ORDER PROCESS, CLOUD DEPLETION IS SIMPLY
               C     EXPONENTIAL. WET DEPOSITION IS TREATED INDEPENDENTLY OF ALL DOSE
               C     CALCULATIONS. ALTHOUGH THE CLOUD IS DEPLETED BY WASHOUT DURING
               C     THE WASHOUT CALCULATIONS, STORED CHI OVER Q'S ARE NOT. IF AN
               C     UNNORMALIZED WINDROSE IS USED, I.E. THE SUM OF THE WIND FREQUEN-
               C     CIES IS MUCH LESS THAN 1.0, RAINF SHOULD BE ENTERED AS 1.E+00. IF
               C     A NORMALIZED ANNUAL WIND ROSE IS USED, I.E. THE SUM OF THE WIND
               C     FREQUENCIES IS 1.0, RAINF SHOULD BE THE DECIMAL FRACTION (NOT
               C     PERCENT) OF THE TIME IT RAINS. DEFAULT VALUES FOR RAINF AND WASHCO
               C     ARE 5.E-02 AND 2.E-04 1/SEC RESPECTIVELY FOR A MODERATELY WET
               C     CLIMATE AND PARTICLE DIAMETERS OF SEVERAL MICRONS. SEE MET AND AT
               C     E FOR DETAILS.
 0183                DO 900 LL=1,L
 0184                IF(NDEP(LL).LE.0) GO TO 900
 0185                IF(NDTR(LL).EQ.0.AND.QL(LL).EQ.0.) GO TO 900
 0186                IF(NDTR(LL).EQ.1.AND.QL(LL).EQ.0..AND.QL(LL-1).EQ.0.) GO TO 900
 0187            650 C5 = 0.0
 0188                C8=0.
 0189                DO 800 II=1,I
 0190                DO 740 JJ=1,J
 0191                DO 740 MM=1,M
 0192                F(1) = 1.0
               C     CHECK FOR CHIOO EQUALS ZERO
 0193                IF(FREQ(II,JJ).GT.0..AND.UBAR(II,JJ).GT.0.) GO TO 670
```

```
0194                QG(MM,JJ)=0.0
0195                WQG(MM,JJ)=0.0
0196                F(MM+1)=0.
0197                GO TO 740
0198            670 KI = MM
0199                C=2.
              C    SINCE CHIOQ INCLUDES DECAY THE DAUGHTER QS'S ARE GROWN BACK TO THE
              C      DAUGHTER INGROWTH IS ADDED TO THE INPUT DAUGHTER STRENGTH.
0200                QS=QL(LL)
0201                IF (NDTR(LL).NE.0) QS=QS+QL(LL-1)*XLMDA(LL)
                   1                      /(XLMDA(LL)-XLMDA(LL-1))
                   2                      *(EXP((XLMDA(LL)-XLMDA(LL-1))*X(MM)
                   3                      /UBAR(II,JJ))-1.0)
              C      PICK UP FACTORS 1 - F(2) -F(3)-.......... -F(MM)
0202                DO 680 MM1=1,KI
0203            680 C=C-F(MM1)
              C     THE FOLLOWING CONSERVES (Q*FREQ).
0204                IF(C) 690,690,700
0205            690 QG(MM,JJ)=0.0
0206                CHIOQ(MM,II,JJ,LL)=0.0
0207                MPLS1=MM+1
0208                F(MPLS1)=2.0
0209                GO TO 740
              C     THE FOLLOWING STEP REPLACES THE OLD CHI OVER Q
              C     WITH THE DEPLETED ONE
0210            700 CHIOQ(MM,II,JJ,LL) = C * CHIOQ(MM,II,JJ,LL)
0211                IF(NDEP(LL).GE.2) GO TO 720
              C     DO PARTICULATE DEPOSITION AND DEPLETION.
0212            710 QG(MM,JJ)=CHIOQ(MM,II,JJ,LL)*QS*AREA(MM)*PDEPV(II,JJ)
0213                GO TO 730
              C     DO HALOGEN DEPOSITION AND DEPLETION
0214            720 QG(MM,JJ)=CHIOQ(MM,II,JJ,LL)*QS*AREA(MM)*HDEPV(II,JJ)
0215            730 MPLS1 = MM+1
0216                QIJ=QS*FREQ(II,JJ)*0.01
0217                F(MPLS1)= QG(MM,JJ)/(QIJ)
              C
              C     CALCULATE WET DEPOSITION
              C
0218                IF(WASHCO.LE.0..OR.RAINF.LE.0.) GO TO 740
0219                DECAY=EXP(-XLMDA(LL)*X(MM)/UBAR(II,JJ))
0220                DENOM=UBAR(II,JJ)*X(MM)*2*3.1416/I
0221                WQG(MM,JJ)=(RAINF*WASHCO*FREQ(II,JJ)/DENOM)*QS*AREA(MM)*DECAY*0.01
                   **EXP(-WASHCO*X(MM)/UBAR(II,JJ))
              C
              C     (LAST TERM INCLUDES CLOUD DEPLETION DURING WET DEPOSITION.)
              C
0222            740 CONTINUE
              C
              C     SUM CURIES ON THE GROUND OVER ALL STABILITY CLASSES IN
              C     EACH SECTOR SEGMENT AND TOTAL CURIES ON THE GROUND.
              C
0223            750 C1=0.0
0224                C7=0.
0225                DO 790 MM=1,M
0226                C2=0.0
0227                C6=0.
0228                DO 760 JJ= 1,J
0229                IF(WQG(MM,JJ).LE.(1.E-12)) WQG(MM,JJ)=0.
```

```
          IF(QG(MM,JJ).LE.(1.E-12)) QG(MM,JJ)=0.0
          C6=C6+WQG(MM,JJ)
      760 C2 = C2 + QG(MM,JJ)
          WQGMI(MM,II)=C6
          QGMI(MM,II) = C2
C
C         COMPUTE SATURATED ACTIVITY ON THE GROUND FOR RELEASE PERIOD OR
C          ONE YEAR ( IN PICOCURIES PER M**2 .
C
          C4=2.6E+06
          C=MONTHS
          IF(C.LE.0.) C=12.
          DECAY=XLMDA(LL)*C*C4
          IF(DECAY.LT.1.E-3) DECAY=1.E-3
          IF(DECAY-5.) 780,780,770
      770 QGAMI(MM,II) = (C2 * 1.0 E+12)/(AREA(MM)*DECAY)
          WQGAMI(MM,II) = (C6 * 1.0 E+12)/(AREA(MM)*DECAY)
          GO TO 785
      780 QGAMI(MM,II) =((C2 * 1.0 E+12)/(AREA(MM)*DECAY))*(1.0-EXP(-DECAY))
          WQGAMI(MM,II) =((C6 * 1.0E+12)/(AREA(MM)*DECAY))*(1.0-EXP(-DECAY))
      785 C7=C7+C6
      790 C1 = C1 + C2
          C8=C8+C7
          C5 = C5 + C1
          WTQG=C8
      800 TQG = C5
C
C
C          SUM CURIES DEPOSITED WITHIN RADII.
C
          C3=0.
          C4=0.
          DO 810 MM=1,M
          DO 810 II=1,I
          IF(WQGMI(MM,II).LE.(1.E-10)) WQGMI(MM,II)=0.0
          IF(QGMI(MM,II).LE.(1.E-10)) QGMI(MM,II)=0.0
          C4=C4+QGMI(MM,II)
          C3=C3+WQGMI(MM,II)
          WTQGM(MM) =C3
      810 TQM(MM)=C4
C
C         FOR PARTICULATES AND HALOGENS
C         WRITE OUT CURIES PER SQUARE METER ON THE GROUND,
C         SATURATED ACTIVITY PER M**2.
C
      820 WRITE(3,830)(ISO(LL),LATWT(LL))
      830 FORMAT(1H1,20X,'ACTIVITY DENSITY AT END OF RELEASE PERIOD FOR ',
     *             'A UNIFORM RELEASE RATE'/
     *             40X,'PICOCURIES/M**2 OF ',A4,A4)
          WRITE(3,839)
      839 FORMAT(44X,'DRY DEPOSITION'//)
          WRITE(3,840)
      840 FORMAT(47X,7H SECTOR,//1X,9H DISTANCE,/1X,9H (METERS),/16X,2H N
     1,7X,4H NNE,6X,3H NE,6X,4H ENE,8X,2H E,8X,4H ESE,6X,3H SE,6X,4H SSE
     2,4X,12H AREAS(M**2),/95X,19H OF SECTOR-SEGMENTS,/)
          DO 860 MM=1,M
      850 FORMAT(9F10.0,5X,E10.3)
      860 WRITE(3,850) (X(MM),(QGAMI(MM,II),II=1,8),AREA(MM))
```

```
0271              WRITF(3,870)
0272          870 FORMAT(1H0//17X,
                 1            2H S,6X,4H SSW,7X,3H SW,6X,4H WSW,7X,2H W,7X,4H WNW,8X,
                 23H NW,6X,4H NNW,6X,17H CURIES DEPOSITED,/97X,13H WITHIN RADII,/)
0273              DO 880 MM=1,M
0274          880 WRITE(3,850)(X(MM),(QGAMI(MM,II),II=9,I),TQM(MM))
0275              QDISP=QL(LL)*TOTFRQ/100.
0276              WRITE(3,890)(ISO(LL),LATWT(LL),XUP(M),TQG,QDISP)
0277          890 FORMAT(1H0/
                 1        1X,10X,'TOTAL CURIES OF',A4,A4,4X,'DEPOSITED ON THE',
                 2           ' GROUND WITHIN',F10.0,' METERS IS',F10.3,' CURIES'/
                 3        1X,10X,'OUT OF A TOTAL OF',F10.3,' CURIES DISPERSED',
                 4           ' DURING THIS PERIOD.')
            C
            C             ACCORDING TO ONE REFERENCE (H.P. 18,1,P.74,JAN 70)
            C            0.09 CURIE PER LITER APPEARS IN COWS MILK PER CURIE PER
            C             SQUARE METER OF I 131 DEPOSITED ON THE GROUND.
            C
            C     WRITE WET DEPOSITION
            C
0278              IF(RAINF.LE.0..OR.WASHCO.LE.0.) GO TO 900
0279              WRITE(3,830) (ISO(LL),LATWT(LL))
0280              WRITE(3,891) (WASHCO,RAINF)
0281          891 FORMAT(44X,'WET DEPOSITION'//20X,'WASHOUT COEF =',1PE10.2,5X,
                 *       'RAINFALL FREQUENCY =',E10.2//)
0282              WRITE(3,840)
0283              DO 892 MM=1,M
0284          892 WRITE(3,850)(X(MM),(WQGAMI(MM,II),II=1,8),AREA(MM))
0285              WRITE(3,870)
0286              DO 893 MM=1,M
0287          893 WRITE(3,850)(X(MM),(WQGAMI(MM,II),II=9,I),WTQGM(MM))
0288              C=QL(LL)*RAINF*TOTFRQ/100.
0289              WRITE(3,894)(ISO(LL),LATWT(LL),XUP(M),WTQG,C)
0290          894 FORMAT(1H0/
                 1        1X,10X,'TOTAL CURIES OF',A4,A4,4X,'DEPOSITED ON THE',
                 2           ' GROUND WITHIN',F10.0,' METERS IS',F10.3,' CURIES'/
                 3        1X,10X,'OUT OF A TOTAL OF',F10.3,' CURIES DISPERSED',
                 4           ' DURING RAINFALL.')
0291          900 CONTINUE
            C
            C
            C     CALCULATE ALL (MXJXIXL) DOSES.
            C     SUM DIFFUSED, DECAYED AND DEPLETED DOSES OVER ALL STABILITY CLASSE
            C     PRESERVING ISOTOPE DESIGNATION.
            C
            C    CALCULATE EXTERNAL GAMMA WHOLE BODY DOSES USING THE DOSE INTEGRALS.
            C
0292              DO 1050 LL=1,L
0293              DO 1050 II=1,I
0294              DO 1050 MM=1,M
0295              WIDTH=2.0*PI*X(MM)/I
0296              C2=0.
0297              DO 1040 JJ=1,J
0298              DMIJ=0.
0299              IF(FREQ(II,JJ).LE.0..OR.UBAR(II,JJ).LE.0.) GO TO 1040
0300              IF(NDTR(LL).EQ.0.AND.QL(LL).EQ.0.) GO TO 1040
0301              IF(NDTR(LL).EQ.1.AND.QL(LL).EQ.0..AND.QL(LL-1).EQ.0.) GO TO 1040
            C
```

FORTRAN IV G LEVEL 21   MAIN   DATE = 74052   20/27/29

```
              C     SINCE CHIOQ INCLUDES DECAY THE DAUGHTER QS'S ARE GROWN BACK TO THE
              C      STACK. DAUGHTER INGROWTH IS ADDED TO THE INPUT DAUGHTER STRENGTH.
              C
 0302                QS=QL(LL)
 0303                IF(NDTR(LL).NE.0) QS=QS+QL(LL-1)*XLMDA(LL)/(XLMDA(LL)-XLMDA(LL-1))
                    1                      *(EXP((XLMDA(LL)-XLMDA(LL-1))*X(MM)
                    2                      /UBAR(II,JJ))-1.0)
 0304                IF (LL.GT.NWB.OR.NGAMMA(LL).EQ.0) GO TO 1020
 0305                DECAY=EXP(-XLMDA(LL)*X(MM)/UBAR(II,JJ))
 0306                SIGMA=SIGMZ(JJ,MM)
 0307                IF (SIGMA.GT.SIGZM(2)) GO TO 910
 0308                IS=1
 0309                IF(SIGMA.LT.SIGZM(1)) SIGMA=SIGZM(1)
 0310                GO TO 950
 0311            910 IF (SIGMA.LE.SIGZM(NSIG-1)) GO TO 920
 0312                IS=NSIG-1
 0313                IF(SIGMA.GT.SIGZM(NSIG)) SIGMA=SIGZM(NSIG)
 0314                GO TO 950
 0315            920 IS=8.0*ALOG10(SIGMA)
 0316                DO 930 IN=IS,NSIG
 0317                IF (SIGZM(IN+1).GE.SIGMA) GO TO 940
 0318            930 CONTINUE
 0319            940 IS=IN
 0320            950 PS=(SIGMA-SIGZM(IS))/(SIGZM(IS+1)-SIGZM(IS))
 0321                DISUM=0.
 0322                NGAML=NGAMMA(LL)
 0323                DO 1010 NG=1,NGAML
 0324                EGAM=AGAM(LL,NG)
              C      INTERPOLATE DOSE INTEGRAL TABLE TO OBTAIN DI
 0325                IF (EGAM.GT.GAMEN(2)) GO TO 960
 0326                IG=1
 0327                GO TO 1000
 0328            960 IF (EGAM.LE.GAMEN(NGAM-1)) GO TO 970
 0329                IG=NGAM-1
 0330                GO TO 1000
 0331            970 IG=8.0*ALOG10(100.0*EGAM)
 0332                DO 980 IN=IG,NGAM
 0333                IF (GAMEN(IN+1).GE.EGAM) GO TO 990
 0334            980 CONTINUE
 0335            990 IG=IN
 0336           1000 PG=(EGAM-GAMEN(IG))/(GAMEN(IG+1)-GAMEN(IG))
 0337                DI= DOSEI(IG,IS)*(1.0-PG)*(1.0-PS)+DOSEI(IG,IS+1)*(1.0-PG)*PS
                    1   +DOSEI(IG+1,IS)*PG*(1.0-PS)+DOSEI(IG+1,IS+1)*PG*PS
 0338           1010 DISUM=DISUM+DI*ABUN(LL,NG)
 0339                DMIJ=DISUM*DECAY*QS*FREQ(II,JJ)*10.0/(WIDTH*UBAR(II,JJ))
 0340                GO TO 1030
 0341           1020 DMIJ=CHIOQ(MM,II,JJ,LL)*QS*DCF(LL)
 0342           1030 DMIJL(MM,II,JJ,LL)=DMIJ
 0343                IF(DMIJ.LE.(1.E-06)) DMIJ=0.
 0344           1040 C2=C2+DMIJ
 0345           1050 DMIL(MM,II,LL)=C2
              C
              C      FOR ORGANS FOR WHICH THERE IS INPUT DATA:
              C
              C
              C      SUM INDIVIDUAL DOSES IN EACH SECTOR-SEGMENT.
              C      CALCULATE       ORGAN MAN-REMS IN EACH SECTOR-SEGMENT.
              C      SUM AT RADII  , THEN TOTAL FOR EACH ORGAN.
```

```
              C      PRINT MILLIREM          BY SECTOR-SEGMENT,
              C      PRINT MAN-REM  BY SECTOR-SEGMENT,
              C      PRINT MAN-REM BY RADIUS.
              C      WRITE OUT ISOTOPE DATA
              C
              C
 0346                IF(NWB)1200,1200,1060
 0347           1060 J1=NWB
 0348                C6=0.0
 0349                DO 1090 MM=1,M
 0350                DO 1090 II= 1,I
 0351                C1=0.0
 0352                DO 1070 LL=1,J1
 0353                IF(DMIL(MM,II,LL).LE.(1.E-06)) DMIL(MM,II,LL)=0.
 0354                C1=C1+DMIL(MM,II,LL)
 0355           1070 WBDOS(MM,II)=C1
 0356           1080 DPWB(MM,II)=WBDOS(MM,II)*POP(MM,II)*(0.001)
 0357                C6=C6+DPWB(MM,II)
 0358           1090 DPWBM(MM)=C6
 0359                WRITE(3,1100)
 0360           1100 FORMAT(1H1,25X,82H     DOSE TO AN INDIVIDUAL IN THE INDICATED COMP
                    1ASS SECTOR AND ANNULAR RING (MREM)//4X,5H DIST,4X,2H N,4X,4H NNE,
                    24X,3H NE,3X,4H ENE,4X,2H E,4X,4H ESE,4X,3H SE,3X,4H SSE,4X,2H S,4X
                    3,4H SSW,4X,3H SW,3X,4H WSW,4X,2H W,4X,4H WNW,4X,3H NW,3X,4H NNW/)
 0361                DO 1110 MM=1,M
 0362           1110 WRITE(3,1120)(X(MM),(WBDOS(MM,II),II=1,I))
 0363           1120 FORMAT(F10.0,16F7.2,F9.2)
 0364                WRITE(3,1130)
 0365           1130 FORMAT(1H0//15X,'POPULATION DOSE IN THE INDICATED COMPASS',
                    1 ' SECTOR AND ANNULAR RING (MAN-REM)'/31X,'AVERAGED',
                    2     ' TO CONFORM TO THE POPULATION WHEEL WIND SECTORS'/41X,
                    3 ' FOR THE ESTIMATED POPULATION',//122X,8H RUNNING,/4X,5H DIST,4X,
                    4 2H N,4X,4H NNE,
                    54X,3H NE,3X,4H ENE,4X,2H E,4X,4H ESE,4X,3H SE,3X,4H SSE,4X,2H S,4X
                    6,4H SSW,4X,3H SW,3X,4H WSW,4X,2H W,4X,4H WNW,4X,3H NW,3X,4H NNW,
                    7 3X,6H TOTAL)
 0366                DO 1140 MM=1,M
 0367           1140 WRITE(3,1120)(XUP(MM),(DPWB(MM,II),II=1,I),DPWBM(MM))
 0368                WRITE(3,1150)
 0369           1150 FORMAT(1H0/
                    1        30X,35H THE CONTRIBUTING RADIONUCLIDES ARE,/)
 0370                WRITE(3,1160)
 0371           1160 FORMAT(10X,8H ISOTOPE,5X,15H CRITICAL ORGAN,6X,4H DCF,6X,16H CURIE
                    1S RELEASED,10X,15H DECAY CONSTANT,10X,'DECON FACTOR',/,83X,8H (1/S
                    2EC) )
 0372                C2=0.
 0373                DO 1170 LL=1,NWB
 0374                C2=C2+QL(LL)
 0375           1170 WRITE(3,1180)(ISO(LL),LATWT(LL),CRTORG(LL),DCF(LL),QL(LL),XLMDA(LL
                    1),DECON(LL))
 0376                WRITE(3,1190) C2
 0377           1180 FORMAT(10X,A4,1X,A4,13X,A4,4X,F10.2,8X,F10.3,15X,E10.2,10X,G10.3)
 0378           1190 FORMAT(48X,'TOTAL CI. ',G11.3)
              C
 0379           1200 IF(NTHY)1280,1280,1210
 0380           1210 J2=NWB+1
 0381                C7=0.0
 0382                DO 1240 MM=1,M
```

```
0383           DO 1240 II=1,I
0384           J3=NWB+NTHY
0385           C2=0.0
0386           DO 1220 LL=J2,J3
0387           IF(DMIL(MM,II,LL).LE.(1.E-06)) DMIL(MM,II,LL)=0.
0388           C2=C2+DMIL(MM,II,LL)
0389      1220 THYDOS(MM,II)=C2
0390      1230 DPTHY(MM,II)=THYDOS(MM,II)*POP(MM,II)*(0.001)
0391           C7=C7+DPTHY(MM,II)
0392      1240 DPTHYM(MM)=C7
0393           WRITE(3,1100)
0394           DO 1250 MM=1,M
0395      1250 WRITE(3,1120)(X(MM),(THYDOS(MM,II),II=1,I))
0396           WRITE(3,1130)
0397           DO 1260 MM=1,M
0398      1260 WRITE(3,1120)(XUP(MM),(DPTHY(MM,II),II=1,I),DPTHYM(MM))
0399           WRITE(3,1150)
0400           WRITE(3,1160)
0401           C2=0.
0402           DO 1270 LL=J2,J3
0403           C2=C2+QL(LL)
0404      1270 WRITE(3,1180)(ISO(LL),LATWT(LL),CRTORG(LL),DCF(LL),QL(LL),XLMDA(LL
              1),DECON(LL))
0405           WRITE(3,1190) C2
0406      1280 IF(NBON)1360,1360,1290
0407      1290 J4=NWB+NTHY+1
0408           C8=0.0
0409           DO 1320 MM=1,M
0410           DO 1320 II=1,I
0411           J5=NWB+NTHY+NBON
0412           C3=0.0
0413           DO 1300 LL=J4,J5
0414           IF(DMIL(MM,II,LL).LE.(1.E-06)) DMIL(MM,II,LL)=0.
0415           C3=C3+DMIL(MM,II,LL)
0416      1300 BONDOS(MM,II)=C3
0417      1310 DPBON(MM,II)=BONDOS(MM,II)*POP(MM,II)*(0.001)
0418           C8=C8+DPBON(MM,II)
0419      1320 DPBONM(MM)=C8
0420           WRITE(3,1100)
0421           DO 1330 MM=1,M
0422      1330 WRITE(3,1120)(X(MM),(BONDOS(MM,II),II=1,I))
0423           WRITE(3,1130)
0424           DO 1340 MM=1,M
0425      1340 WRITE(3,1120)(XUP(MM),(DPBON(MM,II),II=1,I),DPBONM(MM))
0426           WRITE(3,1150)
0427           WRITE(3,1160)
0428           C2=0.
0429           DO 1350 LL=J4,J5
0430           C2=C2+QL(LL)
0431      1350 WRITE(3,1180)(ISO(LL),LATWT(LL),CRTORG(LL),DCF(LL),QL(LL),XLMDA(LL
              1),DECON(LL))
0432           WRITE(3,1190) C2
0433      1360 IF(NSKN) 1440,1440,1370
0434      1370 J6=NWB+NTHY+NBON+1
0435           C9=0.0
0436           DO 1400 MM=1,M
0437           DO 1400 II=1,I
0438           J7=NWB+NTHY+NBON+NSKN
```

```
FORTRAN IV G LEVEL  21                  MAIN                 DATE = 74052          20/27/29

0439             C4=0.0
0440             DO 1380 LL=J6,J7
0441             IF(DMIL(MM,II,LL).LE.(1.E-06)) DMIL(MM,II,LL)=0.
0442             C4=C4+DMIL(MM,II,LL)
0443        1380 SKNDOS(MM,II)=C4
0444        1390 DPSKN(MM,II)=SKNDOS(MM,II)*POP(MM,II)*(0.001)
0445             C9=C9+DPSKN(MM,II)
0446        1400 DPSKNM(MM)=C9
0447             WRITE(3,1100)
0448             DO 1410 MM=1,M
0449        1410 WRITE(3,1120)(X(MM),(SKNDOS(MM,II),II=1,I))
0450             WRITE(3,1130)
0451             DO 1420 MM=1,M
0452        1420 WRITE(3,1120)(XUP(MM),(DPSKN(MM,II),II=1,I),DPSKNM(MM))
0453             WRITE(3,1150)
0454             WRITE(3,1160)
0455             C2=0.
0456             DO 1430 LL=J6,J7
0457             C2=C2+QL(LL)
0458        1430 WRITE(3,1180)(ISO(LL),LATWT(LL),CRTORG(LL),DCF(LL),QL(LL),XLMDA(LL
                1),DECON(LL))
0459             WRITE (3,1190) C2
0460        1440 CONTINUE
           C     A PATCH TO WRITE INDIVIDUAL DOSES MAY BE INSERTED HERE
0461             C1 = 0.0
0462             DO 1450 MM=1,M
0463             DO 1450 II=1,I
0464             C1 = C1 + POP(MM,II)
0465        1450 TOTPOP=C1
0466             C1 = 0.0
0467             WRITE(3,1460) FACIL,MONTH1,NYR1,
                *                MONTH2,NYR2,ETHERM,MONTHS,TOTFRQ,TOTPOP,HOLDUP,H
0468        1460 FORMAT(1H1/46X,'PROBLEM SUMMARY'//6X,'FACILITY',14X,'PERIOD',
                *        11X,'ENERGY',4X,'MONTHS OF',2X,'TOTAL',6X,'TOTAL',7X,
                *        'HOLDUP',2X,'HEFF'/24X,'FROM',7X,'TO',6X,'(MW-D(TH))',
                *        2X,'OPERATION',2X,'FREQUENCY',2X,'POPULATION',2X,'(DAYS)',
                *        2X,'(METERS)'/
                *        1X,5A4,2(1X,A4,I5),F11.0,1X,F5.2,6X,F8.1,3X,F11.0,1X,F6.1,
                *        2X,F7.0)
0469             WRITE(3,1520)
0470        1520 FORMAT(1H0,61H RADIONUCLIDE CONTRIBUTIONS TO THE TOTAL POPULATION
                1 DOSE ARE,/)
0471             DO 1550 LL=1,L
0472             DPL=0.
0473             DO 1530 II=1,I
0474             DO 1530 MM=1,M
0475        1530 DPL=DPL+DMIL(MM,II,LL)*POP(MM,II)*(0.001)
0476             WRITE(3,1540) ISO(LL),LATWT(LL),CRTORG(LL),DPL
0477        1540 FORMAT(1X,A4,1X,A4,5X,A4,5X,F10.2, 8H MAN REM)
0478        1550 CONTINUE
0479        1551 CALL EXIT
0480             STOP
0481             END
```

```
FORTRAN IV G LEVEL  21                  SIGZ               DATE = 74052          20/27/29

0001              FUNCTION SIGZ(KLASS,X)
            C     FUNCTIONS ARE OAP/EPA FITS TO SIGMA ZEES
            C     IN EPA OFFICE OF AIR PROGRAMS DOCUMENT  NO.AP-26.(USGPO,WASH.,DC.
            C     STOCK NO.5503-0015. PRICE ONE DOLLAR.)
            C     FUNCTION CALCULATES THE STANDARD DEVIATION OF PLUME CONCENTRATION
            C          IN THE Z DIRECTION FOR STABILITY KLASS (1 = A, 2 = B, 3 = C,
            C          4 = D, 5 = E, 6 = F) AND THE DISTANCE ALONG THE CENTERLINE OF
            C          THE PLUME IN KILOMETERS, X.
            C     THE STANDARD DEVIATION IS IN METERS.
            C     AS WRITTEN, A CAPPING LAYER (SIGMAX)   UPPER BOUNDS SIGZ
            C
            C     THE RUN IS STOPPED IF X(MM) IS LESS THAN 100. METERS
            C
0002          100 IF (X - 0.1) 110,130,130
0003          110 WRITE(3,120)
0004          120 FORMAT(1X,'ONE X IS TOO SMALL. CHECK X, XUP,AND XLOW DATA.')
0005              STOP
0006          130 XX = ALOG(X)
0007              SIGMAX=10000.
0008              GO TO (140,170,180,190,200,210), KLASS
0009          140 IF(X-1.5) 150,150,160
0010          150 SIGZ = EXP(6.126788 + XX * (2.214445 + XX * (-0.041129 + XX *
                 1(-0.379863 + XX* (-0.099597)))))
0011              IF (SIGZ-SIGMAX) 220,220,230
0012          160 SIGZ=500. * X**2
0013              IF (SIGZ-SIGMAX) 220,220,230
0014          170 SIGZ = EXP(4.686302 + XX * (1.062550 + XX * (0.018771)))
0015              IF (SIGZ-SIGMAX) 220,220,230
0016          180 SIGZ = 61.141032 * X ** .914651
0017              IF (SIGZ-SIGMAX) 220,220,230
0018          190 SIGZ = EXP(3.416367 + XX * (0.729577 + XX * (-0.031207)))
0019              IF (SIGZ-SIGMAX) 220,220,230
0020          200 SIGZ = EXP(3.057629 + XX * (0.679089 + XX * (-0.044892)))
0021              IF (SIGZ-SIGMAX) 220,220,230
0022          210 SIGZ = EXP(2.625488 + XX * (0.658866 + XX * (-0.054137)))
0023              IF (SIGZ-SIGMAX) 220,220,230
0024          230 SIGZ = SIGMAX
0025          220 RETURN
0026              END
```

PROGRAM AIREM04

FOR INFORMATION REGARDING THIS PROGRAM, CONTACT:

ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RADIATION PROGRAMS
FIELD OPERATIONS DIVISION
401 M ST SW
WASHINGTON, DC
20460

INPUT DATA:

FACILITY, NO.MONTHS OF DATA, PERIOD, THERMAL ENERGY GENERATED DURING PERIOD
SAMPLE PROBLEM 12.00 JAN 1972 DEC 1972 200000.

NO. SECTORS, STABILITY CLASSES, RADII AND ISOTOPES, STACK HEIGHT IN METERS, INVERSION LID
HOLDUP IN DAYS,RAINFALL FRACTION,WASHOUT COEFFICIENT (1/SEC)
16 6 12 20 100.00 1000.00 0.0 0.50E-01 0.20E-03

WIND FREQUENCY IN PERCENT BY STABILITY CLASS FOR EACH SECTOR AND TOTAL FREQUENCY FOR SECTOR

DIR	A	B	C	D	E	F	TOTAL
N	1.00	0.0	0.0	0.0	0.0	0.0	1.00
NNE	0.0	1.00	0.0	0.0	0.0	0.0	1.00
NE	0.0	0.0	1.00	0.0	0.0	0.0	1.00
ENE	0.0	0.0	0.0	1.00	0.0	0.0	1.00
E	0.0	0.0	0.0	0.0	1.00	0.0	1.00
ESE	0.0	0.0	0.0	0.0	0.0	1.00	1.00
SE	0.0	1.00	0.0	0.0	0.0	0.0	1.00
SSE	0.0	0.0	1.00	0.0	0.0	0.0	1.00
S	0.0	0.0	0.0	1.00	0.0	0.0	1.00
SSW	0.0	0.0	0.0	0.0	1.00	0.0	1.00
SW	0.0	0.0	0.0	0.0	0.0	1.00	1.00
WSW	0.0	1.00	0.0	0.0	0.0	0.0	1.00
W	0.0	0.0	1.00	0.0	0.0	0.0	1.00
WNW	0.0	0.0	0.0	1.00	0.0	0.0	1.00
NW	0.0	0.0	0.0	0.0	1.00	0.0	1.00
NNW	0.0	0.0	0.0	0.0	0.0	1.00	1.00

WIND SPEED IN METERS PER SECOND BY STABILITY CLASS FOR EACH COMPASS DIRECTION

DIR	A	B	C	D	E	F
N	2.00	0.0	0.0	0.0	0.0	0.0
NNE	0.0	2.00	0.0	0.0	0.0	0.0
NE	0.0	0.0	2.00	0.0	0.0	0.0
ENE	0.0	0.0	0.0	2.00	0.0	0.0
E	0.0	0.0	0.0	0.0	2.00	0.0
ESE	0.0	0.0	0.0	0.0	0.0	2.00
SE	0.0	5.00	0.0	0.0	0.0	0.0
SSE	0.0	0.0	5.00	0.0	0.0	0.0
S	0.0	0.0	0.0	5.00	0.0	0.0
SSW	0.0	0.0	0.0	0.0	5.00	0.0
SW	0.0	0.0	0.0	0.0	0.0	5.00
WSW	0.0	10.00	0.0	0.0	0.0	0.0
W	0.0	0.0	10.00	0.0	0.0	0.0
WNW	0.0	0.0	0.0	10.00	0.0	0.0
NW	0.0	0.0	0.0	0.0	10.00	0.0
NNW	0.0	0.0	0.0	0.0	0.0	10.00

POPULATIONS IN SECTOR SEGMENTS, TWO LINES PER RADIUS (READ CLOCKWISE), AND TOTAL POPULATION IN ANNULI

MM	N/S/TOTAL	NNE/SSW	NE/SW	ENE/WSW	E/W	ESE/WSW	SE/NW	SSE/NNW
1	0.	0.	0.	0.	0.	0.	0.	0.
	0.	0.	0.	0.	0.	0.	0.	0.
	0.							
2	10.	10.	10.	10.	10.	10.	10.	10.
	10.	10.	10.	10.	10.	10.	10.	10.
	160.							
3	30.	30.	30.	30.	30.	30.	30.	30.
	30.	30.	30.	30.	30.	30.	30.	30.
	480.							
4	120.	120.	120.	120.	120.	120.	120.	120.
	120.	120.	120.	120.	120.	120.	120.	120.
	1920.							
5	200.	200.	200.	200.	200.	200.	200.	200.
	200.	200.	200.	200.	200.	200.	200.	200.
	3200.							
6	280.	280.	280.	280.	280.	280.	280.	280.
	280.	280.	280.	280.	280.	280.	280.	280.
	4480.							
7	360.	360.	360.	360.	360.	360.	360.	360.
	360.	360.	360.	360.	360.	360.	360.	360.
	5760.							
8	3000.	3000.	3000.	3000.	3000.	3000.	3000.	3000.
	3000.	3000.	3000.	3000.	3000.	3000.	3000.	3000.
	48000.							
9	12000.	12000.	12000.	12000.	12000.	12000.	12000.	12000.
	12000.	12000.	12000.	12000.	12000.	12000.	12000.	12000.
	192000.							
10	20000.	20000.	20000.	20000.	20000.	20000.	20000.	20000.
	20000.	20000.	20000.	20000.	20000.	20000.	20000.	20000.
	320000.							
11	28000.	28000.	28000.	28000.	28000.	28000.	28000.	28000.
	28000.	28000.	28000.	28000.	28000.	28000.	28000.	28000.
	448000.							
12	36000.	36000.	36000.	36000.	36000.	36000.	36000.	36000.
	36000.	36000.	36000.	36000.	36000.	36000.	36000.	36000.
	576000.							

DISTANCES IN METERS: MIDPOINT, LOWER AND UPPER OF BINS

MM	X	XLOW	XUP
1	250.	100.	400.
2	600.	400.	805.
3	1208.	805.	1610.
4	2414.	1610.	3220.
5	4020.	3220.	4830.
6	5630.	4830.	6440.
7	7250.	6440.	8050.
8	12000.	8050.	16100.
9	24000.	16100.	32200.
10	40000.	32200.	48300.
11	56000.	48300.	64400.
12	72400.	64400.	80500.

PARTICULATE AND HALOGEN DEPOSITION VELOCITY EXPANSION COEFFICIENTS.

0.50E-02	0.50E-02	0.50E-02	0.50E-02	0.50E-02	0.50E-02
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0
0.20E-01	0.20E-01	0.20E-01	0.20E-01	0.20E-01	0.20E-01
0.0	0.0	0.0	0.0	0.0	0.0

```
0.0        0.0        0.0        0.0        0.0        0.0
0.0        0.0        0.0        0.0        0.0        0.0

NUMBER OF ISOTOPES PER SET OF CRITICAL ORGANS. (FOUR SETS OF ORGANS, TWENTY ISOTOPES, MAX. TOTAL
   9    9    1    1

ISOTOPE DATA: ISOTOPE, CRITICAL ORGAN, MRAD/SEC PER CI/METER**3, DECAY CONSTANT (1/SEC),NDEP, NGAMMA, NDTF
              AGAM,ABUN: GAMMA ENERGY (MEV) AND ABUNDANCE (NGAMMA PAIRS)
              ACTIVITY RELEASED (CURIES) DURING PERIOD, NUCLIDE DECONTAMINATION FACTOR
LL
 1     KR  85M  WB       46.0  0.45E-04    0    2    0
         0.151  0.7960      0.305  0.2040
        100000.000    CURIES      DECON=  0.0

 2     KR   85  WB        0.6  0.20E-08    0    1    1
         0.514  0.0043
        100000.000    CURIES      DECON=  0.0

 3     KR   87  WB      370.0  0.15E-03    0    7    0
         0.403  0.4830      0.674  0.0160     0.845  0.0730     1.263  0.0210     1.741  0.0160
     2.471  0.1440      3.310  0.0053
        100000.000    CURIES      DECON=  0.0

 4     KR   88  WB      440.0  0.69E-04    0   10    0
         0.028  0.1400      0.192  0.4480     0.240  0.0030     0.367  0.0360     0.472  0.0060
     0.0    0.0         0.789  0.0040     0.854  0.1550     1.185  0.0510     1.533  0.1310
        100000.000    CURIES      DECON=  0.0

 5     RB   88  WB      166.0  0.65E-03    1    4    1
         0.898  0.1500      1.836  0.2400     2.670  0.0300     2.700  0.0100
             0.0      CURIES      DECON=  0.0

 6     XE  133  WB       20.0  0.15E-05    0    3    0
         0.081  1.0100      0.160  0.0010     0.328  0.0020
        100000.000    CURIES      DECON=  0.0

 7     XE  135  WB       65.0  0.21E-04    0    3    0
         0.250  0.9700      0.360  0.0009     0.604  0.0300
        100000.000    CURIES      DECON=  0.0

 8     XE  138  WB      720.0  0.68E-03    0    3    0
         0.258  1.0000      0.434  0.4800     1.769  0.3900
        100000.000    CURIES      DECON=  0.0

 9     CS  138  WB      525.0  0.36E-03    1   10    1
         0.139  0.0200      0.229  0.0200     0.411  0.0500     0.463  0.2600     0.548  0.1000
     0.872  0.0500      1.010  0.2800     1.443  0.7300     2.218  0.1400     2.638  0.0800
             0.0      CURIES      DECON=  0.0

10     KR  85M  SKN      55.0  0.45E-04    0    0    0
        100000.000    CURIES      DECON=  0.0

11     KR   85  SKN      57.0  0.20E-06    0    0    1
        100000.000    CURIES      DECON=  0.0

12     KR   87  SKN     330.0  0.15E-03    0    0    0
        100000.000    CURIES      DECON=  0.0

13     KR   88  SKN      92.0  0.69E-04    0    0    0
        100000.000    CURIES      DECON=  0.0
```

```
14     RB   88  SKN       77.0  0.65E-03   1     0     1
          0.0        CURIES      DECON=  0.0

15     XE  133  SKN       31.5  0.15E-05   0     0     0
       100000.000    CURIES      DECON=  0.0

16     XE  135  SKN       76.6  0.21E-04   0     0     0
       100000.000    CURIES      DECON=  0.0

17     XE  138  SKN      240.0  0.68E-03   0     0     0
       100000.000    CURIES      DECON=  0.0

18     CS  138  SKN       22.5  0.36E-03   1     0     1
          0.0        CURIES      DECON=  0.0

19      I  131 IATY  105000.0  0.10E-05   1     0     0
          100.000    CURIES      DECON=  0.0

20      I  131 IATY  105000.0  0.10E-05   2     0     0
          100.000    CURIES      DECON=  0.0


EGAD FOR: HS= 100.M  HL= 1000.M  SGMX= 2000.M  RHO=1293.GM/M**3  NG=22  NS=28
NGAM,NSIG
  22   28
GAMEN IN MEV
  0.1000E-01  0.1500E-01  0.2000E-01  0.3000E-01  0.4000E-01  0.5000E-01  0.6000E-01  0.8000E-01
  0.1000E+00  0.1500E+00  0.2000E+00  0.3000E+00  0.4000E+00  0.5000E+00  0.6000E+00  0.8000E+00
  0.1000E+01  0.1500E+01  0.2000E+01  0.3000E+01  0.4000E+01  0.5000E+01
SIGZM IN METERS
  0.1000E+01  0.1500E+01  0.2000E+01  0.3000E+01  0.4000E+01  0.5000E+01  0.6000E+01  0.8000E+01
  0.1000E+02  0.1500E+02  0.2000E+02  0.3000E+02  0.4000E+02  0.5000E+02  0.6000E+02  0.8000E+02
  0.1000E+03  0.1500E+03  0.2000E+03  0.3000E+03  0.4000E+03  0.5000E+03  0.6000E+03  0.8000E+03
  0.1000E+04  0.1500E+04  0.2000E+04  0.3000E+04
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.010 MEV
  0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0
  0.0         0.0         0.4775E-13  0.1658E-06  0.1275E-05  0.2859E-05  0.4016E-05  0.4417E-05
  0.3720E-05  0.1800E-05  0.8147E-06  0.4408E-06  0.3387E-06  0.2743E-06  0.2319E-06  0.1894E-06
  0.1776E-06  0.1752E-06  0.1752E-06  0.1752E-06
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.015 MEV
  0.2419E-12  0.3395E-12  0.4581E-12  0.6878E-12  0.9676E-12  0.1333E-11  0.1778E-11  0.3502E-11
  0.7513E-11  0.9302E-10  0.1719E-08  0.3848E-06  0.2876E-05  0.6729E-05  0.1001E-04  0.1315E-04
  0.1337E-04  0.1043E-04  0.7611E-05  0.5106E-05  0.3924E-05  0.3178E-05  0.2686E-05  0.2194E-05
  0.2058E-05  0.2030E-05  0.2030E-05  0.2030E-05
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.020 MEV
  0.2044E-07  0.2066E-07  0.2124E-07  0.2307E-07  0.2608E-07  0.2847E-07  0.3093E-07  0.3663E-07
  0.4556E-07  0.7613E-07  0.1286E-06  0.8994E-06  0.4512E-05  0.9897E-05  0.1458E-04  0.1927E-04
  0.2002E-04  0.1677E-04  0.1328E-04  0.9318E-05  0.7162E-05  0.5801E-05  0.4903E-05  0.4006E-05
  0.3757E-05  0.3706E-05  0.3706E-05  0.3706E-05
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.030 MEV
  0.1816E-05  0.1823E-05  0.1826E-05  0.1846E-05  0.1860E-05  0.1878E-05  0.1900E-05  0.1977E-05
  0.2056E-05  0.2361E-05  0.2887E-05  0.5325E-05  0.1102E-04  0.1820E-04  0.2425E-04  0.3052E-04
  0.3160E-04  0.2734E-04  0.2233E-04  0.1590E-04  0.1223E-04  0.9913E-05  0.8383E-05  0.6851E-05
  0.6427E-05  0.6341E-05  0.6341E-05  0.6341E-05
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.040 MEV
  0.9427E-05  0.9433E-05  0.9441E-05  0.9465E-05  0.9499E-05  0.9542E-05  0.9593E-05  0.9731E-05
  0.9904E-05  0.1056E-04  0.1157E-04  0.1519E-04  0.2162E-04  0.2905E-04  0.3521E-04  0.4155E-04
  0.4241E-04  0.3690E-04  0.3052E-04  0.2191E-04  0.1689E-04  0.1370E-04  0.1160E-04  0.9486E-05
  0.8901E-05  0.8782E-05  0.8782E-05  0.8782E-05
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.050 MEV
  0.2062E-04  0.2062E-04  0.2063E-04  0.2067E-04  0.2071E-04  0.2077E-04  0.2084E-04  0.2101E-04
```

```
  0.2124E-04  0.2207E-04  0.2329E-04  0.2732E-04  0.3374E-04  0.4088E-04  0.4669E-04  0.5255E-04
  0.5297E-04  0.4613E-04  0.3847E-04  0.2779E-04  0.2148E-04  0.1744E-04  0.1477E-04  0.1209E-04
  0.1135E-04  0.1120E-04  0.1120E-04  0.1120E-04
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.060 MEV
  0.3280E-04  0.3281E-04  0.3282E-04  0.3285E-04  0.3290E-04  0.3297E-04  0.3304E-04  0.3324E-04
  0.3350E-04  0.3441E-04  0.3573E-04  0.3993E-04  0.4633E-04  0.5329E-04  0.5890E-04  0.6434E-04
  0.6429E-04  0.5603E-04  0.4695E-04  0.3411E-04  0.2642E-04  0.2148E-04  0.1820E-04  0.1492E-04
  0.1401E-04  0.1383E-04  0.1383E-04  0.1383E-04
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.080 MEV
  0.5550E-04  0.5551E-04  0.5552E-04  0.5556E-04  0.5561E-04  0.5568E-04  0.5577E-04  0.5599E-04
  0.5627E-04  0.5726E-04  0.5869E-04  0.6314E-04  0.6976E-04  0.7686E-04  0.8251E-04  0.8762E-04
  0.8676E-04  0.7568E-04  0.6381E-04  0.4673E-04  0.3631E-04  0.2958E-04  0.2510E-04  0.2061E-04
  0.1937E-04  0.1911E-04  0.1911E-04  0.1911E-04
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.100 MEV
  0.7684E-04  0.7685E-04  0.7687E-04  0.7691E-04  0.7697E-04  0.7705E-04  0.7715E-04  0.7739E-04
  0.7770E-04  0.7879E-04  0.8037E-04  0.8527E-04  0.9261E-04  0.1005E-03  0.1067E-03  0.1121E-03
  0.1106E-03  0.9664E-04  0.8177E-04  0.6015E-04  0.4686E-04  0.3823E-04  0.3247E-04  0.2670E-04
  0.2509E-04  0.2477E-04  0.2477E-04  0.2477E-04
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.150 MEV
  0.1224E-03  0.1224E-03  0.1224E-03  0.1225E-03  0.1225E-03  0.1226E-03  0.1228E-03  0.1231E-03
  0.1235E-03  0.1249E-03  0.1269E-03  0.1334E-03  0.1433E-03  0.1542E-03  0.1627E-03  0.1698E-03
  0.1673E-03  0.1465E-03  0.1245E-03  0.9211E-04  0.7200E-04  0.5885E-04  0.5006E-04  0.4123E-04
  0.3878E-04  0.3828E-04  0.3828E-04  0.3828E-04
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.200 MEV
  0.1653E-03  0.1654E-03  0.1654E-03  0.1654E-03  0.1655E-03  0.1657E-03  0.1658E-03  0.1662E-03
  0.1667E-03  0.1684E-03  0.1709E-03  0.1790E-03  0.1918E-03  0.2057E-03  0.2167E-03  0.2258E-03
  0.2224E-03  0.1952E-03  0.1662E-03  0.1235E-03  0.9675E-04  0.7919E-04  0.6743E-04  0.5560E-04
  0.5232E-04  0.5165E-04  0.5165E-04  0.5165E-04
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.300 MEV
  0.2456E-03  0.2457E-03  0.2457E-03  0.2458E-03  0.2459E-03  0.2461E-03  0.2463E-03  0.2468E-03
  0.2475E-03  0.2499E-03  0.2533E-03  0.2647E-03  0.2829E-03  0.3030E-03  0.3189E-03  0.3319E-03
  0.3270E-03  0.2876E-03  0.2456E-03  0.1832E-03  0.1438E-03  0.1179E-03  0.1005E-03  0.8298E-04
  0.7812E-04  0.7713E-04  0.7713E-04  0.7713E-04
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.400 MEV
  0.3238E-03  0.3238E-03  0.3238E-03  0.3240E-03  0.3241E-03  0.3243E-03  0.3246E-03  0.3253E-03
  0.3261E-03  0.3292E-03  0.3337E-03  0.3484E-03  0.3721E-03  0.3986E-03  0.4194E-03  0.4365E-03
  0.4303E-03  0.3792E-03  0.3247E-03  0.2430E-03  0.1912E-03  0.1570E-03  0.1339E-03  0.1108E-03
  0.1043E-03  0.1030E-03  0.1030E-03  0.1030E-03
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.500 MEV
  0.4001E-03  0.4002E-03  0.4002E-03  0.4003E-03  0.4005E-03  0.4008E-03  0.4011E-03  0.4019E-03
  0.4029E-03  0.4066E-03  0.4121E-03  0.4300E-03  0.4592E-03  0.4917E-03  0.5173E-03  0.5385E-03
  0.5309E-03  0.4687E-03  0.4020E-03  0.3017E-03  0.2379E-03  0.1955E-03  0.1670E-03  0.1382E-03
  0.1303E-03  0.1287E-03  0.1286E-03  0.1286E-03
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.600 MEV
  0.4773E-03  0.4773E-03  0.4774E-03  0.4776E-03  0.4778E-03  0.4781E-03  0.4785E-03  0.4794E-03
  0.4806E-03  0.4850E-03  0.4914E-03  0.5125E-03  0.5470E-03  0.5855E-03  0.6158E-03  0.6408E-03
  0.6320E-03  0.5587E-03  0.4800E-03  0.3611E-03  0.2851E-03  0.2346E-03  0.2005E-03  0.1662E-03
  0.1567E-03  0.1548E-03  0.1547E-03  0.1547E-03
DOSEI IN RAD METERS**2 PER CURIE SEC AT 0.800 MEV
  0.6295E-03  0.6296E-03  0.6297E-03  0.6299E-03  0.6302E-03  0.6305E-03  0.6310E-03  0.6322E-03
  0.6338E-03  0.6393E-03  0.6475E-03  0.6747E-03  0.7190E-03  0.7683E-03  0.8071E-03  0.8391E-03
  0.8275E-03  0.7332E-03  0.6317E-03  0.4774E-03  0.3780E-03  0.3116E-03  0.2668E-03  0.2216E-03
  0.2091E-03  0.2065E-03  0.2065E-03  0.2065E-03
DOSEI IN RAD METERS**2 PER CURIE SEC AT 1.000 MEV
  0.7820E-03  0.7820E-03  0.7821E-03  0.7823E-03  0.7827E-03  0.7831E-03  0.7836E-03  0.7851E-03
  0.7869E-03  0.7935E-03  0.8033E-03  0.8359E-03  0.8889E-03  0.9480E-03  0.9943E-03  0.1032E-02
  0.1018E-02  0.9034E-03  0.7804E-03  0.5921E-03  0.4700E-03  0.3882E-03  0.3328E-03  0.2770E-03
  0.2616E-03  0.2584E-03  0.2584E-03  0.2584E-03
DOSEI IN RAD METERS**2 PER CURIE SEC AT 1.500 MEV
  0.1150E-02  0.1150E-02  0.1150E-02  0.1150E-02  0.1151E-02  0.1152E-02  0.1152E-02  0.1154E-02
  0.1157E-02  0.1166E-02  0.1179E-02  0.1223E-02  0.1294E-02  0.1373E-02  0.1434E-02  0.1483E-02
```

```
    0.1462E-02   0.1302E-02   0.1131E-02   0.8658E-03   0.6913E-03   0.5734E-03   0.4934E-03   0.4126E-03
    0.3902E-03   0.3856E-03   0.3856E-03   0.3856E-03
DOSEI IN RAD METERS**2 PER CURIF SEC AT 2.000 MEV
    0.1486E-02   0.1486E-02   0.1486E-02   0.1487E-02   0.1487E-02   0.1488E-02   0.1489E-02   0.1491E-02
    0.1494E-02   0.1505E-02   0.1521E-02   0.1573E-02   0.1658E-02   0.1752E-02   0.1826E-02   0.1883E-02
    0.1855E-02   0.1657E-02   0.1445E-02   0.1115E-02   0.8945E-03   0.7447E-03   0.6427E-03   0.5396E-03
    0.5110E-03   0.5052E-03   0.5052E-03   0.5052E-03
DOSEI IN RAD METERS**2 PER CURIF SEC AT 3.000 MEV
    0.2114E-02   0.2114E-02   0.2114E-02   0.2115E-02   0.2115E-02   0.2116E-02   0.2117E-02   0.2120E-02
    0.2124E-02   0.2138E-02   0.2158E-02   0.2225E-02   0.2334E-02   0.2455E-02   0.2548E-02   0.2619E-02
    0.2579E-02   0.2313E-02   0.2029E-02   0.1581E-02   0.1279E-02   0.1071E-02   0.9292E-03   0.7853E-03
    0.7454E-03   0.7373E-03   0.7373E-03   0.7373E-03
DOSEI IN RAD METERS**2 PER CURIF SEC AT 4.000 MEV
    0.2680E-02   0.2680E-02   0.2681E-02   0.2681E-02   0.2682E-02   0.2683E-02   0.2685E-02   0.2688E-02
    0.2693E-02   0.2709E-02   0.2733E-02   0.2812E-02   0.2941E-02   0.3082E-02   0.3192E-02   0.3273E-02
    0.3223E-02   0.2899E-02   0.2553E-02   0.2006E-02   0.1633E-02   0.1374E-02   0.1197E-02   0.1018E-02
    0.9678E-03   0.9577E-03   0.9576E-03   0.9576E-03
DOSEI IN RAD METERS**2 PER CURIF SEC AT 5.000 MEV
    0.3212E-02   0.3212E-02   0.3212E-02   0.3213E-02   0.3214E-02   0.3215E-02   0.3217E-02   0.3221E-02
    0.3226E-02   0.3245E-02   0.3272E-02   0.3363E-02   0.3510E-02   0.3673E-02   0.3798E-02   0.3890E-02
    0.3830E-02   0.3451E-02   0.3048E-02   0.2406E-02   0.1965E-02   0.1659E-02   0.1449E-02   0.1236E-02
    0.1176E-02   0.1164E-02   0.1164E-02   0.1164E-02
```

OUTPUT DATA:

SIGMA ZEE'S BY STABILITY CLASS AND RADIUS

A	B	C	D	E	F
0.37E+02	0.26E+02	0.17E+02	0.10E+02	0.76E+01	0.50E+01
0.15E+03	0.63E+02	0.38E+02	0.21E+02	0.15E+02	0.97E+01
0.69E+03	0.13E+03	0.73E+02	0.35E+02	0.24E+02	0.16E+02
0.29E+04	0.28E+03	0.14E+03	0.57E+02	0.37E+02	0.24E+02
0.81E+04	0.49E+03	0.22E+03	0.79E+02	0.50E+02	0.31E+02
0.10E+05	0.72E+03	0.30E+03	0.98E+02	0.60E+02	0.37E+02
0.10E+05	0.96E+03	0.37E+03	0.11E+03	0.68E+02	0.41E+02
0.10E+05	0.17E+04	0.59E+03	0.15E+03	0.87E+02	0.51E+02
0.10E+05	0.38E+04	0.11E+04	0.23E+03	0.12E+03	0.65E+02
0.10E+05	0.71E+04	0.18E+04	0.29E+03	0.14E+03	0.75E+02
0.10E+05	0.10E+05	0.24E+04	0.35E+03	0.16E+03	0.81E+02
0.10E+05	0.10E+05	0.31E+04	0.39E+03	0.17E+03	0.86E+02

CHI/Q SUMMED OVER STABILITY CLASSES

DIR	250.	600.	1208.	2414.	4020.	DISTANCE (METERS) 5630.	7250.	12000.	24000.	40000.	56000.	72400.
N	3.05E-08	8.94E-08	1.20E-08	4.18E-09	2.51E-09	1.79E-09	1.39E-09	8.42E-10	4.21E-10	2.52E-10	1.80E-10	1.39E-10
NNE	8.48E-10	7.68E-08	4.77E-08	1.41E-08	5.02E-09	2.48E-09	1.45E-09	8.42E-10	4.21E-10	2.52E-10	1.80E-10	1.39E-10
NE	1.09E-13	1.47E-08	4.49E-08	2.35E-08	1.04E-08	5.74E-09	3.61E-09	1.41E-09	4.21E-10	2.52E-10	1.80E-10	1.39E-10
ENE	4.37E-26	7.88E-12	3.99E-09	1.56E-08	1.44E-08	1.09E-08	8.35E-09	4.45E-09	1.70E-09	8.15E-10	5.02E-10	3.47E-10
E	1.85E-43	1.70E-16	6.59E-11	3.14E-09	6.91E-09	7.53E-09	7.04E-09	5.03E-09	2.51E-09	1.40E-09	9.38E-10	6.91E-10
ESE	3.02E-49	1.93E-29	6.64E-16	2.36E-11	4.62E-10	1.20E-09	1.78E-09	2.40E-09	1.99E-09	1.39E-09	1.05E-09	8.29E-10
SE	3.39E-10	3.07E-08	1.91E-08	5.62E-09	2.01E-09	9.93E-10	5.81E-10	3.37E-10	1.68E-10	1.01E-10	7.21E-11	5.58E-11
SSE	4.36E-14	5.86E-09	1.79E-08	9.41E-09	4.17E-09	2.29E-09	1.44E-09	5.62E-10	1.68E-10	1.01E-10	7.21E-11	5.58E-11
S	1.75E-26	3.15E-12	1.60E-09	6.23E-09	5.74E-09	4.37E-09	3.34E-09	1.78E-09	6.79E-10	3.26E-10	2.01E-10	1.39E-10
SSW	7.39E-44	6.78E-17	2.63E-11	1.26E-09	2.76E-09	3.01E-09	2.82E-09	2.01E-09	1.00E-09	5.59E-10	3.75E-10	2.76E-10
SW	1.21E-49	7.70E-30	2.66E-16	9.44E-12	1.85E-10	4.79E-10	7.14E-10	9.61E-10	7.95E-10	5.57E-10	4.19E-10	3.32E-10
WSW	1.70E-10	1.54E-08	9.53E-09	2.81E-09	1.00E-09	4.96E-10	2.91E-10	1.68E-10	8.42E-11	5.05E-11	3.61E-11	2.79E-11
W	2.18E-14	2.93E-09	8.97E-09	4.70E-09	2.08E-09	1.15E-09	7.22E-10	2.81E-10	8.42E-11	5.05E-11	3.61E-11	2.79E-11
WNW	8.75E-27	1.58E-12	7.98E-10	3.11E-09	2.87E-09	2.19E-09	1.67E-09	8.90E-10	3.40E-10	1.63E-10	1.00E-10	6.94E-11
NW	3.69E-44	3.39E-17	1.32E-11	6.28E-10	1.38E-09	1.51E-09	1.41E-09	1.01E-09	5.02E-10	2.79E-10	1.88E-10	1.38E-10
NNW	6.05E-50	3.85E-30	1.33E-16	4.72E-12	9.25E-11	2.39E-10	3.57E-10	4.80E-10	3.98E-10	2.79E-10	2.10E-10	1.66E-10

ACTIVITY DENSITY AT END OF RELEASE PERIOD FOR A UNIFORM RELEASE RATE
PICOCURIES/M**2 OF RB 88
DRY DEPOSITION

SECTOR

DISTANCE (METERS)	N	NNE	NE	ENE	E	ESE	SE	SSE	AREAS(M**2) OF SECTOR-SEGMENTS
250.	58.	2.	0.	0.	0.	0.	0.	0.	0.295E+05
600.	386.	332.	63.	0.	0.	0.	57.	11.	0.958E+05
1208.	94.	372.	351.	31.	1.	0.	68.	64.	0.382E+06
2414.	53.	178.	299.	199.	40.	0.	37.	61.	0.153E+07
4020.	41.	82.	170.	236.	114.	8.	19.	40.	0.254E+07
5630.	33.	45.	103.	198.	137.	22.	12.	28.	0.356E+07
7250.	26.	27.	67.	155.	132.	34.	8.	20.	0.458E+07
12000.	15.	15.	24.	77.	88.	42.	6.	10.	0.382E+08
24000.	5.	5.	5.	20.	30.	24.	3.	3.	0.153E+09
40000.	2.	2.	2.	6.	10.	10.	2.	2.	0.254E+09
56000.	1.	1.	1.	2.	4.	4.	1.	1.	0.356E+09
72400.	0.	0.	0.	1.	2.	2.	1.	1.	0.458E+09

DISTANCE (METERS)	S	SSW	SW	WSW	W	WNW	NW	NNW	CURIES DEPOSITED WITHIN RADII
250.	0.	0.	0.	0.	0.	0.	0.	0.	0.361E-01
600.	0.	0.	0.	14.	3.	0.	0.	0.	0.172E+01
1208.	6.	0.	0.	18.	17.	1.	0.	0.	0.963E+01
2414.	41.	8.	0.	10.	17.	11.	2.	0.	0.392E+02
4020.	56.	27.	2.	6.	12.	16.	8.	1.	0.824E+02
5630.	53.	37.	6.	4.	8.	16.	11.	2.	0.134E+03
7250.	47.	40.	10.	3.	6.	15.	13.	3.	0.190E+03
12000.	31.	35.	17.	2.	4.	11.	13.	6.	0.497E+03
24000.	12.	18.	15.	1.	1.	6.	9.	7.	0.101E+04
40000.	5.	9.	9.	1.	1.	3.	5.	5.	0.137E+04
56000.	2.	5.	5.	1.	1.	2.	3.	4.	0.163E+04
72400.	1.	3.	3.	0.	0.	1.	2.	3.	0.183E+04

TOTAL CURIES OF RB 88 DEPOSITED ON THE GROUND WITHIN 80500. METERS IS 1826.356 CURIES
OUT OF A TOTAL OF 0.0 CURIES DISPERSED DURING THIS PERIOD.

ACTIVITY DENSITY AT END OF RELEASE PERIOD FOR A UNIFORM RELEASE RATE
PICOCURIES/M**2 OF RB 88
WET DEPOSITION

WASHOUT COEF = 2.00E-04 RAINFALL FREQUENCY = 5.00E-02

SECTOR

DISTANCE (METERS)	N	NNE	NE	ENE	E	ESE	SE	SSE	AREAS(M**2) OF SECTOR-SEGMENTS
250.	190.	190.	190.	190.	190.	190.	32.	32.	0.295E+05
600.	173.	173.	173.	173.	173.	173.	31.	31.	0.958E+05
1208.	146.	146.	146.	146.	146.	146.	29.	29.	0.382E+06
2414.	106.	106.	106.	106.	106.	106.	25.	25.	0.153E+07
4020.	70.	70.	70.	70.	70.	70.	21.	21.	0.254E+07
5630.	47.	47.	47.	47.	47.	47.	18.	18.	0.356E+07
7250.	32.	32.	32.	32.	32.	32.	15.	15.	0.458E+07
12000.	11.	11.	11.	11.	11.	11.	9.	9.	0.382E+08
24000.	1.	1.	1.	1.	1.	1.	3.	3.	0.153E+09
40000.	0.	0.	0.	0.	0.	0.	1.	1.	0.254E+09
56000.	0.	0.	0.	0.	0.	0.	0.	0.	0.356E+09
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.458E+09

DISTANCE (METERS)	S	SSW	SW	WSW	W	WNW	NW	NNW	CURIES DEPOSITED WITHIN RADII
250.	32.	32.	32.	8.	8.	8.	8.	8.	0.801E+00
600.	31.	31.	31.	8.	8.	8.	8.	8.	0.319E+01
1208.	29.	29.	29.	8.	8.	8.	8.	8.	0.114E+02
2414.	25.	25.	25.	7.	7.	7.	7.	7.	0.361E+02
4020.	21.	21.	21.	7.	7.	7.	7.	7.	0.649E+02
5630.	18.	18.	18.	6.	6.	6.	6.	6.	0.938E+02
7250.	15.	15.	15.	5.	5.	5.	5.	5.	0.121E+03
12000.	9.	9.	9.	4.	4.	4.	4.	4.	0.226E+03
24000.	3.	3.	3.	2.	2.	2.	2.	2.	0.330E+03
40000.	1.	1.	1.	1.	1.	1.	1.	1.	0.381E+03
56000.	0.	0.	0.	1.	1.	1.	1.	1.	0.410E+03
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.426E+03

TOTAL CURIES OF RB 88 DEPOSITED ON THE GROUND WITHIN 80500. METERS IS 426.029 CURIES
OUT OF A TOTAL OF 0.0 CURIES DISPERSED DURING RAINFALL.

ACTIVITY DENSITY AT END OF RELEASE PERIOD FOR A UNIFORM RELEASE RATE
PICOCURIES/M**2 OF CS 138
DRY DEPOSITION

SECTOR

DISTANCE (METERS)	N	NNE	NE	ENE	E	ESE	SE	SSE	AREAS(M**2) OF SECTOR-SEGMENTS
250.	57.	2.	0.	0.	0.	0.	0.	0.	0.295E+05
600.	368.	316.	60.	0.	0.	0.	56.	11.	0.958E+05
1208.	85.	336.	317.	28.	0.	0.	65.	61.	0.382E+06
2414.	43.	145.	243.	162.	33.	0.	34.	56.	0.153E+07
4020.	29.	57.	118.	164.	79.	5.	17.	35.	0.254E+07
5630.	19.	26.	60.	116.	81.	13.	10.	23.	0.356E+07
7250.	13.	13.	33.	76.	65.	17.	6.	16.	0.458E+07
12000.	4.	4.	7.	21.	24.	12.	4.	6.	0.382E+08
24000.	0.	0.	0.	1.	2.	1.	1.	1.	0.153E+09
40000.	0.	0.	0.	0.	0.	0.	0.	0.	0.254E+09
56000.	0.	0.	0.	0.	0.	0.	0.	0.	0.356E+09
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.458E+09

DISTANCE (METERS)	S	SSW	SW	WSW	W	WNW	NW	NNW	CURIES DEPOSITED WITHIN RADII
250.	0.	0.	0.	0.	0.	0.	0.	0.	0.196E-01
600.	0.	0.	0.	14.	3.	0.	0.	0.	0.910E+00
1208.	5.	0.	0.	17.	16.	1.	0.	0.	0.492E+01
2414.	38.	8.	0.	10.	16.	11.	2.	0.	0.186E+02
4020.	49.	23.	2.	5.	11.	15.	7.	0.	0.362E+02
5630.	44.	30.	5.	3.	8.	15.	10.	2.	0.548E+02
7250.	36.	31.	8.	2.	6.	13.	11.	3.	0.728E+02
12000.	20.	22.	11.	2.	3.	9.	10.	5.	0.143E+03
24000.	5.	7.	5.	1.	1.	4.	6.	4.	0.211E+03
40000.	1.	1.	1.	0.	0.	1.	2.	2.	0.243E+03
56000.	0.	0.	0.	0.	0.	1.	1.	1.	0.259E+03
72400.	0.	0.	0.	0.	0.	0.	0.	1.	0.267E+03

TOTAL CURIES OF CS 138 DEPOSITED ON THE GROUND WITHIN 80500. METERS IS 267.428 CURIES
OUT OF A TOTAL OF 0.0 CURIES DISPERSED DURING THIS PERIOD.

ACTIVITY DENSITY AT END OF RELEASE PERIOD FOR A UNIFORM RELEASE RATE
PICOCURIES/M**2 OF CS 138
WET DEPOSITION

WASHOUT COEF = 2.00E-04 RAINFALL FREQUENCY = 5.00E-02

SECTOR

DISTANCE (METERS)	N	NNE	NE	ENE	E	ESE	SE	SSE	AREAS(M**2) OF SECTOR-SEGMENTS
250.	186.	186.	186.	186.	186.	186.	31.	31.	0.295E+05
600.	164.	164.	164.	164.	164.	164.	30.	30.	0.958E+05
1208.	132.	132.	132.	132.	132.	132.	27.	27.	0.382E+06
2414.	86.	86.	86.	86.	86.	86.	23.	23.	0.153E+07
4020.	49.	49.	49.	49.	49.	49.	18.	18.	0.254E+07
5630.	28.	28.	28.	28.	28.	28.	15.	15.	0.356E+07
7250.	16.	16.	16.	16.	16.	16.	12.	12.	0.458E+07
12000.	3.	3.	3.	3.	3.	3.	6.	6.	0.382E+08
24000.	0.	0.	0.	0.	0.	0.	1.	1.	0.153E+09
40000.	0.	0.	0.	0.	0.	0.	0.	0.	0.254E+09
56000.	0.	0.	0.	0.	0.	0.	0.	0.	0.356E+09
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.458E+09

DISTANCE (METERS)	S	SSW	SW	WSW	W	WNW	NW	NNW	CURIES DEPOSITED WITHIN RADII
250.	31.	31.	31.	8.	8.	8.	8.	8.	0.436E+00
600.	30.	30.	30.	8.	8.	8.	8.	8.	0.170E+01
1208.	27.	27.	27.	7.	7.	7.	7.	7.	0.585E+01
2414.	23.	23.	23.	7.	7.	7.	7.	7.	0.173E+02
4020.	18.	18.	18.	6.	6.	6.	6.	6.	0.292E+02
5630.	15.	15.	15.	5.	5.	5.	5.	5.	0.398E+02
7250.	12.	12.	12.	5.	5.	5.	5.	5.	0.490E+02
12000.	6.	6.	6.	3.	3.	3.	3.	3.	0.772E+02
24000.	1.	1.	1.	1.	1.	1.	1.	1.	0.100E+03
40000.	0.	0.	0.	0.	C.	0.	0.	0.	0.109E+03
56000.	0.	0.	0.	0.	0.	0.	0.	0.	0.113E+03
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.114E+03

TOTAL CURIES OF CS 138 DEPOSITED ON THE GROUND WITHIN 80500. METERS IS 114.364 CURIES
OUT OF A TOTAL OF 0.0 CURIES DISPERSED DURING RAINFALL.

ACTIVITY DENSITY AT END OF RELEASE PERIOD FOR A UNIFORM RELEASE RATE
PICOCURIES/M**2 OF RB 88
DRY DEPOSITION

SECTOR

DISTANCE (METERS)	N	NNE	NE	ENE	E	ESE	SE	SSE	AREAS(M**2) OF SECTOR-SEGMENTS
250.	58.	2.	0.	0.	0.	0.	0.	0.	0.295E+05
600.	386.	332.	63.	0.	0.	0.	57.	11.	0.958E+05
1208.	94.	372.	351.	31.	1.	0.	68.	64.	0.382E+06
2414.	53.	178.	299.	199.	40.	0.	37.	61.	0.153E+07
4020.	41.	82.	170.	236.	114.	8.	19.	40.	0.254E+07
5630.	33.	45.	103.	198.	137.	22.	12.	28.	0.356E+07
7250.	26.	27.	67.	155.	132.	34.	8.	20.	0.458E+07
12000.	15.	15.	24.	77.	88.	42.	6.	10.	0.382E+08
24000.	5.	5.	5.	20.	30.	24.	3.	3.	0.153E+09
40000.	2.	2.	2.	6.	10.	10.	2.	2.	0.254E+09
56000.	1.	1.	1.	2.	4.	4.	1.	1.	0.356E+09
72400.	0.	0.	0.	1.	2.	2.	1.	1.	0.458E+09

DISTANCE (METERS)	S	SSW	SW	WSW	W	WNW	NW	NNW	CURIES DEPOSITED WITHIN RADII
250.	0.	0.	0.	0.	0.	0.	0.	0.	0.361E-01
600.	0.	0.	0.	14.	3.	0.	0.	0.	0.172E+01
1208.	6.	0.	0.	18.	17.	1.	0.	0.	0.963E+01
2414.	41.	8.	0.	10.	17.	11.	2.	0.	0.392E+02
4020.	56.	27.	2.	6.	12.	16.	8.	1.	0.824E+02
5630.	53.	37.	6.	4.	8.	16.	11.	2.	0.134E+03
7250.	47.	40.	10.	3.	6.	15.	13.	3.	0.190E+03
12000.	31.	35.	17.	2.	4.	11.	13.	6.	0.497E+03
24000.	12.	18.	15.	1.	1.	6.	9.	7.	0.101E+04
40000.	5.	9.	9.	1.	1.	3.	5.	5.	0.137E+04
56000.	2.	5.	5.	1.	1.	2.	3.	4.	0.163E+04
72400.	1.	3.	3.	0.	0.	1.	2.	3.	0.183E+04

TOTAL CURIES OF RB 88 DEPOSITED ON THE GROUND WITHIN 80500. METERS IS 1826.356 CURIES
OUT OF A TOTAL OF 0.0 CURIES DISPERSED DURING THIS PERIOD.

ACTIVITY DENSITY AT END OF RELEASE PERIOD FOR A UNIFORM RELEASE RATE
PICOCURIES/M**2 OF RB 88
WET DEPOSITION

WASHOUT COEF = 2.00E-04 RAINFALL FREQUENCY = 5.00E-02

SECTOR

DISTANCE (METERS)	N	NNE	NE	ENE	E	ESE	SE	SSE	AREAS(M**2) OF SECTOR-SEGMENTS
250.	190.	190.	190.	190.	190.	190.	32.	32.	0.295E+05
600.	173.	173.	173.	173.	173.	173.	31.	31.	0.958E+05
1208.	146.	146.	146.	146.	146.	146.	29.	29.	0.382E+06
2414.	106.	106.	106.	106.	106.	106.	25.	25.	0.153E+07
4020.	70.	70.	70.	70.	70.	70.	21.	21.	0.254E+07
5630.	47.	47.	47.	47.	47.	47.	18.	18.	0.356E+07
7250.	32.	32.	32.	32.	32.	32.	15.	15.	0.458E+07
12000.	11.	11.	11.	11.	11.	11.	9.	9.	0.382E+08
24000.	1.	1.	1.	1.	1.	1.	3.	3.	0.153E+09
40000.	0.	0.	0.	0.	0.	0.	1.	1.	0.254E+09
56000.	0.	0.	0.	0.	0.	0.	0.	0.	0.356E+09
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.458E+09

DISTANCE (METERS)	S	SSW	SW	WSW	W	WNW	NW	NNW	CURIES DEPOSITED WITHIN RADII
250.	32.	32.	32.	8.	8.	8.	8.	8.	0.801E+00
600.	31.	31.	31.	8.	8.	8.	8.	8.	0.319E+01
1208.	29.	29.	29.	8.	8.	8.	8.	8.	0.114E+02
2414.	25.	25.	25.	7.	7.	7.	7.	7.	0.361E+02
4020.	21.	21.	21.	7.	7.	7.	7.	7.	0.649E+02
5630.	18.	18.	18.	6.	6.	6.	6.	6.	0.938E+02
7250.	15.	15.	15.	5.	5.	5.	5.	5.	0.121E+03
12000.	9.	9.	9.	4.	4.	4.	4.	4.	0.226E+03
24000.	3.	3.	3.	2.	2.	2.	2.	2.	0.330E+03
40000.	1.	1.	1.	1.	1.	1.	1.	1.	0.381E+03
56000.	0.	0.	0.	1.	1.	1.	1.	1.	0.410E+03
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.426E+03

TOTAL CURIES OF RB 88 DEPOSITED ON THE GROUND WITHIN 80500. METERS IS 426.029 CURIES
OUT OF A TOTAL OF 0.0 CURIES DISPERSED DURING RAINFALL.

ACTIVITY DENSITY AT END OF RELEASE PERIOD FOR A UNIFORM RELEASE RATE
PICOCURIES/M**2 OF CS 138
DRY DEPOSITION

SECTOR

DISTANCE (METERS)	N	NNE	NE	ENE	E	ESE	SE	SSE	AREAS(M**2) OF SECTOR-SEGMENTS
250.	57.	2.	0.	0.	0.	0.	0.	0.	0.295E+05
600.	368.	316.	60.	0.	0.	0.	56.	11.	0.958E+05
1208.	85.	336.	317.	28.	0.	0.	65.	61.	0.382E+06
2414.	43.	145.	243.	162.	33.	0.	34.	56.	0.153E+07
4020.	29.	57.	118.	164.	79.	5.	17.	35.	0.254E+07
5630.	19.	26.	60.	116.	81.	13.	10.	23.	0.356E+07
7250.	13.	13.	33.	76.	65.	17.	6.	16.	0.458E+07
12000.	4.	4.	7.	21.	24.	12.	4.	6.	0.382E+08
24000.	0.	0.	0.	1.	2.	1.	1.	1.	0.153E+09
40000.	0.	0.	0.	0.	0.	0.	0.	0.	0.254E+09
56000.	0.	0.	0.	0.	0.	0.	0.	0.	0.356E+09
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.458E+09

DISTANCE (METERS)	S	SSW	SW	WSW	W	WNW	NW	NNW	CURIES DEPOSITED WITHIN RADII
250.	0.	0.	0.	0.	0.	0.	0.	0.	0.196E-01
600.	0.	0.	0.	14.	3.	0.	0.	0.	0.910E+00
1208.	5.	0.	0.	17.	16.	1.	0.	0.	0.492E+01
2414.	38.	8.	0.	10.	16.	11.	2.	0.	0.186E+02
4020.	49.	23.	2.	5.	11.	15.	7.	0.	0.362E+02
5630.	44.	30.	5.	3.	8.	15.	10.	2.	0.548E+02
7250.	36.	31.	8.	2.	6.	13.	11.	3.	0.728E+02
12000.	20.	22.	11.	2.	3.	9.	10.	5.	0.143E+03
24000.	5.	7.	5.	1.	1.	4.	6.	4.	0.211E+03
40000.	1.	1.	1.	0.	0.	1.	2.	2.	0.243E+03
56000.	0.	0.	0.	0.	0.	1.	1.	1.	0.259E+03
72400.	0.	0.	0.	0.	0.	0.	0.	1.	0.267E+03

TOTAL CURIES OF CS 138 DEPOSITED ON THE GROUND WITHIN 80500. METERS IS 267.428 CURIES
OUT OF A TOTAL OF 0.0 CURIES DISPERSED DURING THIS PERIOD.

ACTIVITY DENSITY AT END OF RELEASE PERIOD FOR A UNIFORM RELEASE RATE
PICOCURIES/M**2 OF CS 138
WET DEPOSITION

WASHOUT COEF = 2.00E-04   RAINFALL FREQUENCY = 5.00E-02

SECTOR

DISTANCE (METERS)	N	NNE	NE	ENE	E	ESE	SE	SSE	AREAS(M**2) OF SECTOR-SEGMENTS
250.	186.	186.	186.	186.	186.	186.	31.	31.	0.295E+05
600.	164.	164.	164.	164.	164.	164.	30.	30.	0.958E+05
1208.	132.	132.	132.	132.	132.	132.	27.	27.	0.382E+06
2414.	86.	86.	86.	86.	86.	86.	23.	23.	0.153E+07
4020.	49.	49.	49.	49.	49.	49.	18.	18.	0.254E+07
5630.	28.	28.	28.	28.	28.	28.	15.	15.	0.356E+07
7250.	16.	16.	16.	16.	16.	16.	12.	12.	0.458E+07
12000.	3.	3.	3.	3.	3.	3.	6.	6.	0.382E+08
24000.	0.	0.	0.	0.	0.	0.	1.	1.	0.153E+09
40000.	0.	0.	0.	0.	0.	0.	0.	0.	0.254E+09
56000.	0.	0.	0.	0.	0.	0.	0.	0.	0.356E+09
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.458E+09

DISTANCE (METERS)	S	SSW	SW	WSW	W	WNW	NW	NNW	CURIES DEPOSITED WITHIN RADII
250.	31.	31.	31.	8.	8.	8.	8.	8.	0.436E+00
600.	30.	30.	30.	8.	8.	8.	8.	8.	0.170E+01
1208.	27.	27.	27.	7.	7.	7.	7.	7.	0.585E+01
2414.	23.	23.	23.	7.	7.	7.	7.	7.	0.173E+02
4020.	18.	18.	18.	6.	6.	6.	6.	6.	0.292E+02
5630.	15.	15.	15.	5.	5.	5.	5.	5.	0.398E+02
7250.	12.	12.	12.	5.	5.	5.	5.	5.	0.490E+02
12000.	6.	6.	6.	3.	3.	3.	3.	3.	0.772E+02
24000.	1.	1.	1.	1.	1.	1.	1.	1.	0.100E+03
40000.	0.	0.	0.	0.	0.	0.	0.	0.	0.109E+03
56000.	0.	0.	0.	0.	0.	0.	0.	0.	0.113E+03
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.114E+03

TOTAL CURIES OF CS 138 DEPOSITED ON THE GROUND WITHIN 80500. METERS IS 114.364 CURIES
OUT OF A TOTAL OF 0.0 CURIES DISPERSED DURING RAINFALL.

ACTIVITY DENSITY AT END OF RELEASE PERIOD FOR A UNIFORM RELEASE RATE
PICOCURIES/M**2 OF I 131
DRY DEPOSITION

SECTOR

DISTANCE (METERS)	N	NNE	NE	ENE	E	ESE	SE	SSE	AREAS(M**2) OF SECTOR-SEGMENTS
250.	489.	14.	0.	0.	0.	0.	5.	0.	0.295E+05
600.	1431.	1230.	235.	0.	0.	0.	492.	94.	0.958E+05
1208.	191.	761.	718.	64.	1.	0.	305.	287.	0.382E+06
2414.	66.	222.	373.	249.	50.	0.	90.	150.	0.153E+07
4020.	40.	78.	162.	227.	110.	7.	32.	66.	0.254E+07
5630.	28.	38.	88.	169.	119.	19.	16.	36.	0.356E+07
7250.	22.	22.	55.	127.	110.	28.	9.	23.	0.458E+07
12000.	13.	13.	21.	66.	77.	38.	5.	9.	0.382E+08
24000.	6.	6.	6.	23.	34.	30.	3.	3.	0.153E+09
40000.	4.	4.	4.	10.	15.	18.	2.	2.	0.254E+09
56000.	3.	2.	2.	5.	9.	11.	1.	1.	0.356E+09
72400.	2.	2.	2.	3.	5.	7.	1.	1.	0.458E+09

DISTANCE (METERS)	S	SSW	SW	WSW	W	WNW	NW	NNW	CURIES DEPOSITED WITHIN RADII
250.	0.	0.	0.	3.	0.	0.	0.	0.	0.469E-03
600.	0.	0.	0.	246.	47.	0.	0.	0.	0.118E-01
1208.	26.	0.	0.	153.	144.	13.	0.	0.	0.435E-01
2414.	100.	20.	0.	45.	75.	50.	10.	0.	0.115E+00
4020.	91.	44.	3.	16.	33.	46.	22.	1.	0.193E+00
5630.	69.	48.	8.	8.	18.	35.	24.	4.	0.274E+00
7250.	52.	45.	11.	5.	11.	26.	22.	6.	0.356E+00
12000.	28.	32.	15.	3.	4.	14.	16.	8.	0.786E+00
24000.	10.	15.	12.	1.	1.	5.	8.	6.	0.160E+01
40000.	5.	8.	8.	1.	1.	2.	4.	4.	0.231E+01
56000.	3.	5.	6.	1.	1.	1.	3.	3.	0.293E+01
72400.	2.	3.	4.	0.	0.	1.	2.	2.	0.348E+01

TOTAL CURIES OF I 131 DEPOSITED ON THE GROUND WITHIN 80500. METERS IS 3.477 CURIES
OUT OF A TOTAL OF 16.000 CURIES DISPERSED DURING THIS PERIOD.

ACTIVITY DENSITY AT END OF RELEASE PERIOD FOR A UNIFORM RELEASE RATE
PICOCURIES/M**2 OF I 131
WET DEPOSITION

WASHOUT COEF = 2.00E-04 RAINFALL FREQUENCY = 5.00E-02

SECTOR

DISTANCE (METERS)	N	NNE	NE	ENE	E	ESE	SE	SSE	AREAS(M**2) OF SECTOR-SEGMENTS
250.	1592.	1592.	1592.	1592.	1592.	1592.	646.	646.	0.295E+05
600.	640.	640.	640.	640.	640.	640.	266.	266.	0.958E+05
1208.	299.	299.	299.	299.	299.	299.	129.	129.	0.382E+06
2414.	133.	133.	133.	133.	133.	133.	61.	61.	0.153E+07
4020.	68.	68.	68.	68.	68.	68.	35.	35.	0.254E+07
5630.	41.	41.	41.	41.	41.	41.	23.	23.	0.356E+07
7250.	27.	27.	27.	27.	27.	27.	17.	17.	0.458E+07
12000.	10.	10.	10.	10.	10.	10.	8.	8.	0.382E+08
24000.	2.	2.	2.	2.	2.	2.	3.	3.	0.153E+09
40000.	0.	0.	0.	0.	0.	0.	1.	1.	0.254E+09
56000.	0.	0.	0.	0.	0.	0.	0.	0.	0.356E+09
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.458E+09

	S	SSW	SW	WSW	W	WNW	NW	NNW	CURIES DEPOSITED WITHIN RADII
250.	646.	646.	646.	325.	325.	325.	325.	325.	0.132E-01
600.	266.	266.	266.	134.	134.	134.	134.	134.	0.307E-01
1208.	129.	129.	129.	66.	66.	66.	66.	66.	0.637E-01
2414.	61.	61.	61.	32.	32.	32.	32.	32.	0.124E+00
4020.	35.	35.	35.	19.	19.	19.	19.	19.	0.177E+00
5630.	23.	23.	23.	13.	13.	13.	13.	13.	0.225E+00
7250.	17.	17.	17.	10.	10.	10.	10.	10.	0.267E+00
12000.	8.	8.	8.	5.	5.	5.	5.	5.	0.422E+00
24000.	3.	3.	3.	2.	2.	2.	2.	2.	0.577E+00
40000.	1.	1.	1.	1.	1.	1.	1.	1.	0.654E+00
56000.	0.	0.	0.	0.	0.	0.	0.	0.	0.699E+00
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.727E+00

TOTAL CURIES OF I 131 DEPOSITED ON THE GROUND WITHIN 80500. METERS IS 0.727 CURIES
OUT OF A TOTAL OF 0.800 CURIES DISPERSED DURING RAINFALL.

ACTIVITY DENSITY AT END OF RELEASE PERIOD FOR A UNIFORM RELEASE RATE
PICOCURIES/M**2 OF I 131
DRY DEPOSITION

SECTOR

DISTANCE (METERS)	N	NNE	NE	ENE	E	ESE	SE	SSE	AREAS(M**2) OF SECTOR-SEGMENTS
250.	1955.	54.	0.	0.	0.	0.	22.	0.	0.295E+05
600.	5718.	4921.	939.	1.	0.	0.	1969.	376.	0.958E+05
1208.	754.	3009.	2866.	255.	4.	0.	1215.	1149.	0.382E+06
2414.	260.	855.	1450.	994.	201.	2.	353.	594.	0.153E+07
4020.	154.	292.	596.	872.	438.	30.	124.	255.	0.254E+07
5630.	109.	140.	310.	615.	460.	76.	61.	138.	0.356E+07
7250.	83.	81.	187.	433.	407.	113.	35.	85.	0.458E+07
12000.	50.	46.	70.	213.	271.	149.	20.	33.	0.382E+08
24000.	23.	21.	19.	53.	83.	100.	10.	9.	0.153E+09
40000.	12.	11.	10.	12.	11.	28.	6.	5.	0.254E+09
56000.	7.	7.	6.	4.	2.	6.	4.	4.	0.356E+09
72400.	5.	5.	4.	2.	1.	1.	3.	3.	0.458E+09

DISTANCE (METERS)	S	SSW	SW	WSW	W	WNW	NW	NNW	CURIES DEPOSITED WITHIN RADII
250.	0.	0.	0.	11.	0.	0.	0.	0.	0.188E-02
600.	0.	0.	0.	984.	188.	0.	0.	0.	0.470E-01
1208.	102.	2.	0.	609.	575.	51.	1.	0.	0.173E+00
2414.	399.	81.	1.	178.	299.	199.	40.	0.	0.455E+00
4020.	360.	176.	12.	63.	131.	182.	88.	6.	0.755E+00
5630.	266.	189.	31.	31.	71.	137.	96.	15.	0.106E+01
7250.	197.	173.	45.	18.	44.	103.	88.	23.	0.136E+01
12000.	102.	120.	61.	10.	17.	54.	62.	31.	0.292E+01
24000.	33.	51.	46.	5.	5.	19.	29.	24.	0.546E+01
40000.	13.	20.	25.	3.	3.	8.	14.	15.	0.700E+01
56000.	7.	9.	13.	2.	2.	5.	8.	10.	0.807E+01
72400.	4.	5.	7.	2.	2.	3.	5.	6.	0.888E+01

TOTAL CURIES OF I 131 DEPOSITED ON THE GROUND WITHIN 80500. METERS IS 8.883 CURIES
OUT OF A TOTAL OF 16.000 CURIES DISPERSED DURING THIS PERIOD.

ACTIVITY DENSITY AT END OF RELEASE PERIOD FOR A UNIFORM RELEASE RATE
PICOCURIES/M**2 OF I 131
WET DEPOSITION

WASHOUT COEF = 2.00E-04 RAINFALL FREQUENCY = 5.00E-02

SECTOR

DISTANCE (METERS)	N	NNE	NE	ENE	E	ESE	SE	SSE	AREAS(M**2) OF SECTOR-SEGMENTS
250.	1592.	1592.	1592.	1592.	1592.	1592.	646.	646.	0.295E+05
600.	640.	640.	640.	640.	640.	640.	266.	266.	0.958E+05
1208.	299.	299.	299.	299.	299.	299.	129.	129.	0.382E+06
2414.	133.	133.	133.	133.	133.	133.	61.	61.	0.153E+07
4020.	68.	68.	68.	68.	68.	68.	35.	35.	0.254E+07
5630.	41.	41.	41.	41.	41.	41.	23.	23.	0.356E+07
7250.	27.	27.	27.	27.	27.	27.	17.	17.	0.458E+07
12000.	10.	10.	10.	10.	10.	10.	8.	8.	0.382E+08
24000.	2.	2.	2.	2.	2.	2.	3.	3.	0.153E+09
40000.	0.	0.	0.	0.	0.	0.	1.	1.	0.254E+09
56000.	0.	0.	0.	0.	0.	0.	0.	0.	0.356E+09
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.458E+09

DISTANCE (METERS)	S	SSW	SW	WSW	W	WNW	NW	NNW	CURIES DEPOSITED WITHIN RADII
250.	646.	646.	646.	325.	325.	325.	325.	325.	0.132E-01
600.	266.	266.	266.	134.	134.	134.	134.	134.	0.307E-01
1208.	129.	129.	129.	66.	66.	66.	66.	66.	0.637E-01
2414.	61.	61.	61.	32.	32.	32.	32.	32.	0.124E+00
4020.	35.	35.	35.	19.	19.	19.	19.	19.	0.177E+00
5630.	23.	23.	23.	13.	13.	13.	13.	13.	0.225E+00
7250.	17.	17.	17.	10.	10.	10.	10.	10.	0.267E+00
12000.	8.	8.	8.	5.	5.	5.	5.	5.	0.422E+00
24000.	3.	3.	3.	2.	2.	2.	2.	2.	0.577E+00
40000.	1.	1.	1.	1.	1.	1.	1.	1.	0.654E+00
56000.	0.	0.	0.	0.	0.	0.	0.	0.	0.699E+00
72400.	0.	0.	0.	0.	0.	0.	0.	0.	0.727E+00

TOTAL CURIES OF I 131 DEPOSITED ON THE GROUND WITHIN 80500. METERS IS 0.727 CURIES
OUT OF A TOTAL OF 0.800 CURIES DISPERSED DURING RAINFALL.

DOSE TO AN INDIVIDUAL IN THE INDICATED COMPASS SECTOR AND ANNULAR RING (MREM)

DIST	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
250.	12.90	12.11	11.74	11.59	11.54	11.52	4.82	4.67	4.61	4.59	4.58	2.41	2.33	2.30	2.29	2.29
600.	5.53	6.19	5.45	4.98	4.91	4.86	2.46	2.16	1.98	1.95	1.93	1.22	1.08	0.98	0.97	0.96
1208.	0.94	2.90	3.14	2.66	2.52	2.45	1.15	1.25	1.06	1.00	0.97	0.57	0.62	0.53	0.50	0.48
2414.	0.39	0.95	1.41	1.48	1.33	1.24	0.39	0.57	0.60	0.54	0.50	0.19	0.29	0.30	0.27	0.25
4020.	0.22	0.34	0.64	0.88	0.81	0.72	0.14	0.27	0.38	0.35	0.31	0.07	0.14	0.19	0.18	0.16
5630.	0.15	0.17	0.34	0.58	0.56	0.49	0.08	0.16	0.27	0.26	0.23	0.04	0.08	0.13	0.13	0.12
7250.	0.10	0.11	0.20	0.40	0.41	0.36	0.05	0.10	0.20	0.20	0.18	0.03	0.05	0.10	0.10	0.09
12000.	0.05	0.05	0.06	0.17	0.19	0.18	0.03	0.04	0.10	0.11	0.11	0.02	0.02	0.05	0.06	0.06
24000.	0.01	0.01	0.01	0.04	0.06	0.06	0.01	0.01	0.03	0.04	0.04	0.01	0.01	0.02	0.03	0.03
40000.	0.01	0.01	0.01	0.01	0.02	0.02	0.00	0.00	0.01	0.02	0.02	0.00	0.00	0.01	0.01	0.01
56000.	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01
72400.	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01

POPULATION DOSE IN THE INDICATED COMPASS SECTOR AND ANNULAR RING (MAN-REM)
AVERAGED TO CONFORM TO THE POPULATION WHEEL WIND SECTORS
FOR THE ESTIMATED POPULATION

DIST	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	RUNNING TOTAL
400.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
805.	0.06	0.06	0.05	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.48
1610.	0.03	0.09	0.09	0.08	0.08	0.07	0.03	0.04	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	1.16
3220.	0.05	0.11	0.17	0.18	0.16	0.15	0.05	0.07	0.07	0.06	0.06	0.02	0.03	0.04	0.03	0.03	2.44
4830.	0.04	0.07	0.13	0.18	0.16	0.14	0.03	0.05	0.08	0.07	0.06	0.01	0.03	0.04	0.04	0.03	3.60
6440.	0.04	0.05	0.09	0.16	0.16	0.14	0.02	0.04	0.07	0.07	0.06	0.01	0.02	0.04	0.04	0.03	4.66
8050.	0.04	0.04	0.07	0.14	0.15	0.13	0.02	0.04	0.07	0.07	0.06	0.01	0.02	0.04	0.04	0.03	5.61
16100.	0.15	0.15	0.19	0.51	0.58	0.54	0.09	0.11	0.30	0.34	0.32	0.05	0.06	0.16	0.19	0.17	9.53
32200.	0.18	0.18	0.18	0.50	0.68	0.70	0.13	0.13	0.38	0.50	0.52	0.09	0.09	0.24	0.33	0.33	14.69
48300.	0.11	0.11	0.11	0.26	0.41	0.45	0.10	0.10	0.23	0.35	0.39	0.07	0.07	0.17	0.26	0.29	18.15
64400.	0.08	0.08	0.08	0.16	0.27	0.32	0.07	0.07	0.16	0.26	0.30	0.06	0.06	0.13	0.21	0.24	20.69
80500.	0.06	0.06	0.06	0.10	0.19	0.23	0.06	0.06	0.11	0.20	0.24	0.05	0.05	0.10	0.17	0.21	22.64

THE CONTRIBUTING RADIONUCLIDES ARE

ISOTOPE	CRITICAL ORGAN	DCF	CURIES RELEASED	DECAY CONSTANT (1/SEC)	DECON FACTOR
KR 85M	WB	46.00	100000.000	0.45E-04	1.00
KR 85	WB	0.56	100000.000	0.20E-08	1.00
KR 87	WB	370.00	100000.000	0.15E-03	1.00
KR 88	WB	440.00	100000.000	0.69E-04	1.00
RB 88	WB	166.00	0.0	0.65E-03	1.00
XE 133	WB	20.00	100000.000	0.15E-05	1.00
XE 135	WB	65.00	100000.000	0.21E-04	1.00
XE 138	WB	720.00	100000.000	0.68E-03	1.00
CS 138	WB	525.00	0.0	0.36E-03	1.00
		TOTAL CI.	.700E+06		

DOSE TO AN INDIVIDUAL IN THE INDICATED COMPASS SECTOR AND ANNULAR RING (MREM)

DIST	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
250.	2.63	0.07	0.00	0.0	0.0	0.0	0.03	0.00	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0
600.	7.47	6.42	1.23	0.00	0.0	0.0	2.65	0.51	0.00	0.0	0.0	1.34	0.26	0.00	0.0	0.0
1208.	0.95	3.79	3.56	0.32	0.01	0.0	1.61	1.52	0.13	0.00	0.0	0.82	0.77	0.07	0.00	0.0
2414.	0.30	1.02	1.71	1.13	0.23	0.00	0.46	0.76	0.50	0.10	0.00	0.24	0.40	0.26	0.05	0.00
4020.	0.16	0.33	0.68	0.94	0.45	0.03	0.15	0.32	0.44	0.21	0.01	0.08	0.17	0.24	0.11	0.01
5630.	0.11	0.15	0.34	0.65	0.45	0.07	0.07	0.17	0.32	0.22	0.04	0.04	0.09	0.17	0.12	0.02
7250.	0.08	0.08	0.20	0.46	0.39	0.10	0.04	0.10	0.23	0.20	0.05	0.02	0.06	0.13	0.11	0.03
12000.	0.04	0.04	0.06	0.20	0.23	0.11	0.02	0.04	0.11	0.13	0.06	0.01	0.02	0.06	0.07	0.03
24000.	0.01	0.01	0.01	0.05	0.08	0.06	0.01	0.01	0.03	0.05	0.04	0.01	0.01	0.02	0.03	0.02
40000.	0.01	0.01	0.01	0.02	0.03	0.03	0.00	0.00	0.01	0.02	0.02	0.00	0.00	0.01	0.01	0.01
56000.	0.00	0.00	0.00	0.01	0.02	0.02	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01
72400.	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01

POPULATION DOSE IN THE INDICATED COMPASS SECTOR AND ANNULAR RING (MAN-REM)
AVERAGED TO CONFORM TO THE POPULATION WHEEL WIND SECTORS
FOR THE ESTIMATED POPULATION

DIST	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	RUNNING TOTAL
400.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
805.	0.07	0.06	0.01	0.00	0.0	0.0	0.03	0.01	0.00	0.0	0.0	0.01	0.00	0.00	0.0	0.0	0.20
1610.	0.03	0.11	0.11	0.01	0.00	0.0	0.05	0.05	0.00	0.00	0.0	0.02	0.02	0.00	0.00	0.0	0.61
3220.	0.04	0.12	0.20	0.14	0.03	0.00	0.05	0.09	0.06	0.01	0.00	0.03	0.05	0.03	0.01	0.00	1.47
4830.	0.03	0.07	0.14	0.19	0.09	0.01	0.03	0.06	0.09	0.04	0.00	0.02	0.03	0.05	0.02	0.00	2.34
6440.	0.03	0.04	0.10	0.18	0.13	0.02	0.02	0.05	0.09	0.06	0.01	0.01	0.03	0.05	0.03	0.01	3.19
8050.	0.03	0.03	0.07	0.17	0.14	0.04	0.01	0.04	0.08	0.07	0.02	0.01	0.02	0.05	0.04	0.01	4.01
16100.	0.11	0.11	0.19	0.61	0.68	0.33	0.06	0.11	0.33	0.38	0.18	0.04	0.06	0.19	0.22	0.10	7.72
32200.	0.16	0.16	0.16	0.63	0.94	0.74	0.10	0.10	0.41	0.60	0.48	0.06	0.06	0.25	0.38	0.30	13.25
48300.	0.11	0.11	0.11	0.36	0.62	0.62	0.08	0.08	0.26	0.44	0.44	0.05	0.05	0.17	0.30	0.30	17.35
64400.	0.09	0.09	0.09	0.25	0.46	0.52	0.07	0.07	0.18	0.34	0.38	0.05	0.05	0.13	0.25	0.27	20.63
80500.	0.07	0.07	0.07	0.19	0.37	0.45	0.06	0.06	0.14	0.27	0.33	0.04	0.04	0.10	0.21	0.25	23.35

THE CONTRIBUTING RADIONUCLIDES ARE

ISOTOPE	CRITICAL ORGAN	DCF	CURIES RELEASED	DECAY CONSTANT (1/SEC)	DECON FACTOR
KR 85M	SKN	55.00	100000.000	0.45E-04	1.00
KR 85	SKN	57.00	100000.000	0.20E-06	1.00
KR 87	SKN	330.00	100000.000	0.15E-03	1.00
KR 88	SKN	92.00	100000.000	0.69E-04	1.00
RB 88	SKN	77.00	0.0	0.65E-03	1.00
XE 133	SKN	31.50	100000.000	0.15E-05	1.00
XE 135	SKN	76.60	100000.000	0.21E-04	1.00
XE 138	SKN	240.00	100000.000	0.68E-03	1.00
CS 138	SKN	22.50	0.0	0.36E-03	1.00
		TOTAL CI.	.700E+06		

DOSE TO AN INDIVIDUAL IN THE INDICATED COMPASS SECTOR AND ANNULAR RING (MREM)

DIST	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
250.	0.96	0.03	0.00	0.0	0.0	0.0	0.01	0.00	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0
600.	2.81	2.42	0.46	0.00	0.0	0.0	0.97	0.18	0.00	0.0	0.0	0.48	0.09	0.00	0.0	0.0
1208.	0.38	1.50	1.41	0.13	0.00	0.0	0.60	0.56	0.05	0.00	0.0	0.30	0.28	0.03	0.00	0.0
2414.	0.13	0.44	0.73	0.49	0.10	0.00	0.18	0.30	0.20	0.04	0.00	0.09	0.15	0.10	0.02	0.00
4020.	0.08	0.15	0.32	0.45	0.22	0.01	0.06	0.13	0.18	0.09	0.01	0.03	0.07	0.09	0.04	0.00
5630.	0.06	0.08	0.17	0.33	0.23	0.04	0.03	0.07	0.14	0.09	0.02	0.02	0.04	0.07	0.05	0.01
7250.	0.04	0.04	0.11	0.25	0.22	0.06	0.02	0.04	0.10	0.09	0.02	0.01	0.02	0.05	0.04	0.01
12000.	0.03	0.03	0.04	0.13	0.15	0.07	0.01	0.02	0.05	0.06	0.03	0.01	0.01	0.03	0.03	0.02
24000.	0.01	0.01	0.01	0.05	0.07	0.06	0.01	0.01	0.02	0.03	0.02	0.00	0.00	0.01	0.02	0.01
40000.	0.01	0.01	0.01	0.02	0.03	0.03	0.00	0.00	0.01	0.02	0.02	0.00	0.00	0.00	0.01	0.01
56000.	0.00	0.00	0.00	0.01	0.02	0.02	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01
72400.	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00

POPULATION DOSE IN THE INDICATED COMPASS SECTOR AND ANNULAR RING (MAN-REM)
AVERAGED TO CONFORM TO THE POPULATION WHEEL WIND SECTORS
FOR THE ESTIMATED POPULATION

DIST	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	RUNNING TOTAL
400.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
805.	0.03	0.02	0.00	0.00	0.0	0.0	0.01	0.00	0.00	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0.07
1610.	0.01	0.04	0.04	0.00	0.00	0.0	0.02	0.02	0.00	0.00	0.0	0.01	0.01	0.00	0.00	0.0	0.23
3220.	0.02	0.05	0.09	0.06	0.01	0.00	0.02	0.04	0.02	0.00	0.00	0.01	0.02	0.01	0.00	0.00	0.59
4830.	0.02	0.03	0.06	0.09	0.04	0.00	0.01	0.03	0.04	0.02	0.00	0.01	0.01	0.02	0.01	0.00	0.97
6440.	0.02	0.02	0.05	0.09	0.07	0.01	0.01	0.02	0.04	0.03	0.00	0.00	0.01	0.02	0.01	0.00	1.37
8050.	0.02	0.02	0.04	0.09	0.08	0.02	0.01	0.02	0.04	0.03	0.01	0.00	0.01	0.02	0.02	0.00	1.78
16100.	0.08	0.08	0.12	0.39	0.45	0.22	0.03	0.05	0.16	0.19	0.09	0.02	0.03	0.08	0.09	0.05	3.91
32200.	0.15	0.15	0.14	0.54	0.81	0.70	0.06	0.06	0.24	0.36	0.29	0.03	0.03	0.12	0.18	0.15	7.95
48300.	0.15	0.14	0.14	0.37	0.61	0.69	0.06	0.06	0.18	0.31	0.32	0.03	0.03	0.10	0.16	0.17	11.47
64400.	0.14	0.14	0.13	0.29	0.47	0.60	0.06	0.06	0.15	0.27	0.31	0.03	0.03	0.08	0.15	0.17	14.54
80500.	0.13	0.13	0.13	0.23	0.37	0.49	0.06	0.06	0.13	0.23	0.29	0.03	0.03	0.07	0.14	0.17	17.23

THE CONTRIBUTING RADIONUCLIDES ARE

ISOTOPE	CRITICAL ORGAN	DCF	CURIES RELEASED	DECAY CONSTANT (1/SEC)	DECON FACTOR
I 131	IATY	315000.00	100.000	0.10E-05	1.00
		TOTAL CI.	100.		

DOSE TO AN INDIVIDUAL IN THE INDICATED COMPASS SECTOR AND ANNULAR RING (MREM)

DIST	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
250.	0.96	0.03	0.00	0.0	0.0	0.0	0.01	0.00	0.0	0.0	0.0	0.01	0.0	0.0	0.0	0.0
600.	2.81	2.42	0.46	0.00	0.0	0.0	0.97	0.18	0.00	0.0	0.0	0.48	0.09	0.00	0.0	0.0
1208.	0.37	1.48	1.41	0.13	0.00	0.0	0.60	0.56	0.05	0.00	0.0	0.30	0.28	0.03	0.00	0.0
2414.	0.13	0.42	0.71	0.49	0.10	0.00	0.17	0.29	0.20	0.04	0.00	0.09	0.15	0.10	0.02	0.00
4020.	0.08	0.14	0.29	0.43	0.22	0.01	0.06	0.13	0.18	0.09	0.01	0.03	0.06	0.09	0.04	0.00
5630.	0.05	0.07	0.15	0.30	0.23	0.04	0.03	0.07	0.13	0.09	0.02	0.02	0.03	0.07	0.05	0.01
7250.	0.04	0.04	0.09	0.21	0.20	0.06	0.02	0.04	0.10	0.09	0.02	0.01	0.02	0.05	0.04	0.01
12000.	0.02	0.02	0.03	0.10	0.13	0.07	0.01	0.02	0.05	0.06	0.03	0.01	0.01	0.03	0.03	0.02
24000.	0.01	0.01	0.01	0.03	0.04	0.05	0.00	0.00	0.02	0.02	0.02	0.00	0.00	0.01	0.01	0.01
40000.	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.01
56000.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
72400.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

POPULATION DOSE IN THE INDICATED COMPASS SECTOR AND ANNULAR RING (MAN-REM)
AVERAGED TO CONFORM TO THE POPULATION WHEEL WIND SECTORS
FOR THE ESTIMATED POPULATION

DIST	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	RUNNING TOTAL
400.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
805.	0.03	0.02	0.00	0.00	0.0	0.0	0.01	0.00	0.00	0.0	0.0	0.00	0.00	0.00	0.0	0.0	0.07
1610.	0.01	0.04	0.04	0.00	0.00	0.0	0.02	0.02	0.00	0.00	0.0	0.01	0.01	0.00	0.00	0.0	0.23
3220.	0.02	0.05	0.09	0.06	0.01	0.00	0.02	0.04	0.02	0.00	0.00	0.01	0.02	0.01	0.00	0.00	0.58
4830.	0.02	0.03	0.06	0.09	0.04	0.00	0.01	0.03	0.04	0.02	0.00	0.01	0.01	0.02	0.01	0.00	0.95
6440.	0.01	0.02	0.04	0.08	0.06	0.01	0.01	0.02	0.04	0.03	0.00	0.00	0.01	0.02	0.01	0.00	1.33
8050.	0.01	0.01	0.03	0.08	0.07	0.02	0.01	0.02	0.03	0.03	0.01	0.00	0.01	0.02	0.02	0.00	1.70
16100.	0.07	0.07	0.10	0.31	0.40	0.22	0.03	0.05	0.15	0.18	0.09	0.02	0.03	0.08	0.09	0.05	3.63
32200.	0.14	0.13	0.11	0.32	0.49	0.59	0.06	0.06	0.20	0.30	0.27	0.03	0.03	0.11	0.17	0.14	6.77
48300.	0.12	0.11	0.10	0.12	0.11	0.27	0.05	0.05	0.12	0.19	0.24	0.03	0.03	0.08	0.13	0.15	8.68
64400.	0.10	0.09	0.08	0.06	0.03	0.09	0.05	0.05	0.09	0.13	0.18	0.03	0.03	0.06	0.11	0.13	10.01
80500.	0.09	0.08	0.07	0.04	0.01	0.02	0.05	0.05	0.07	0.09	0.13	0.03	0.03	0.05	0.09	0.11	11.01

THE CONTRIBUTING RADIONUCLIDES ARE

ISOTOPE	CRITICAL ORGAN	DCF	CURIES RELEASED	DECAY CONSTANT (1/SEC)	DECON FACTOR
I 131	IATY	315000.00	100.000	0.10E-05	1.00
		TOTAL CI.	100.		

PROBLEM SUMMARY

FACILITY	PERIOD FROM	PERIOD TO	ENERGY (MW-D(TH))	MONTHS OF OPERATION	TOTAL FREQUENCY	TOTAL POPULATION	HOLDUP (DAYS)	HEFF (METERS)
SAMPLE PROBLEM	JAN 1972	DEC 1972	200000.	12.00	16.0	1600000.	0.0	100.

RADIONUCLIDE CONTRIBUTIONS TO THE TOTAL POPULATION DOSE ARE

KR	85M	WB	1.90 MAN REM
KR	85	WB	0.04 MAN REM
KR	87	WB	3.17 MAN REM
KR	88	WB	4.00 MAN REM
RB	88	WB	4.78 MAN REM
XE	133	WB	1.39 MAN REM
XE	135	WB	3.51 MAN REM
XE	138	WB	1.46 MAN REM
CS	138	WB	2.39 MAN REM
KR	85M	SKN	2.07 MAN REM
KR	85	SKN	3.79 MAN REM
KR	87	SKN	5.67 MAN REM
KR	88	SKN	2.75 MAN REM
RB	88	SKN	2.21 MAN REM
XE	133	SKN	2.05 MAN REM
XE	135	SKN	3.81 MAN REM
XE	138	SKN	0.90 MAN REM
CS	138	SKN	0.09 MAN REM
I	131	IATY	5.74 MAN REM
I	131	IATY	3.67 MAN REM

APPENDIX B

Dose Integral Calculations, Input Variables,
Input Data Description, Modified EGAD Listing,
and Dose Integral Tables

DOSE INTEGRAL CALCULATIONS

For the calculation of whole body doses due to gamma rays emanating from radionuclides in the overhead airborne cloud (cloud gamma doses), AIREM can utilize dose integrals obtained from a model that considers the finite extent of the cloud. A set of dose integrals obtained from one such model is included in this Appendix, as well as a short discussion and listing of the code used to generate the dose integrals.

Gamma doses are calculated using a sector-average diffusion model based on a crosswind integrated gaussian plume constrained between the ground and an inversion lid. A slightly modified and corrected version of Cooper's EGAD code (B1) may be used to produce a table of dose integrals appropriate to the effective stack height and lid height (H_{lid}) for the facility. The table of dose integrals is interpolated by AIREM for specific gamma energies and vertical dispersion coefficients. The energy and dispersion values used in generating the table are approximately logrithmic in sequence.

Cooper's original program has been modified so that vertical dispersion parameter σ_z values are input data rather than program generated values. Cooper assumes a concentration which is uniform in the horizontal plane and gaussian with reflections from the ground and lid in the vertical direction. The geometry of EGAD is illustrated in figure B1. Buildup factors are calculated using a third order polynomial fitted to experimental data. The three-dimensional integration is reduced to two dimensions by an explicit integration in one direction in terms of modified Bessel functions. The remaining integrations are performed by gaussian quadrature.

The assumption that the horizontal concentration is uniform means that the dose contribution from an adjacent sector will be accounted for as if it had the same concentration distribution as the sector of interest. Contributions from adjacent sectors are seldom a consideration at distances greater than 1000 meters. If one is dealing with a uniform wind rose, calculations based on dose integrals (DI's) are valid for distances greater than 200 meters from a 100-meter stack. Variations in the parameter DI/E (where E is the gamma energy in MeV) with stack height and σ_z's are illustrated in figure B2. Dose integral tables for typical effective release heights are presented in this Appendix.

In AIREM, cloud gamma doses are calculated using the dose integral tables if NWB>0, and if NGAMMA is greater than zero on a radionuclide card; otherwise, the dose conversion factor on the card will be used for the calculations.

Note that cloud depletion by deposition is not considered in EGAD. For normal wind speeds (~5 m/s), deposition velocities less than 1 cm/s and a mixture of stability classes, this does not represent a major source of error.

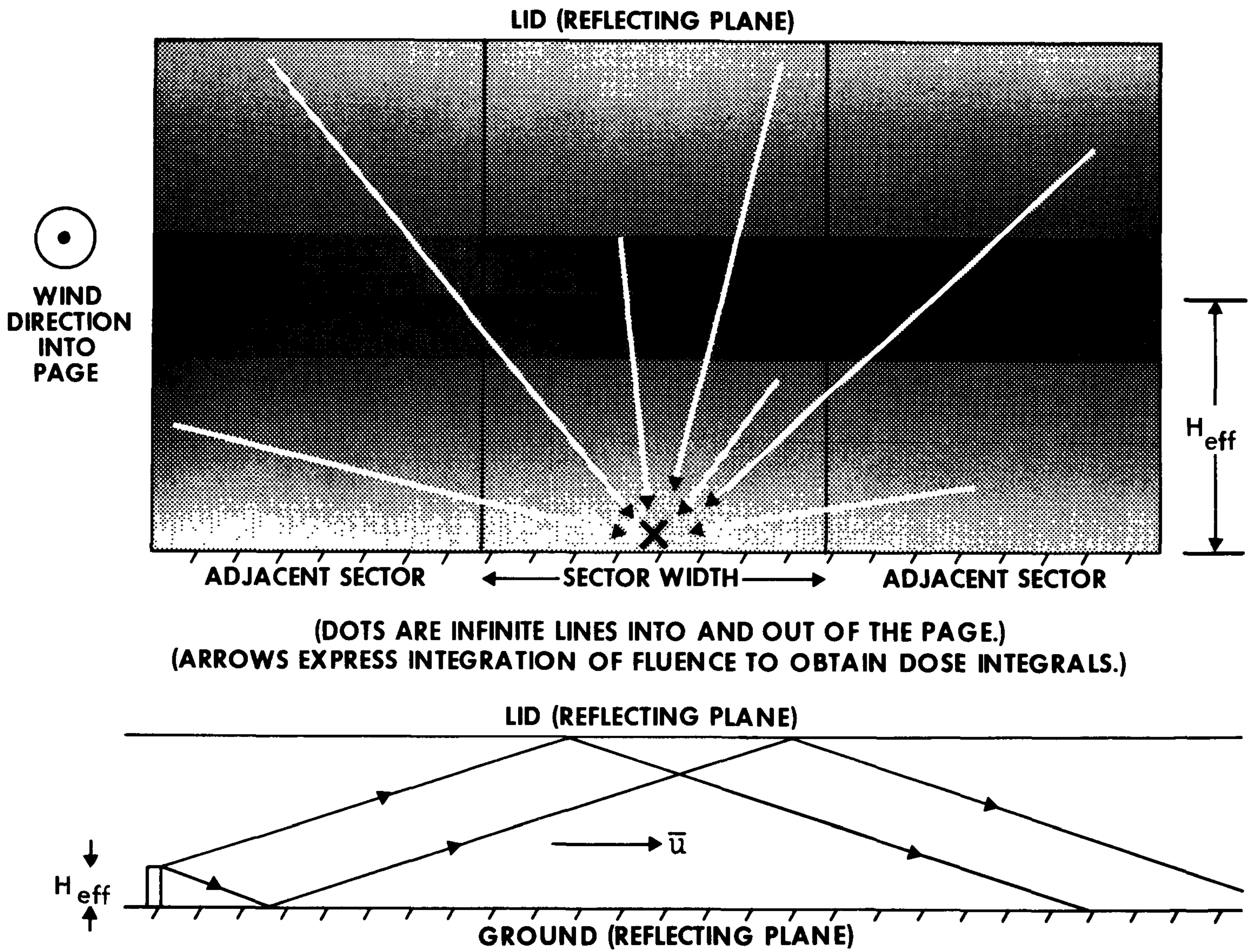


Figure B1. Geometry of EGAD

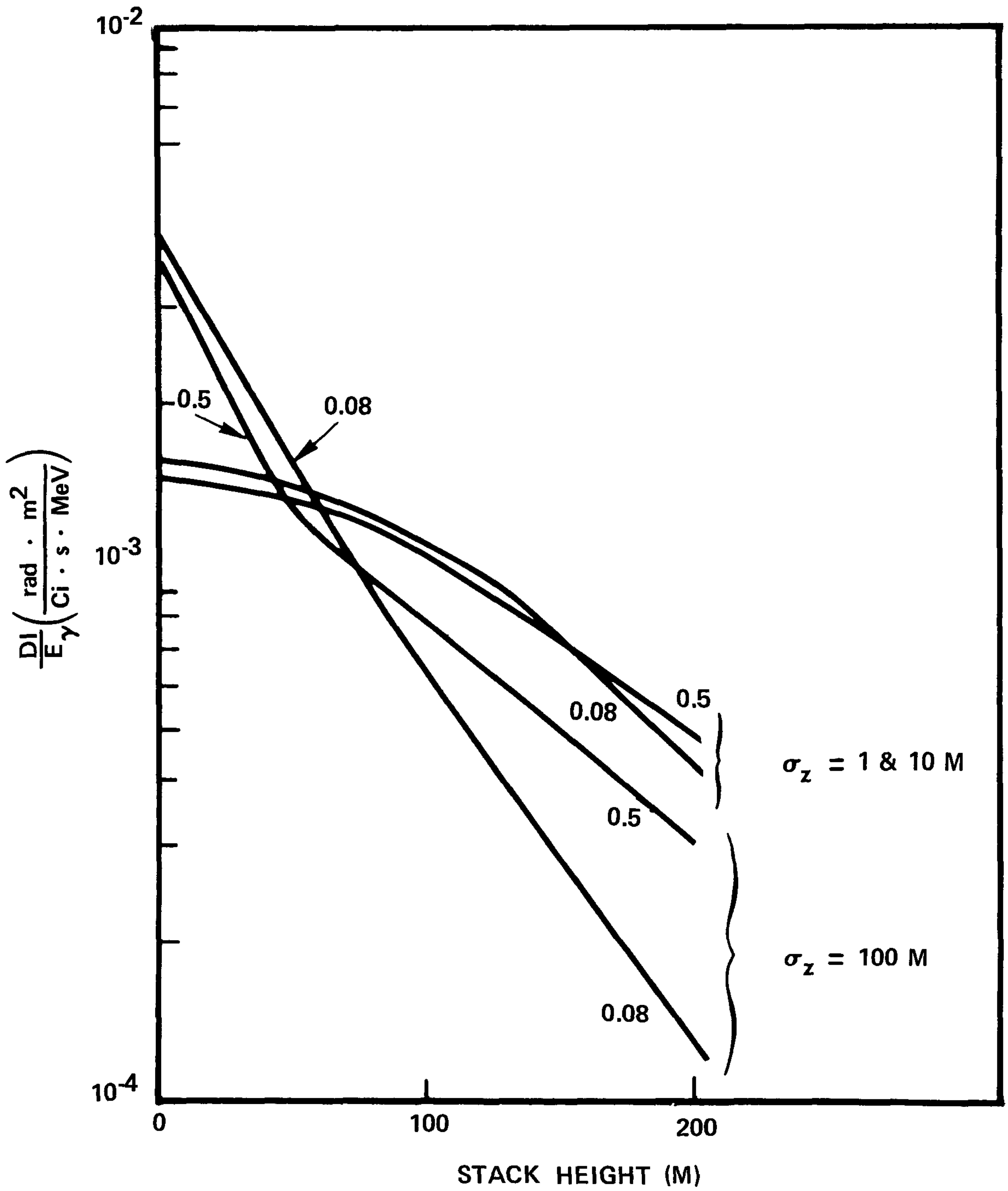


Figure B2. Illustration of EGAD normalized dose integrals as a function of stack height for σ_z = 1, 10, and 100 m, and E_γ = 0.08 and 0.5 MeV

	Definition
Card type 1.	Eighty characters are read into TITLE and become a heading for the printed output and the first card for the punched output.
Card type 2.	NGAM is the number of gamma energies which will be used to generate the dose integral table $1 < NGAM < 32$. NSIG is the number of vertical dispersion coefficients (σ_z's) which will be used to generate the dose integral table $1 < NSIG < 32$. NFLG is the punch flag. If NFLG = 1, the output is punched as well as printed. If NFLG = 0, the output only is printed.
Card type 3.	There must be NGAM cards. Each contains the following data: GAMEN is the gamma energy in MeV. GMU is the corresponding mass attenuation coefficient (μ/ρ) for air in cm^2/gm (B2). GNU is the mass energy absorption coefficient (μ_{en}/ρ) for muscle in cm^2/g (B3). COF(1,I), COF(2,I), COF(3,I) are the polynomial coefficients for the buildup factor as given by Cooper (B1).
Card type 4.	SIGMA is the vertical dispersion coefficient in meters. There are NSIG values of SIGMA, eight per card.
Card type 5.	HS is the effective stack height in meters (called H in AIREM). This is usually the sum of the physical stack height and plume rise, less ground altitude. HL is the lid height in meters. When the vertical dispersion coefficient is greater than SGMX, a uniform distribution between the ground and the lid is used for the calculation. Typically SGMX is set to 2 • HL. RHO is the density of air in g/m^3 (RHO = 1293 at STP). The dose integrals have the dimension of dose • windspeed • sector width/curie, where dose is in rads, windspeed is in m/s, and sector width is in meters. An intensity of one photon per disintegration is assumed.

REFERENCES

(B1) COOPER, R. E. EGAD - A computer program to compute dose integrals from external gamma emitters, DP-1304 (TID-4500, UC-32). E. I. DuPont de Nemours & Company, Savannah River Laboratory, Aiken, S.C. 29801 (September 1972).

(B2) U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE. Radiological health handbook, revised edition. U.S. Department of Health, Education, and Welfare, Rockville, Md. 20852 (January 1970).

(B3) U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE. Radiological health handbook, revised edition. U.S. Department of Health, Education, and Welfare, Rockville, Md. 20852 (January 1970) p. 140.

EGAD INPUT DATA DESCRIPTION

Card type 1.

List: TITLE
Format: 20A4
Columns 1-80, TITLE = heading for output
Number of cards: 1

Card type 2.

List: NGAM, NSIG, NFLG
Format: 20I4
Columns 1- 4, NGSM = number of gamma energies in the gamma data table
Columns 5- 8, NSIG = number of σ_z's
Columns 9-12, NFLG = { 0 - print but do not punch dose integral table; 1 - print and punch dose integral table }
Number of cards: 1

Card type 3.

List: GAMEN(I), GMU(I), GNU(I), [COF(J,I), J=1,3]
Format: 8E10.4
Columns 1-10, GAMEN(I) = gamma energy in MeV
Columns 11-20, GMU(I) = mass attenuation coefficient μ/ρ for air in cm^2/g
Columns 21-30, GNU(I) = mass energy absorption coefficient μ_{en}/ρ for muscle in cm^2/g
Columns 31-40, COF(1,I)
Columns 41-50, COF(2,I) } = polynomial coefficients for buildup factor
Columns 51-60, COF(3,I)
Number of cards: NGAM (1 for each energy in table)

Card type 4.

List: [SIGMZ(I), I = 1, NSIG]
Format: 8E10.4
SIGMZ(I) = vertical dispersion, σ_z, in meters
Number of cards: NSIG

Card type 5. List: HS, HL, SGMX, RHO

Format: 8E10.4

Columns 1-10, HS = effective stack height in meters

Columns 11-20, HL = mixing lid height in meters

Columns 21-30, SGMX = critical value for σ_z in meters. If σ_z >SGMX, a uniform concentration between the ground and the lid is used to calculate the corresponding dose integrals. Typically, SGMX = 2. • HL.

Columns 31-40, RHO = density of air in g/m^3

Number of cards: 1

```
             C     PROGRAM TO COMPUTE DOSE INTEGRALS FOR MATERIAL CONFINED WITHIN SECTOR
             C     BOUNDARIES AND WITH GROUND AND INVERSION LID REFLECTIONS
             C
0001               DIMENSION G(16),H(16),TITLE(20),GMU(32),COF(3,32),GAMEN(32)
0002               DIMENSION GNU(32),SPN(32),SIGMZ(32)
             C
0003               DATA G     /  5.29954E-3, 2.77125E-2, 6.18440E-2, 1.22298E-1,
                *                1.91062E-1, 2.70992E-1, 3.59198E-1, 4.52494E-1,
                *                5.47506E-1, 6.40802E-1, 7.29008E-1, 8.08938E-1,
                *                8.77702F-1, 9.32816E-1, 9.72288E-1, 9.94700E-1 /
             C
0004               DATA H     /  1.35762E-2, 3.11268E-2, 4.75792E-2, 6.23145E-2,
                *                7.47980E-2, 8.45783E-2, 9.13017E-2, 9.47253E-2,
                *                9.47253E-2, 9.13017E-2, 8.45783E-2, 7.47980E-2,
                *                6.23145E-2, 4.75792E-2, 3.11268E-2, 1.35762E-2 /
             C
0005               DATA NGAS /16/
0006               DATA PI /3.141593/
             C
             C     CALCULATE DOSE CONVERSION CONSTANT FOR EGAD.
0007               CONG=3.7E10*1.6021E-6*1.E-2*1.E-4
             C
0008               READ (5,101) TITLE
0009               READ (5,102) NGAM,NSIG,NFLG
0010               DO 60 I=1,NGAM
0011            60 READ (5,103) (GAMEN(I),GMU(I),GNU(I),(COF(J,I),J=1,3))
0012               READ (5,103) (SIGMZ(I),I=1,NSIG)
0013               READ (5,103) HS,HL,SGMX,RHO
             C
0014               WRITE(6,200) TITLE
0015               WRITE(6,204) HS,HL,SGMX,RHO
0016               WRITE(6,203) (SIGMZ(M),M=1,NSIG)
             C
0017               IF (NFLG.EQ.0) GO TO 50
0018               WRITE(7,101) TITLE
0019               WRITE(7,104) HS,HL,SGMX,RHO,NGAM,NSIG
0020               WRITE(7,102) NGAM,NSIG
0021               WRITE(7,103) (GAMEN(I),I=1,NGAM)
0022               WRITE(7,103) (SIGMZ(I),I=1,NSIG)
             C     CONVERT GMU FROM CM**2/GM TO 1/M.
0023            50 DO 1 I=1,NGAM
0024             1 GMU(I)=GMU(I)*RHO*1.E-4
0025               DO 30 NG=1,NGAM
0026               COF1=COF(1,NG)
0027               COF2=COF(2,NG)
0028               COF3=COF(3,NG)
             C     USE NEWTON'S METHOD TO CALCULATE YLIM SO THAT
             C      B*EXP(-YLIM*GMU)=EXP(-6.)
0029               A=6.
0030               DO 40 I=1,3
0031               B=1.+A*(COF1+A*(COF2+A*COF3))
0032               F=A-ALOG(B)
0033               F1=1.-(COF1+A*(2.*COF2+A*3.*COF3))/B
0034            40 A=A+(6.-F)/F1
0035               YLIM=A/GMU(NG)
0036               DO  20 M=1,NSIG
0037               SIGZ=SIGMZ(M)
0038               CON=1.0/(PI*SQRT(2.0*PI)*SIGZ)
```

```
              ZLIM=HS+4.*SIGZ
              Z0=HS-4.0*SIGZ
              IF (Z0.LT.0.) Z0=0.
              ZMAX=ZLIM
              IF(ZLIM.GT.HL) ZLIM=HL
C             GAUSSIAN QUADRATURE INTEGRATION ORDER 16 - TWO DIMENSIONAL
              SUM1=0.
              DO 10 I=1,NGAS
              SUM2=0.
              Z=Z0+G(I)*(ZLIM-Z0)
              IF(SIGZ.GT.SGMX) GO TO 6
              ZF1=EXP(-0.5*((Z-HS)/SIGZ)**2)
              ZSUM=ZF1
              DO 2 L=1,10
              MZ=L+1
              MZ=MOD(MZ,2)
              ZF=(((L+1-MZ)*HL-HS+(-1.)**L*Z)/SIGZ)**2
              IF((ZF.GT.20.).OR.(ZF.GT.ZMAX)) GO TO 3
              ZF2=EXP(-0.5*ZF)
            2 ZSUM=ZSUM+ZF2
            3 DO 4 L=1,10
              MZ=L+1
              MZ=MOD(MZ,2)
              ZF=(((L-1+MZ)*HL+HS+(-1.)**(L+1)*Z)/SIGZ)**2
              IF((ZF.GT.20.).OR.(ZF.GT.ZMAX)) GO TO 5
              ZF3=EXP(-0.5*ZF)
            4 ZSUM=ZSUM+ZF3
            5 ZSUM=ZSUM*CON
              GO TO 7
            6 ZSUM=1./(PI*HL)
            7 DO 8 J=1,NGAS
              Y=G(J)*YLIM
              A=SQRT(Z*Z+Y*Y)*GMU(NG)
              IF(A.GT.20.) GO TO 8
              CALL BESK(A,BK0,BK1,BKI1)
              A1=A
              A2=A*A
              A3=A1*A2
              GF=(BKI1+(COF1*A1+COF3*A3)*BK0+(COF2+COF3)*A2*BK1)*GMU(NG)/A
              SUM2=SUM2+GF*H(J)
            8 CONTINUE
           10 SUM1=SUM1+ZSUM*H(I)*SUM2
           20 SPN(M)=SUM1*(ZLIM-Z0)*YLIM*CONG*GAMEN(NG)*GNU(NG)
              WRITE(6,201) GAMEN(NG)
              WRITE(6,202) (SPN(M),M=1,NSIG)
              IF (NFLG.NE.0) WRITE(7,103) (SPN(M),M=1,NSIG)
           30 CONTINUE
          101 FORMAT(20A4)
          102 FORMAT(20I4)
          103 FORMAT(8E10.4)
          104 FORMAT('EGAD FOR: HS=',F5.0,'M  HL=',F6.0,'M  SGMX=',
             *       F6.0,'M  RHO=',F5.0,'GM/M**3  NG=',I2,'  NS=',I2)
          200 FORMAT('1',20X,20A4)
          201 FORMAT('0DOSE INTEGRALS FOR',F6.3,' MEV',/)
          202 FORMAT(1P8E13.3)
          203 FORMAT('0DOSE INTEGRALS FOR SIGMA Z = (METERS)',/,
             *       (8(3X,F7.1,3X)))
          204 FORMAT('0STACK HEIGHT =',F7.1,' METERS',/,
```

```
                  *        '   LID HEIGHT =',F7.1,' METERS',/,
                  *        '         SGMX =',F7.1,' METERS',/,
                  *        '          RHO =',F7.1,' GM/M**3',/)
 0094             RETURN
 0095             END
```

```
FORTRAN IV G LEVEL  21                 BESK              DATE = 74052          19/22/13

0001            SUBROUTINE BESK(X,BK0,BK1,BKI1)                                                125.
0002            DIMENSION T(12)                                                              BESK 420
0003            BK0=0.                                                                         127.
0004            BK1=0.                                                                         128.
0005            IF(X-1.)36,36,25                                                             BESK 540
0006         25 A=EXP(-X)                                                                    BESK 550
0007            B=1./X                                                                       BESK 560
0008            C=SQRT(B)                                                                    BESK 570
0009            T(1)=B                                                                       BESK 580
0010            DO 26 L=2,12                                                                 BESK 590
0011            T(L)=0.                                                                        135.
0012            IF (T(L-1).GE.1.E-8) T(L)=T(L-1)*B                                             136.
0013         26 CONTINUE                                                                       137.
          C                                                                                  BESK 620
          C     COMPUTE K0 USING POLYNOMIAL APPROXIMATION                                    BESK 630
          C                                                                                  BESK 640
0014         27 G0=A*(1.2533141-.1566642*T(1)+.08811128*T(2)-.09139095*T(3)                  BESK 650
               2+.1344596*T(4)-.2299850*T(5)+.3792410*T(6)-.5247277*T(7)                     BESK 660
               3+.5575368*T(8)-.4262633*T(9)+.2184518*T(10)-.06680977*T(11)                  BESK 670
               4+.009189383*T(12))*C                                                         BESK 680
0015         28 BK0=G0                                                                         145.
          C                                                                                  BESK 720
          C     COMPUTE K1 USING POLYNOMIAL APPROXIMATION                                    BESK 730
          C                                                                                  BESK 740
0016         29 G1=A*(1.2533141+.4699927*T(1)-.1468583*T(2)+.1280427*T(3)                    BESK 750
               2-.1736432*T(4)+.2847618*T(5)-.4594342*T(6)+.6283381*T(7)                     BESK 760
               3-.6632295*T(8)+.5050239*T(9)-.2581304*T(10)+.07880001*T(11)                  BESK 770
               4-.01082418*T(12))*C                                                          BESK 780
0017         30 BK1=G1                                                                         153.
0018            GO TO 60                                                                       154.
          C                                                                                    155.
0019         36 B=X/2.                                                                         156.
0020            A=.5772157+ALOG(B)                                                             157.
0021            C=B*B                                                                          158.
          C                                                                                  BESK 980
          C     COMPUTE K0 USING SERIES EXPANSION                                            BESK 990
          C                                                                                  BESK1000
0022         37 G0=-A                                                                        BESK1010
0023            X2J=1.                                                                       BESK1020
0024            FACT=1.                                                                      BESK1030
0025            HJ=.0                                                                        BESK1040
0026            DO 40 J=1,6                                                                  BESK1050
0027            RJ=1./FLOAT(J)                                                               BESK1060
0028            X2J=X2J*C                                                                    BESK1070
0029            FACT=FACT*RJ*RJ                                                              BESK1080
0030            HJ=HJ+RJ                                                                     BESK1090
0031         40 G0=G0+X2J*FACT*(HJ-A)                                                        BESK1100
0032         42 BK0=G0                                                                         172.
          C                                                                                  BESK1140
          C     COMPUTE K1 USING SERIES EXPANSION                                            BESK1150
          C                                                                                  BESK1160
0033         43 X2J=B                                                                        BESK1170
0034            FACT=1.                                                                      BESK1180
0035            HJ=1.                                                                        BESK1190
0036            G1=1./X+X2J*(.5+A-HJ)                                                        BESK1200
0037            DO 50 J=2,8                                                                  BESK1210
0038            RJ=1./FLOAT(J)                                                               BESK1230
0039            X2J=X2J*C                                                                      182.
```

```
0040            FACT=FACT*RJ*RJ                                                 BESK1240
0041            HJ=HJ+RJ                                                        BESK1250
0042         50 G1=G1+X2J*FACT*(.5+(A-HJ)*FLOAT(J))                             BESK1260
0043         52 BK1=G1                                                            186.
          C                                                                       187.
          C     COMPUTE BICKLEY-NAYLOR FUNCTION KI OF ORDER 1                     188.
          C                                                                       189.
0044         60 IF(X.LT.0.5) GO TO 64                                             190.
0045            IF(X.LT.2.4) GO TO 63                                             191.
0046            IF(X.LT.5.9) GO TO 62                                             192.
0047            IF(X.LT.9.4) GO TO 61                                             193.
0048            A=EXP(-X)                                                         194.
0049            C=SQRT(1./X)                                                      195.
0050            BKI1=(1.253314*A/C)*(1.+(-.625+.803683/X)/X)                      196.
0051            GO TO 70                                                          197.
0052         61 SUM1=X*(X*(X*(-.1695446E-5)+.6393034E-4)-.8261898E-3)+.666866E-2  198.
0053            SUM2=X*(X*(X*(X*(.002372806)-.03531575)+.2442256)-.7806482)+1.    199.
0054            BKI1=SUM1/SUM2                                                    200.
0055            GO TO 70                                                          201.
0056         62 SUM1=X*(X*(X*(-.001137023)+.03061024)-.2895912)+.965721           202.
0057            SUM2=X*(X*(X*(X*(.0395732)-.03979183)+.7326127)+.4511824)+1.      203.
0058            BKI1=SUM1/SUM2                                                    204.
0059            GO TO 70                                                          205.
0060         63 SUM1=X*(X*(-.1108377)+.5157786)+1.484674                          206.
0061            SUM2=X*(X*(X*(X*(.07879607)+.0195582)+.9487851)+1.2504993)+       207.
               1     2.45835)+1.                                                  208.
0062            BKI1=SUM1/SUM2                                                    209.
0063            GO TO 70                                                          210.
0064         64 SUM1=X*(X*(X*(X*(X*(-.2710254E8)+.1344714E10)+.1667065E9)+.2989166 211.
               1     E7)+7523.557)+1.570796                                       212.
0065            SUM2=X*(X*(X*(X*(X*(X*(.6291512E9)+.7097694E9)+.1891334E10)+      213.
               1     .1167903E10)+.1136180E9)+.1928012E7)+4796.828)+1.            214.
0066            BKI1=SUM1/SUM2                                                    215.
0067         70 RETURN                                                            216.
          C                                                                       217.
0068            END                                                             BESK1300
```

EGAD DOSE INTEGRALS (MA METERS**2 PER CURIE*SEC)

STACK HEIGHT = 0.0 METERS
LID HEIGHT = 1000.0 METERS
SGMX = 2000.0 METERS
RHO = 1293.0 GM/M**3

NGAM=22 NSIG=28

DOSE INTEGRALS FOR SIGMA Z = (METERS)

1.0	1.5	2.0	3.0	4.0	5.0	6.0	8.0
10.0	15.0	20.0	30.0	40.0	50.0	60.0	80.0
100.0	150.0	200.0	300.0	400.0	500.0	600.0	800.0
1000.0	1500.0	2000.0	3000.0				

DOSE INTEGRALS FOR 0.010 MEV

1.389E-03	1.043E-03	8.322E-04	5.875E-04	4.500E-04	3.626E-04	3.026E-04	2.259E-04
1.790E-04	1.156E-04	8.379E-05	5.166E-05	3.601E-05	2.640E-05	2.011E-05	1.260E-05
8.163E-06	3.038E-06	1.255E-06	4.660E-07	3.495E-07	2.798E-07	2.348E-07	1.901E-07
1.777E-07	1.752E-07	1.752E-07	1.752E-07				

DOSE INTEGRALS FOR 0.015 MEV

1.155E-03	9.614E-04	8.262E-04	6.483E-04	5.351E-04	4.557E-04	3.965E-04	3.137E-04
2.584E-04	1.773E-04	1.338E-04	8.854E-05	6.548E-05	5.137E-05	4.205E-05	3.017E-05
2.314E-05	1.383E-05	9.187E-06	5.397E-06	4.048E-06	3.241E-06	2.720E-06	2.2[illegible]E-06
2.059E-06	2.030E-06	2.030E-06	2.030E-06				

DOSE INTEGRALS FOR 0.020 MEV

8.628E-04	7.614E-04	6.845E-04	5.740E-04	4.973E-04	4.401E-04	3.954E-04	3.295E-04
2.826E-04	2.079E-04	1.636E-04	1.133E-04	8.592E-05	6.886E-05	5.725E-05	4.252E-05
3.350E-05	2.141E-05	1.536E-05	9.849E-06	7.390E-06	5.917E-06	4.966E-06	4.021E-06
3.760E-06	3.706E-06	3.706E-06	3.706E-06				

DOSE INTEGRALS FOR 0.030 MEV

5.442E-04	5.110E-04	4.813E-04	4.338E-04	3.977E-04	3.688E-04	3.448E-04	3.065E-04
2.768E-04	2.241E-04	1.887E-04	1.434E-04	1.151E-04	9.583E-05	8.183E-05	6.297E-05
5.095E-05	3.414E-05	2.543E-05	1.680E-05	1.262E-05	1.011E-05	8.489E-06	6.878E-06
6.431E-06	6.341E-06	6.341E-06	6.341E-06				

DOSE INTEGRALS FOR 0.040 MEV

4.192E-04	4.063E-04	3.919E-04	3.657E-04	3.444E-04	3.267E-04	3.116E-04	2.865E-04
2.662E-04	2.276E-04	1.996E-04	1.606E-04	1.342E-04	1.151E-04	1.005E-04	7.981E-05
6.592E-05	4.550E-05	3.451E-05	2.314E-05	1.743E-05	1.398E-05	1.174E-05	9.522E-06
8.907E-06	8.782E-06	8.782E-06	8.782E-06				

DOSE INTEGRALS FOR 0.050 MEV

3.736E-04	3.676E-04	3.587E-04	3.408E-04	3.253E-04	3.121E-04	3.007E-04	2.813E-04
2.653E-04	2.339E-04	2.101E-04	1.753E-04	1.504E-04	1.316E-04	1.168E-04	9.494E-05
7.968E-05	5.632E-05	4.326E-05	2.933E-05	2.214E-05	1.778E-05	1.496E-05	1.214E-05
1.136E-05	1.120E-05	1.120E-05	1.120E-05				

DOSE INTEGRALS FOR 0.060 MEV

3.697E-04	3.662E-04	3.595E-04	3.446E-04	3.313E-04	3.197E-04	3.095E-04	2.922E-04

2.778E-04	2.491E-04	2.269E-04	1.936E-04	1.690E-04	1.498E-04	1.344E-04	1.111E-04
9.432E-05	6.784E-05	5.260E-05	3.599E-05	2.724E-05	2.190E-05	1.843E-05	1.493E-05
1.402E-05	1.383E-05	1.383E-05	1.383E-05				

DOSE INTEGRALS FOR 0.080 MEV

4.105E-04	4.088E-04	4.031E-04	3.892E-04	3.761E-04	3.646E-04	3.543E-04	3.367E-04
3.220E-04	2.927E-04	2.698E-04	2.349E-04	2.084E-04	1.874E-04	1.701E-04	1.433E-04
1.234E-04	9.070E-05	7.117E-05	4.923E-05	3.742E-05	3.016E-05	2.542E-05	2.069E-05
1.938E-05	1.911E-05	1.911E-05	1.911E-05				

DOSE INTEGRALS FOR 0.100 MEV

4.865E-04	4.854E-04	4.793E-04	4.637E-04	4.487E-04	4.353E-04	4.233E-04	4.028E-04
3.856E-04	3.516E-04	3.252E-04	2.849E-04	2.545E-04	2.301E-04	2.100E-04	1.784E-04
1.547E-04	1.151E-04	9.096E-05	6.334E-05	4.828E-05	3.897E-05	3.288E-05	2.679E-05
2.511E-05	2.477E-05	2.477E-05	2.477E-05				

DOSE INTEGRALS FOR 0.150 MEV

7.103E-04	7.094E-04	7.010E-04	6.784E-04	6.562E-04	6.361E-04	6.182E-04	5.873E-04
5.615E-04	5.109E-04	4.722E-04	4.141E-04	3.708E-04	3.364E-04	3.081E-04	2.636E-04
2.301E-04	1.733E-04	1.380E-04	9.690E-05	7.416E-05	5.998E-05	5.068E-05	4.138E-05
3.880E-05	3.828E-05	3.828E-05	3.828E-05				

DOSE INTEGRALS FOR 0.200 MEV

9.374E-04	9.368E-04	9.260E-04	8.963E-04	8.666E-04	8.395E-04	8.152E-04	7.733E-04
7.384E-04	6.703E-04	6.187E-04	5.420E-04	4.854E-04	4.407E-04	4.040E-04	3.467E-04
3.034E-04	2.300E-04	1.840E-04	1.299E-04	9.963E-05	8.070E-05	6.825E-05	5.580E-05
5.236E-05	5.165E-05	5.165E-05	5.165E-05				

DOSE INTEGRALS FOR 0.300 MEV

1.376E-03	1.375E-03	1.360E-03	1.317E-03	1.273E-03	1.232E-03	1.196E-03	1.133E-03
1.080E-03	9.775E-04	9.007E-04	7.877E-04	7.051E-04	6.403E-04	5.875E-04	5.051E-04
4.431E-04	3.379E-04	2.714E-04	1.925E-04	1.481E-04	1.201E-04	1.017E-04	8.328E-05
7.817E-05	7.714E-05	7.713E-05	7.713E-05				

DOSE INTEGRALS FOR 0.400 MEV

1.798E-03	1.799E-03	1.781E-03	1.727E-03	1.670E-03	1.617E-03	1.569E-03	1.486E-03
1.416E-03	1.280E-03	1.178E-03	1.029E-03	9.207E-04	8.361E-04	7.672E-04	6.604E-04
5.803E-04	4.443E-04	3.582E-04	2.552E-04	1.968E-04	1.599E-04	1.356E-04	1.112E-04
1.044E-04	1.030E-04	1.030E-04	1.030E-04				

DOSE INTEGRALS FOR 0.500 MEV

2.200E-03	2.204E-03	2.184E-03	2.119E-03	2.051E-03	1.988E-03	1.929E-03	1.827E-03
1.741E-03	1.573E-03	1.447E-03	1.263E-03	1.130E-03	1.026E-03	9.419E-04	8.113E-04
7.136E-04	5.480E-04	4.430E-04	3.167E-04	2.448E-04	1.991E-04	1.690E-04	1.387E-04
1.304E-04	1.287E-04	1.286E-04	1.286E-04				

DOSE INTEGRALS FOR 0.600 MEV

2.588E-03	2.595E-03	2.573E-03	2.500E-03	2.423E-03	2.349E-03	2.281E-03	2.161E-03
2.060E-03	1.862E-03	1.713E-03	1.496E-03	1.338E-03	1.216E-03	1.116E-03	9.621E-04
8.470E-04	6.520E-04	5.283E-04	3.789E-04	2.933E-04	2.359E-04	2.029E-04	1.668E-04
1.566E-04	1.548E-04	1.547E-04	1.547E-04				

DOSE INTEGRALS FOR 0.800 MEV

3.296E-03	3.309E-03	3.285E-03	3.201E-03	3.108E-03	3.018E-03	2.933E-03	2.783E-03
2.655E-03	2.403E-03	2.213E-03	1.935E-03	1.733E-03	1.576E-03	1.448E-03	1.251E-03
1.103E-03	8.530E-04	6.940E-04	5.006E-04	3.888E-04	3.173E-04	2.699E-04	2.224E-04
2.092E-04	2.065E-04	2.065E-04	2.065E-04				

DOSE INTEGRALS FOR 1.000 MEV

3.936E-03	3.955E-03	3.932E-03	3.839E-03	3.734E-03	3.631E-03	3.534E-03	3.359E-03
3.208E-03	2.908E-03	2.682E-03	2.349E-03	2.107E-03	1.918E-03	1.765E-03	1.527E-03
1.350E-03	1.048E-03	8.559E-04	6.205E-04	4.833E-04	3.953E-04	3.367E-04	2.780E-04
2.617E-04	2.584E-04	2.584E-04	2.584E-04				

DOSE INTEGRALS FOR 1.500 MEV

5.269E-03	5.305E-03	5.285E-03	5.184E-03	5.062E-03	4.938E-03	4.818E-03	4.598E-03
4.403E-03	4.011E-03	3.710E-03	3.266E-03	2.941E-03	2.687E-03	2.480E-03	2.158E-03
1.916E-03	1.502E-03	1.236E-03	9.060E-04	7.104E-04	5.836E-04	4.990E-04	4.140E-04
3.904E-04	3.856E-04	3.856E-04	3.856E-04				

DOSE INTEGRALS FOR 2.000 MEV

6.319E-03	6.370E-03	6.356E-03	6.254E-03	6.124E-03	5.989E-03	5.857E-03	5.607E-03
5.383E-03	4.923E-03	4.566E-03	4.036E-03	3.647E-03	3.342E-03	3.092E-03	2.703E-03
2.408E-03	1.902E-03	1.575E-03	1.165E-03	9.186E-04	7.577E-04	6.498E-04	5.414E-04
5.113E-04	5.052E-04	5.052E-04	5.052E-04				

DOSE INTEGRALS FOR 3.000 MEV

8.114E-03	8.192E-03	8.188E-03	8.088E-03	7.951E-03	7.803E-03	7.654E-03	7.364E-03
7.096E-03	6.530E-03	6.082E-03	5.407E-03	4.909E-03	4.517E-03	4.195E-03	3.689E-03
3.304E-03	2.638E-03	2.202E-03	1.650E-03	1.312E-03	1.089E-03	9.391E-04	7.878E-04
7.458E-04	7.373E-04	7.373E-04	7.373E-04				

DOSE INTEGRALS FOR 4.000 MEV

9.550E-03	9.651E-03	9.658E-03	9.567E-03	9.431E-03	9.281E-03	9.125E-03	8.816E-03
8.523E-03	7.885E-03	7.368E-03	6.581E-03	5.996E-03	5.533E-03	5.152E-03	4.551E-03
4.092E-03	3.291E-03	2.763E-03	2.090E-03	1.674E-03	1.397E-03	1.210E-03	1.021E-03
9.683E-04	9.577E-04	9.576E-04	9.576E-04				

DOSE INTEGRALS FOR 5.000 MEV

1.099E-02	1.111E-02	1.112E-02	1.103E-02	1.089E-02	1.073E-02	1.056E-02	1.022E-02
9.896E-03	9.181E-03	8.596E-03	7.698E-03	7.027E-03	6.496E-03	6.058E-03	5.366E-03
4.836E-03	3.907E-03	3.293E-03	2.505E-03	2.014E-03	1.686E-03	1.464E-03	1.239E-03
1.177E-03	1.164E-03	1.164E-03	1.164E-03				

EGAM DOSE INTEGRALS (RAD*METERS**2 PER CURIE*SEC)

STACK HEIGHT = 10.0 METERS
LID HEIGHT = 1000.0 METERS
SGMX = 2500.0 METERS
RHO = 1293.0 GM/M**3

NGAM=22 NSIG=24

DOSE INTEGRALS FOR SIGMA Z = (METERS)

1.0	1.5	2.0	3.0	4.0	5.0	6.0	8.0
10.0	15.0	20.0	30.0	40.0	50.0	60.0	80.0
100.0	150.0	200.0	300.0	400.0	500.0	600.0	800.0

DOSE INTEGRALS FOR 0.010 MEV

2.436E-06	2.243E-06	2.563E-06	7.201E-06	2.680E-05	5.529E-05	7.986E-05	1.054E-04
1.096E-04	9.365E-05	7.538E-05	5.087E-05	3.667E-05	2.825E-05	2.214E-05	1.466E-05
1.026E-05	4.584E-06	2.209E-06	5.965E-07	3.494E-07	2.797E-07	2.348E-07	1.901E-07

DOSE INTEGRALS FOR 0.015 MEV

4.030E-05	4.229E-05	4.540E-05	5.756E-05	8.201E-05	1.118E-04	1.368E-04	1.627E-04
1.662E-04	1.444E-04	1.192E-04	8.466E-05	6.437E-05	5.150E-05	4.249E-05	3.118E-05
2.417E-05	1.495E-05	1.030E-05	5.708E-06	4.047E-06	3.240E-06	2.720E-06	2.202E-06

DOSE INTEGRALS FOR 0.020 MEV

1.147E-04	1.167E-04	1.196E-04	1.296E-04	1.469E-04	1.667E-04	1.828E-04	1.981E-04
1.976E-04	1.734E-04	1.467E-04	1.079E-04	8.388E-05	6.806E-05	5.704E-05	4.278E-05
3.401E-05	2.206E-05	1.602E-05	1.001E-05	7.387E-06	5.915E-06	4.965E-06	4.021E-06

DOSE INTEGRALS FOR 0.030 MEV

1.893E-04	1.903E-04	1.918E-04	1.967E-04	2.045E-04	2.130E-04	2.194E-04	2.236E-04
2.197E-04	1.974E-04	1.739E-04	1.371E-04	1.119E-04	9.397E-05	8.073E-05	6.259E-05
5.085E-05	3.433E-05	2.571E-05	1.689E-05	1.262E-05	1.011E-05	8.488E-06	6.877E-06

DOSE INTEGRALS FOR 0.040 MEV

2.116E-04	2.122E-04	2.131E-04	2.160E-04	2.203E-04	2.249E-04	2.281E-04	2.293E-04
2.254E-04	2.071E-04	1.875E-04	1.550E-04	1.310E-04	1.129E-04	9.900E-05	7.900E-05
6.545E-05	4.541E-05	3.455E-05	2.318E-05	1.742E-05	1.397E-05	1.174E-05	9.522E-06

DOSE INTEGRALS FOR 0.050 MEV

2.240E-04	2.245E-04	2.251E-04	2.273E-04	2.304E-04	2.336E-04	2.357E-04	2.360E-04
2.323E-04	2.167E-04	1.996E-04	1.702E-04	1.474E-04	1.295E-04	1.152E-04	9.397E-05
7.902E-05	5.604E-05	4.315E-05	2.934E-05	2.214E-05	1.778E-05	1.495E-05	1.214E-05

DOSE INTEGRALS FOR 0.060 MEV

2.411E-04	2.415E-04	2.421E-04	2.441E-04	2.468E-04	2.495E-04	2.512E-04	2.512E-04
2.478E-04	2.331E-04	2.170E-04	1.886E-04	1.659E-04	1.477E-04	1.328E-04	1.100E-04
9.356E-05	6.745E-05	5.238E-05	3.595E-05	2.723E-05	2.190E-05	1.843E-05	1.498E-05

DOSE INTEGRALS FOR 0.080 MEV

2.845E-04	2.850E-04	2.857E-04	2.878E-04	2.906E-04	2.932E-04	2.949E-04	2.948E-04
2.912E-04	2.761E-04	2.594E-04	2.296E-04	2.052E-04	1.851E-04	1.684E-04	1.421E-04

1.224E-04	9.014E-05	7.082E-05	4.915E-05	3.741E-05	3.015E-05	2.541E-05	2.069E-05

DOSE INTEGRALS FOR 0.100 MEV

3.416E-04	3.422E-04	3.430E-04	3.456E-04	3.489E-04	3.520E-04	3.540E-04	3.539E-04
3.498E-04	3.324E-04	3.132E-04	2.788E-04	2.507E-04	2.274E-04	2.079E-04	1.770E-04
1.536E-04	1.144E-04	9.051E-05	6.325E-05	4.827E-05	3.896E-05	3.287E-05	2.679E-05

DOSE INTEGRALS FOR 0.150 MEV

4.943E-04	4.953E-04	4.967E-04	5.008E-04	5.060E-04	5.107E-04	5.138E-04	5.139E-04
5.080E-04	4.825E-04	4.547E-04	4.054E-04	3.654E-04	3.327E-04	3.052E-04	2.616E-04
2.285E-04	1.723E-04	1.374E-04	9.677E-05	7.414E-05	5.997E-05	5.067E-05	4.138E-05

DOSE INTEGRALS FOR 0.200 MEV

6.468E-04	6.482E-04	6.502E-04	6.560E-04	6.631E-04	6.695E-04	6.738E-04	6.740E-04
6.662E-04	6.323E-04	5.954E-04	5.305E-04	4.784E-04	4.359E-04	4.004E-04	3.442E-04
3.014E-04	2.287E-04	1.832E-04	1.297E-04	9.960E-05	8.069E-05	6.824E-05	5.580E-05

DOSE INTEGRALS FOR 0.300 MEV

9.411E-04	9.433E-04	9.465E-04	9.555E-04	9.662E-04	9.759E-04	9.823E-04	9.827E-04
9.710E-04	9.207E-04	8.660E-04	7.708E-04	6.949E-04	6.334E-04	5.823E-04	5.015E-04
4.403E-04	3.359E-04	2.701E-04	1.922E-04	1.480E-04	1.201E-04	1.017E-04	8.327E-05

DOSE INTEGRALS FOR 0.400 MEV

1.234E-03	1.237E-03	1.241E-03	1.253E-03	1.267E-03	1.279E-03	1.287E-03	1.287E-03
1.272E-03	1.205E-03	1.132E-03	1.007E-03	9.074E-04	8.271E-04	7.605E-04	6.558E-04
5.766E-04	4.417E-04	3.564E-04	2.549E-04	1.968E-04	1.599E-04	1.355E-04	1.112E-04

DOSE INTEGRALS FOR 0.500 MEV

1.519E-03	1.522E-03	1.528E-03	1.542E-03	1.559E-03	1.573E-03	1.583E-03	1.582E-03
1.562E-03	1.480E-03	1.390E-03	1.236E-03	1.114E-03	1.015E-03	9.337E-04	8.058E-04
7.091E-04	5.447E-04	4.407E-04	3.162E-04	2.447E-04	1.991E-04	1.689E-04	1.387E-04

DOSE INTEGRALS FOR 0.600 MEV

1.802E-03	1.807E-03	1.813E-03	1.830E-03	1.848E-03	1.865E-03	1.875E-03	1.873E-03
1.850E-03	1.752E-03	1.646E-03	1.463E-03	1.319E-03	1.202E-03	1.106E-03	9.556E-04
8.418E-04	6.482E-04	5.255E-04	3.784E-04	2.933E-04	2.389E-04	2.029E-04	1.668E-04

DOSE INTEGRALS FOR 0.800 MEV

2.339E-03	2.344E-03	2.352E-03	2.372E-03	2.394E-03	2.413E-03	2.424E-03	2.420E-03
2.389E-03	2.263E-03	2.127E-03	1.893E-03	1.708E-03	1.559E-03	1.436E-03	1.243E-03
1.097E-03	8.481E-04	6.902E-04	4.998E-04	3.887E-04	3.173E-04	2.699E-04	2.224E-04

DOSE INTEGRALS FOR 1.000 MEV

2.845E-03	2.851E-03	2.860E-03	2.883E-03	2.907E-03	2.927E-03	2.938E-03	2.930E-03
2.892E-03	2.740E-03	2.578E-03	2.298E-03	2.076E-03	1.898E-03	1.750E-03	1.518E-03
1.342E-03	1.042E-03	8.511E-04	6.194E-04	4.831E-04	3.952E-04	3.367E-04	2.780E-04

DOSE INTEGRALS FOR 1.500 MEV

3.968E-03	3.976E-03	3.986E-03	4.011E-03	4.035E-03	4.055E-03	4.064E-03	4.046E-03
3.992E-03	3.789E-03	3.573E-03	3.197E-03	2.900E-03	2.659E-03	2.460E-03	2.145E-03
1.906E-03	1.494E-03	1.229E-03	9.042E-04	7.102E-04	5.835E-04	4.989E-04	4.139E-04

DOSE INTEGRALS FOR 2.000 MEV

4.914E-03	4.921E-03	4.931E-03	4.955E-03	4.978E-03	4.994E-03	4.999E-03	4.971E-03
4.904E-03	4.661E-03	4.402E-03	3.953E-03	3.596E-03	3.307E-03	3.067E-03	2.687E-03
2.396E-03	1.893E-03	1.566E-03	1.162E-03	9.183E-04	7.576E-04	6.498E-04	5.414E-04

DOSE INTEGRALS FOR 3.000 MEV

6.594E-03	6.601E-03	6.610E-03	6.630E-03	6.645E-03	6.653E-03	6.650E-03	6.603E-03
6.513E-03	6.203E-03	5.874E-03	5.301E-03	4.843E-03	4.471E-03	4.161E-03	3.668E-03
3.289E-03	2.626E-03	2.191E-03	1.647E-03	1.312E-03	1.089E-03	9.390E-04	7.878E-04

DOSE INTEGRALS FOR 4.000 MEV

8.030E-03	8.035E-03	8.041E-03	8.054E-03	8.060E-03	8.059E-03	8.046E-03	7.980E-03
7.872E-03	7.510E-03	7.128E-03	6.456E-03	5.917E-03	5.477E-03	5.110E-03	4.525E-03
4.073E-03	3.278E-03	2.752E-03	2.086E-03	1.674E-03	1.397E-03	1.210E-03	1.021E-03

DOSE INTEGRALS FOR 5.000 MEV

9.380E-03	9.384E-03	9.390E-03	9.399E-03	9.401E-03	9.394E-03	9.375E-03	9.295E-03
9.170E-03	8.758E-03	8.323E-03	7.555E-03	6.937E-03	6.432E-03	6.009E-03	5.335E-03
4.813E-03	3.893E-03	3.280E-03	2.500E-03	2.014E-03	1.686E-03	1.464E-03	1.239E-03

EGAD DOSE INTEGRALS (RAD*METERS**2 PER CURIE*SEC)

STACK HEIGHT = 50.0 METERS
LID HEIGHT = 1000.0 METERS
SGMX = 2500.0 METERS
RHO = 1293.0 GM/M**3

NGAM=22 NSIG=24

DOSE INTEGRALS FOR SIGMA Z = (METERS)

1.0	1.5	2.0	3.0	4.0	5.0	6.0	8.0
10.0	15.0	20.0	30.0	40.0	50.0	60.0	80.0
100.0	150.0	200.0	300.0	400.0	500.0	600.0	800.0

DOSE INTEGRALS FOR 0.010 MEV

0.0	0.0	0.0	0.0	0.0	8.461E-17	5.413E-15	9.381E-13
1.478E-10	4.449E-07	3.531E-06	1.248E-05	1.615E-05	1.602E-05	1.455E-05	1.107E-05
8.283E-06	3.868E-06	1.902E-06	5.344E-07	3.468E-07	2.784E-07	2.341E-07	1.899E-07

DOSE INTEGRALS FOR 0.015 MEV

2.606E-08	2.726E-08	2.902E-08	3.609E-08	4.703E-08	5.971E-08	7.437E-08	1.130E-07
1.699E-07	1.291E-06	6.891E-06	2.258E-05	3.014E-05	3.130E-05	2.990E-05	2.525E-05
2.100E-05	1.389E-05	9.754E-06	5.497E-06	4.017E-06	3.225E-06	2.711E-06	2.200E-06

DOSE INTEGRALS FOR 0.020 MEV

1.284E-06	1.304E-06	1.314E-06	1.335E-06	1.393E-06	1.474E-06	1.553E-06	1.787E-06
2.188E-06	4.921E-06	1.258E-05	3.174E-05	4.096E-05	4.253E-05	4.094E-05	3.528E-05
2.995E-05	2.077E-05	1.539E-05	9.798E-06	7.332E-06	5.887E-06	4.950E-06	4.017E-06

DOSE INTEGRALS FOR 0.030 MEV

1.988E-05	1.991E-05	1.996E-05	2.009E-05	2.028E-05	2.053E-05	2.084E-05	2.165E-05
2.276E-05	2.750E-05	3.587E-05	5.359E-05	6.177E-05	6.266E-05	6.020E-05	5.261E-05
4.534E-05	3.253E-05	2.490E-05	1.662E-05	1.252E-05	1.006E-05	8.462E-06	6.871E-06

DOSE INTEGRALS FOR 0.040 MEV

4.726E-05	4.730E-05	4.735E-05	4.750E-05	4.770E-05	4.796E-05	4.828E-05	4.912E-05
5.023E-05	5.459E-05	6.143E-05	7.493E-05	8.051E-05	8.004E-05	7.667E-05	6.759E-05
5.894E-05	4.321E-05	3.356E-05	2.286E-05	1.729E-05	1.391E-05	1.171E-05	9.513E-06

DOSE INTEGRALS FOR 0.050 MEV

7.130E-05	7.133E-05	7.139E-05	7.152E-05	7.170E-05	7.194E-05	7.222E-05	7.297E-05
7.394E-05	7.767E-05	8.326E-05	9.385E-05	9.756E-05	9.599E-05	9.186E-05	8.153E-05
7.170E-05	5.347E-05	4.197E-05	2.895E-05	2.198E-05	1.770E-05	1.491E-05	1.213E-05

DOSE INTEGRALS FOR 0.060 MEV

9.281E-05	9.284E-05	9.288E-05	9.300E-05	9.317E-05	9.339E-05	9.365E-05	9.432E-05
9.521E-05	9.854E-05	1.035E-04	1.126E-04	1.153E-04	1.129E-04	1.081E-04	9.645E-05
8.539E-05	6.448E-05	5.101E-05	3.550E-05	2.703E-05	2.180E-05	1.838E-05	1.496E-05

DOSE INTEGRALS FOR 0.080 MEV

1.288E-04	1.288E-04	1.289E-04	1.290E-04	1.292E-04	1.294E-04	1.296E-04	1.303E-0
1.311E-04	1.343E-04	1.391E-04	1.477E-04	1.495E-04	1.461E-04	1.402E-04	1.261E-0

1.125E-04	8.637E-05	6.903E-05	4.856E-05	3.714E-05	3.001E-05	2.534E-05	2.067E-05

DOSE INTEGRALS FOR 0.100 MEV

1.632E-04	1.632E-04	1.633E-04	1.634E-04	1.636E-04	1.638E-04	1.641E-04	1.648E-04
1.657E-04	1.693E-04	1.746E-04	1.844E-04	1.863E-04	1.821E-04	1.749E-04	1.580E-04
1.417E-04	1.098E-04	8.828E-05	6.250E-05	4.792E-05	3.878E-05	3.277E-05	2.677E-05

DOSE INTEGRALS FOR 0.150 MEV

2.403E-04	2.404E-04	2.405E-04	2.406E-04	2.409E-04	2.412E-04	2.416E-04	2.426E-04
2.439E-04	2.490E-04	2.569E-04	2.715E-04	2.746E-04	2.688E-04	2.588E-04	2.348E-04
2.116E-04	1.656E-04	1.341E-04	9.565E-05	7.361E-05	5.970E-05	5.052E-05	4.134E-05

DOSE INTEGRALS FOR 0.200 MEV

3.140E-04	3.141E-04	3.142E-04	3.144E-04	3.147E-04	3.152E-04	3.157E-04	3.170E-04
3.187E-04	3.254E-04	3.361E-04	3.559E-04	3.605E-04	3.533E-04	3.404E-04	3.096E-04
2.796E-04	2.200E-04	1.788E-04	1.282E-04	9.890E-05	8.032E-05	6.804E-05	5.575E-05

DOSE INTEGRALS FOR 0.300 MEV

4.539E-04	4.540E-04	4.541E-04	4.544E-04	4.549E-04	4.555E-04	4.562E-04	4.581E-04
4.607E-04	4.707E-04	4.866E-04	5.167E-04	5.243E-04	5.145E-04	4.961E-04	4.520E-04
4.090E-04	3.233E-04	2.639E-04	1.900E-04	1.470E-04	1.196E-04	1.014E-04	8.320E-05

DOSE INTEGRALS FOR 0.400 MEV

5.892E-04	5.894E-04	5.895E-04	5.900E-04	5.906E-04	5.914E-04	5.924E-04	5.949E-04
5.982E-04	6.116E-04	6.330E-04	6.737E-04	6.845E-04	6.722E-04	6.487E-04	5.917E-04
5.362E-04	4.254E-04	3.483E-04	2.520E-04	1.954E-04	1.592E-04	1.351E-04	1.111E-04

DOSE INTEGRALS FOR 0.500 MEV

7.212E-04	7.214E-04	7.216E-04	7.221E-04	7.229E-04	7.239E-04	7.251E-04	7.282E-04
7.324E-04	7.490E-04	7.757E-04	8.264E-04	8.402E-04	8.256E-04	7.970E-04	7.276E-04
6.600E-04	5.250E-04	4.308E-04	3.128E-04	2.430E-04	1.982E-04	1.684E-04	1.386E-04

DOSE INTEGRALS FOR 0.600 MEV

8.540E-04	8.542E-04	8.545E-04	8.551E-04	8.560E-04	8.572E-04	8.586E-04	8.623E-04
8.673E-04	8.871E-04	9.188E-04	9.792E-04	9.959E-04	9.788E-04	9.452E-04	8.635E-04
7.839E-04	6.249E-04	5.139E-04	3.742E-04	2.913E-04	2.378E-04	2.023E-04	1.666E-04

DOSE INTEGRALS FOR 0.800 MEV

1.111E-03	1.111E-03	1.112E-03	1.112E-03	1.114E-03	1.115E-03	1.117E-03	1.122E-03
1.128E-03	1.154E-03	1.195E-03	1.272E-03	1.294E-03	1.272E-03	1.229E-03	1.124E-03
1.022E-03	8.181E-04	6.752E-04	4.943E-04	3.860E-04	3.159E-04	2.691E-04	2.222E-04

DOSE INTEGRALS FOR 1.000 MEV

1.361E-03	1.361E-03	1.361E-03	1.362E-03	1.364E-03	1.366E-03	1.368E-03	1.373E-03
1.381E-03	1.412E-03	1.461E-03	1.554E-03	1.580E-03	1.554E-03	1.502E-03	1.376E-03
1.253E-03	1.006E-03	8.329E-04	6.129E-04	4.799E-04	3.935E-04	3.357E-04	2.778E-04

DOSE INTEGRALS FOR 1.500 MEV

1.938E-03	1.939E-03	1.939E-03	1.941E-03	1.943E-03	1.945E-03	1.948E-03	1.956E-03
1.966E-03	2.008E-03	2.073E-03	2.197E-03	2.231E-03	2.194E-03	2.124E-03	1.952E-03
1.783E-03	1.444E-03	1.204E-03	8.950E-04	7.055E-04	5.811E-04	4.976E-04	4.136E-04

DOSE INTEGRALS FOR 2.000 MEV

2.443E-03	2.443E-03	2.444E-03	2.445E-03	2.448E-03	2.451E-03	2.454E-03	2.463E-03
2.476E-03	2.526E-03	2.605E-03	2.752E-03	2.791E-03	2.747E-03	2.661E-03	2.452E-03
2.247E-03	1.831E-03	1.535E-03	1.151E-03	9.125E-04	7.544E-04	6.480E-04	5.409E-04

DOSE INTEGRALS FOR 3.000 MEV

3.362E-03	3.363E-03	3.364E-03	3.366E-03	3.369E-03	3.373E-03	3.377E-03	3.389E-03
3.406E-03	3.472E-03	3.573E-03	3.758E-03	3.806E-03	3.747E-03	3.636E-03	3.363E-03
3.094E-03	2.545E-03	2.149E-03	1.631E-03	1.304E-03	1.085E-03	9.366E-04	7.872E-04

DOSE INTEGRALS FOR 4.000 MEV

4.172E-03	4.173E-03	4.174E-03	4.176E-03	4.180E-03	4.184E-03	4.190E-03	4.205E-03
4.225E-03	4.305E-03	4.424E-03	4.638E-03	4.691E-03	4.620E-03	4.487E-03	4.162E-03
3.840E-03	3.180E-03	2.700E-03	2.067E-03	1.664E-03	1.391E-03	1.207E-03	1.020E-03

DOSE INTEGRALS FOR 5.000 MEV

4.936E-03	4.937E-03	4.938E-03	4.941E-03	4.945E-03	4.950E-03	4.957E-03	4.974E-03
4.998E-03	5.090E-03	5.227E-03	5.470E-03	5.529E-03	5.446E-03	5.292E-03	4.916E-03
4.545E-03	3.778E-03	3.220E-03	2.477E-03	2.002E-03	1.679E-03	1.460E-03	1.238E-03

EGAD DOSE INTEGRALS (RAD*METERS**2 PER CURIE*SEC)

```
STACK HEIGHT =   75.0 METERS
  LID HEIGHT = 1000.0 METERS
        SGMX = 2500.0 METERS
         RHO = 1293.0 GM/M**3
```

NGAM=22 NSIG=24

DOSE INTEGRALS FOR SIGMA Z = (METERS)

1.0	1.5	2.0	3.0	4.0	5.0	6.0	8.0
10.0	15.0	20.0	30.0	40.0	50.0	60.0	80.0
100.0	150.0	200.0	300.0	400.0	500.0	600.0	800.0

DOSE INTEGRALS FOR 0.010 MEV

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	1.957E-12	6.960E-08	2.107E-06	5.771E-06	8.124E-06	8.918E-06	8.198E-06
6.610E-06	3.347E-06	1.696E-06	4.870E-07	3.434E-07	2.767E-07	2.331E-07	1.897E-07

DOSE INTEGRALS FOR 0.015 MEV

1.642E-10	1.685E-10	1.746E-10	1.935E-10	2.233E-10	2.683E-10	3.358E-10	6.032E-1
1.336E-09	1.286E-08	1.979E-07	4.144E-06	1.137E-05	1.665E-05	1.920E-05	1.953E-0
1.771E-05	1.278E-05	9.252E-06	5.308E-06	3.978E-06	3.205E-06	2.701E-06	2.198E-0

DOSE INTEGRALS FOR 0.020 MEV

3.135E-07	3.148E-07	3.165E-07	3.214E-07	3.299E-07	3.399E-07	3.502E-07	3.698E-0
3.928E-07	5.191E-07	1.073E-06	6.777E-06	1.626E-05	2.325E-05	2.669E-05	2.762E-0
2.550E-05	1.927E-05	1.473E-05	9.592E-06	7.261E-06	5.851E-06	4.931E-06	4.012E-0

DOSE INTEGRALS FOR 0.030 MEV

5.832E-06	5.841E-06	5.854E-06	5.890E-06	5.940E-06	6.005E-06	6.085E-06	6.298E-0
6.573E-06	7.665E-06	9.652E-06	1.821E-05	2.929E-05	3.717E-05	4.115E-05	4.196E-0
3.908E-05	3.036E-05	2.394E-05	1.631E-05	1.240E-05	9.999E-06	8.429E-06	6.863E-0

DOSE INTEGRALS FOR 0.040 MEV

2.085E-05	2.087E-05	2.089E-05	2.095E-05	2.103E-05	2.113E-05	2.126E-05	2.158E-0
2.201E-05	2.358E-05	2.607E-05	3.468E-05	4.476E-05	5.177E-05	5.515E-05	5.512E-0
5.136E-05	4.048E-05	3.231E-05	2.246E-05	1.713E-05	1.382E-05	1.166E-05	9.502E-0

DOSE INTEGRALS FOR 0.050 MEV

3.811E-05	3.813E-05	3.815E-05	3.822E-05	3.830E-05	3.842E-05	3.855E-05	3.890E-0
3.935E-05	4.097E-05	4.344E-05	5.136E-05	6.022E-05	6.618E-05	6.881E-05	6.775E-0
6.312E-05	5.025E-05	4.046E-05	2.846E-05	2.177E-05	1.759E-05	1.485E-05	1.211E-0

DOSE INTEGRALS FOR 0.060 MEV

5.498E-05	5.500E-05	5.502E-05	5.509E-05	5.517E-05	5.529E-05	5.542E-05	5.577E-0
5.622E-05	5.783E-05	6.024E-05	6.771E-05	7.587E-05	8.119E-05	8.328E-05	8.127E-0
7.574E-05	6.074E-05	4.924E-05	3.492E-05	2.677E-05	2.166E-05	1.830E-05	1.495E-0

DOSE INTEGRALS FOR 0.080 MEV

8.429E-05	8.431E-05	8.433E-05	8.440E-05	8.449E-05	8.460E-05	8.474E-05	8.509E-0
8.555E-05	8.716E-05	8.957E-05	9.696E-05	1.049E-04	1.099E-04	1.115E-04	1.080E-0

1.008E-04	8.163E-05	6.672E-05	4.779F-05	3.679F-05	2.983E-05	2.524E-05	2.065E-05

DOSE INTEGRALS FOR 0.100 MEV

1.115E-04	1.115E-04	1.115E-04	1.116E-04	1.117F-04	1.118E-04	1.120E-04	1.123E-04
1.128E-04	1.146E-04	1.172E-04	1.254F-04	1.343F-04	1.396E-04	1.411E-04	1.365E-04
1.276E-04	1.040E-04	8.539E-05	6.151F-05	4.748F-05	3.855E-05	3.265E-05	2.674E-05

DOSE INTEGRALS FOR 0.150 MEV

1.700E-04	1.701E-04	1.701E-04	1.702E-04	1.703F-04	1.705E-04	1.707E-04	1.712E-04
1.719E-04	1.742E-04	1.777E-04	1.891E-04	2.016F-04	2.092E-04	2.112E-04	2.044E-04
1.915E-04	1.571E-04	1.298E-04	9.416E-05	7.294F-05	5.934E-05	5.033F-05	4.129E-05

DOSE INTEGRALS FOR 0.200 MEV

2.254E-04	2.254E-04	2.255E-04	2.256E-04	2.258F-04	2.260E-04	2.262E-04	2.269E-04
2.277E-04	2.306E-04	2.352E-04	2.500E-04	2.664F-04	2.765E-04	2.791E-04	2.704E-04
2.537E-04	2.090E-04	1.733E-04	1.262E-04	9.800E-05	7.985E-05	6.779E-05	5.569E-05

DOSE INTEGRALS FOR 0.300 MEV

3.297E-04	3.297E-04	3.298E-04	3.299F-04	3.302E-04	3.305E-04	3.308E-04	3.317E-04
3.329E-04	3.370E-04	3.435E-04	3.650E-04	3.893F-04	4.041E-04	4.082E-04	3.959E-04
3.718E-04	3.075E-04	2.558E-04	1.971E-04	1.457F-04	1.189E-04	1.010E-04	8.311E-05

DOSE INTEGRALS FOR 0.400 MEV

4.302E-04	4.303E-04	4.304E-04	4.306E-04	4.309F-04	4.313E-04	4.317E-04	4.329E-04
4.344E-04	4.399E-04	4.484E-04	4.769E-04	5.091E-04	5.291E-04	5.348E-04	5.192E-04
4.881E-04	4.049E-04	3.378E-04	2.482E-04	1.937F-04	1.583E-04	1.346E-04	1.109E-04

DOSE INTEGRALS FOR 0.500 MEV

5.284E-04	5.285E-04	5.286E-04	5.289E-04	5.292F-04	5.297E-04	5.302E-04	5.317E-04
5.335E-04	5.402E-04	5.507E-04	5.859E-04	6.259F-04	6.507E-04	6.579E-04	6.392E-04
6.014E-04	5.000E-04	4.180E-04	3.082E-04	2.409F-04	1.971E-04	1.678E-04	1.384E-04

DOSE INTEGRALS FOR 0.600 MEV

6.274E-04	6.275E-04	6.276E-04	6.279F-04	6.284F-04	6.289E-04	6.296E-04	6.313F-04
6.335E-04	6.414E-04	6.538E-04	6.957E-04	7.432F-04	7.727E-04	7.814E-04	7.594E-04
7.150E-04	5.955E-04	4.988E-04	3.687E-04	2.887F-04	2.365E-04	2.015E-04	1.665E-04

DOSE INTEGRALS FOR 0.800 MEV

8.211E-04	8.212E-04	8.214E-04	8.218E-04	8.223E-04	8.230E-04	8.239E-04	8.261E-04
8.289E-04	8.391E-04	8.551E-04	9.089E-04	9.701E-04	1.008E-03	1.019E-03	9.911E-04
9.340E-04	7.803E-04	6.557E-04	4.872E-04	3.827F-04	3.141E-04	2.682E-04	2.220E-04

DOSE INTEGRALS FOR 1.000 MEV

1.012E-03	1.012E-03	1.012E-03	1.013E-03	1.013F-03	1.014E-03	1.015E-03	1.018E-03
1.021E-03	1.034E-03	1.053E-03	1.117E-03	1.191E-03	1.236E-03	1.250E-03	1.215E-03
1.146E-03	9.603E-04	8.092E-04	6.042E-04	4.758F-04	3.913E-04	3.345E-04	2.775E-04

DOSE INTEGRALS FOR 1.500 MEV

1.465E-03	1.465E-03	1.465E-03	1.466E-03	1.467E-03	1.468E-03	1.470E-03	1.473E-03
1.478E-03	1.494E-03	1.520E-03	1.606E-03	1.704F-03	1.764E-03	1.782E-03	1.733E-03
1.638E-03	1.381E-03	1.171E-03	8.828E-04	6.996F-04	5.779E-04	4.958E-04	4.132E-04

DOSE INTEGRALS FOR 2.000 MEV

1.870E-03	1.870E-03	1.870E-03	1.871E-03	1.872E-03	1.873E-03	1.875E-03	1.879E-03
1.885E-03	1.904E-03	1.935E-03	2.039E-03	2.156E-03	2.227E-03	2.247E-03	2.187E-03
2.070E-03	1.754E-03	1.494E-03	1.136E-03	9.049E-04	7.503E-04	6.458E-04	5.404E-04

DOSE INTEGRALS FOR 3.000 MEV

2.617E-03	2.617E-03	2.618E-03	2.619E-03	2.620E-03	2.622E-03	2.624E-03	2.629E-03
2.636E-03	2.661E-03	2.701E-03	2.834E-03	2.983E-03	3.073E-03	3.097E-03	3.017E-03
2.862E-03	2.442E-03	2.095E-03	1.610E-03	1.294E-03	1.079E-03	9.335E-04	7.864E-04

DOSE INTEGRALS FOR 4.000 MEV

3.283E-03	3.283E-03	3.284E-03	3.285E-03	3.286E-03	3.288E-03	3.291E-03	3.297E-03
3.306E-03	3.335E-03	3.383E-03	3.540E-03	3.714E-03	3.820E-03	3.847E-03	3.749E-03
3.562E-03	3.056E-03	2.634E-03	2.042E-03	1.651E-03	1.384E-03	1.203E-03	1.019E-03

DOSE INTEGRALS FOR 5.000 MEV

3.909E-03	3.910E-03	3.910E-03	3.911E-03	3.913E-03	3.916E-03	3.918E-03	3.926E-03
3.935E-03	3.969E-03	4.024E-03	4.205E-03	4.404E-03	4.524E-03	4.554E-03	4.439E-03
4.223E-03	3.634E-03	3.142E-03	2.447E-03	1.987E-03	1.671E-03	1.455E-03	1.237E-03

STACK HEIGHT = 100.0 METERS
LID HEIGHT = 1000.0 METERS
SGMX = 2000.0 METERS
RHO = 1293.0 GM/M**3

DOSE INTEGRALS FOR SIGMA Z = (METERS)

1.0	1.5	2.0	3.0	4.0	5.0	6.0	8.0
10.0	15.0	20.0	30.0	40.0	50.0	60.0	80.0
100.0	150.0	200.0	300.0	400.0	500.0	600.0	800.0
1000.0	1500.0	2000.0	3000.0				

DOSE INTEGRALS FOR 0.010 MEV

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	4.775E-14	1.658E-07	1.275E-06	2.859E-06	4.016E-06	4.417E-06
3.720E-06	1.800E-06	8.147E-07	4.408E-07	3.387E-07	2.743E-07	2.319E-07	1.894E-07
1.776E-07	1.752E-07	1.752E-07	1.752E-07				

DOSE INTEGRALS FOR 0.015 MEV

2.419E-13	3.395E-13	4.581E-13	6.878E-13	9.676E-13	1.333E-12	1.778E-12	3.502E-12
7.513E-12	9.302E-11	1.719E-09	3.848E-07	2.876E-06	6.729E-06	1.001E-05	1.315E-05
1.337E-05	1.043E-05	7.611E-06	5.106E-06	3.924E-06	3.178E-06	2.686E-06	2.194E-06
2.058E-06	2.030E-06	2.030E-06	2.030E-06				

DOSE INTEGRALS FOR 0.020 MEV

2.044E-08	2.066E-08	2.124E-08	2.307E-08	2.608E-08	2.847E-08	3.093E-08	3.663E-08
4.556E-08	7.613E-08	1.286E-07	8.994E-07	4.512E-06	9.897E-06	1.458E-05	1.927E-05
2.002E-05	1.677E-05	1.328E-05	9.318E-06	7.162E-06	5.801E-06	4.903E-06	4.006E-06
3.757E-06	3.706E-06	3.706E-06	3.706E-06				

DOSE INTEGRALS FOR 0.030 MEV

1.816E-06	1.823E-06	1.826E-06	1.846E-06	1.860E-06	1.878E-06	1.900E-06	1.977E-06
2.056E-06	2.361E-06	2.887E-06	5.325E-06	1.102E-05	1.820E-05	2.425E-05	3.052E-05
3.160E-05	2.734E-05	2.233E-05	1.590E-05	1.223E-05	9.913E-06	8.383E-06	6.851E-06
6.427E-06	6.341E-06	6.341E-06	6.341E-06				

DOSE INTEGRALS FOR 0.040 MEV

9.427E-06	9.433E-06	9.441E-06	9.465E-06	9.499E-06	9.542E-06	9.593E-06	9.731E-06
9.904E-06	1.056E-05	1.157E-05	1.519E-05	2.162E-05	2.905E-05	3.521E-05	4.155E-05
4.241E-05	3.690E-05	3.052E-05	2.191E-05	1.689E-05	1.370E-05	1.160E-05	9.486E-06
8.901E-06	8.782E-06	8.782E-06	8.782E-06				

DOSE INTEGRALS FOR 0.050 MEV

2.062E-05	2.062E-05	2.063E-05	2.067E-05	2.071E-05	2.077E-05	2.084E-05	2.101E-05
2.124E-05	2.207E-05	2.329E-05	2.732E-05	3.374E-05	4.088E-05	4.669E-05	5.255E-05
5.297E-05	4.613E-05	3.847E-05	2.779E-05	2.148E-05	1.744E-05	1.477E-05	1.209E-05
1.135E-05	1.120E-05	1.120E-05	1.120E-05				

DOSE INTEGRALS FOR 0.060 MEV

3.280E-05	3.281E-05	3.282E-05	3.285E-05	3.290E-05	3.297E-05	3.304E-05	3.324E-05
3.350E-05	3.441E-05	3.573E-05	3.993E-05	4.633E-05	5.329E-05	5.890E-05	6.434E-05
6.429E-05	5.603E-05	4.695E-05	3.411E-05	2.642E-05	2.148E-05	1.820E-05	1.492E-05

1.401E-05	1.383E-05	1.383E-05	1.383E-05				

DOSE INTEGRALS FOR 0.080 MEV

5.550E-05	5.551E-05	5.552E-05	5.556E-05	5.561E-05	5.568E-05	5.577E-05	5.599E-05
5.627E-05	5.726E-05	5.869E-05	6.314E-05	6.976E-05	7.686E-05	8.251E-05	8.762E-05
8.676E-05	7.568E-05	6.381E-05	4.673E-05	3.631E-05	2.958E-05	2.510E-05	2.061E-05
1.937E-05	1.911E-05	1.911E-05	1.911E-05				

DOSE INTEGRALS FOR 0.100 MEV

7.684E-05	7.685E-05	7.687E-05	7.691E-05	7.697E-05	7.705E-05	7.715E-05	7.739E-05
7.770E-05	7.879E-05	8.037E-05	8.527E-05	9.261E-05	1.005E-04	1.067E-04	1.121E-04
1.106E-04	9.664E-05	8.177E-05	6.015E-05	4.686E-05	3.823E-05	3.247E-05	2.670E-05
2.509E-05	2.477E-05	2.477E-05	2.477E-05				

DOSE INTEGRALS FOR 0.150 MEV

1.224E-04	1.224E-04	1.224E-04	1.225E-04	1.225E-04	1.226E-04	1.228E-04	1.231E-04
1.235E-04	1.249E-04	1.269E-04	1.334E-04	1.433E-04	1.542E-04	1.627E-04	1.698E-04
1.673E-04	1.465E-04	1.245E-04	9.211E-05	7.200E-05	5.885E-05	5.006E-05	4.123E-05
3.878E-05	3.828E-05	3.828E-05	3.828E-05				

DOSE INTEGRALS FOR 0.200 MEV

1.653E-04	1.654E-04	1.654E-04	1.654E-04	1.655E-04	1.657E-04	1.658E-04	1.662E-04
1.667E-04	1.684E-04	1.709E-04	1.790E-04	1.918E-04	2.057E-04	2.167E-04	2.258E-04
2.224E-04	1.952E-04	1.662E-04	1.235E-04	9.675E-05	7.919E-05	6.743E-05	5.560E-05
5.232E-05	5.165E-05	5.165E-05	5.165E-05				

DOSE INTEGRALS FOR 0.300 MEV

2.456E-04	2.457E-04	2.457E-04	2.458E-04	2.459E-04	2.461E-04	2.463E-04	2.468E-04
2.475E-04	2.499E-04	2.533E-04	2.647E-04	2.829E-04	3.030E-04	3.189E-04	3.319E-04
3.270E-04	2.876E-04	2.456E-04	1.832E-04	1.438E-04	1.179E-04	1.005E-04	8.298E-05
7.812E-05	7.713E-05	7.713E-05	7.713E-05				

DOSE INTEGRALS FOR 0.400 MEV

3.238E-04	3.238E-04	3.238E-04	3.240E-04	3.241E-04	3.243E-04	3.246E-04	3.253E-04
3.261E-04	3.292E-04	3.337E-04	3.484E-04	3.721E-04	3.986E-04	4.194E-04	4.365E-04
4.303E-04	3.792E-04	3.247E-04	2.430E-04	1.912E-04	1.570E-04	1.339E-04	1.108E-04
1.043E-04	1.030E-04	1.030E-04	1.030E-04				

DOSE INTEGRALS FOR 0.500 MEV

4.001E-04	4.002E-04	4.002E-04	4.003E-04	4.005E-04	4.008E-04	4.011E-04	4.019E-04
4.029E-04	4.066E-04	4.121E-04	4.300E-04	4.592E-04	4.917E-04	5.173E-04	5.385E-04
5.309E-04	4.687E-04	4.020E-04	3.017E-04	2.379E-04	1.955E-04	1.670E-04	1.382E-04
1.303E-04	1.287E-04	1.286E-04	1.286E-04				

DOSE INTEGRALS FOR 0.600 MEV

4.773E-04	4.773E-04	4.774E-04	4.776E-04	4.778E-04	4.781E-04	4.785E-04	4.794E-04
4.806E-04	4.850E-04	4.914E-04	5.125E-04	5.470E-04	5.855E-04	6.158E-04	6.408E-04
6.320E-04	5.587E-04	4.800E-04	3.611E-04	2.851E-04	2.346E-04	2.005E-04	1.662E-04
1.567E-04	1.548E-04	1.547E-04	1.547E-04				

DOSE INTEGRALS FOR 0.800 MEV

6.295E-04	6.296E-04	6.297E-04	6.299E-04	6.302E-04	6.305E-04	6.310E-04	6.322E-04

6.338E-04	6.393E-04	6.475E-04	6.747E-04	7.190F-04	7.683E-04	8.071E-04	8.391E-04
8.275E-04	7.332E-04	5.317E-04	4.774E-04	3.780F-04	3.116E-04	2.668E-04	2.216E-04
2.091E-04	2.065F-04	2.065F-04	2.065E-04				

DOSE INTEGRALS FOR 1.000 MEV

7.820E-04	7.820E-04	7.821E-04	7.823E-04	7.827E-04	7.831E-04	7.836E-04	7.851E-04
7.869E-04	7.935E-04	8.033E-04	8.359E-04	8.889E-04	9.480E-04	9.943E-04	1.032E-03
1.018E-03	9.034E-04	7.804E-04	5.921E-04	4.700E-04	3.882E-04	3.328E-04	2.770F-04
2.616E-04	2.584E-04	2.584E-04	2.584E-04				

DOSE INTEGRALS FOR 1.500 MEV

1.150E-03	1.150E-03	1.150E-03	1.150E-03	1.151F-03	1.152E-03	1.152E-03	1.154E-03
1.157E-03	1.166E-03	1.179E-03	1.223E-03	1.294E-03	1.373E-03	1.434E-03	1.483E-03
1.462E-03	1.302E-03	1.131E-03	8.658E-04	6.913F-04	5.734E-04	4.934E-04	4.126E-04
3.902E-04	3.856E-04	3.856F-04	3.856E-04				

DOSE INTEGRALS FOR 2.000 MEV

1.486E-03	1.486E-03	1.486E-03	1.487E-03	1.487E-03	1.488E-03	1.489E-03	1.491E-03
1.494E-03	1.505E-03	1.521E-03	1.573E-03	1.658E-03	1.752E-03	1.826E-03	1.883E-03
1.855E-03	1.657E-03	1.445E-03	1.115E-03	8.945F-04	7.447E-04	6.427E-04	5.396E-04
5.110E-04	5.052E-04	5.052E-04	5.052E-04				

DOSE INTEGRALS FOR 3.000 MEV

2.114E-03	2.114E-03	2.114E-03	2.115E-03	2.115E-03	2.116E-03	2.117E-03	2.120E-03
2.124E-03	2.138E-03	2.158E-03	2.225E-03	2.334F-03	2.455E-03	2.548E-03	2.619E-03
2.579E-03	2.313E-03	2.029E-03	1.581E-03	1.279F-03	1.071E-03	9.292E-04	7.853E-04
7.454E-04	7.373E-04	7.373E-04	7.373E-04				

DOSE INTEGRALS FOR 4.000 MEV

2.680E-03	2.680E-03	2.681E-03	2.681E-03	2.682F-03	2.683E-03	2.685E-03	2.688E-03
2.693E-03	2.709E-03	2.733E-03	2.812E-03	2.941F-03	3.082E-03	3.192E-03	3.273E-03
3.223E-03	2.899E-03	2.553E-03	2.006E-03	1.633F-03	1.374E-03	1.197E-03	1.018E-03
9.678E-04	9.577E-04	9.576E-04	9.576E-04				

DOSE INTEGRALS FOR 5.000 MEV

3.212E-03	3.212E-03	3.212E-03	3.213E-03	3.214F-03	3.215E-03	3.217E-03	3.221E-03
3.226E-03	3.245E-03	3.272E-03	3.363E-03	3.510E-03	3.673E-03	3.798E-03	3.890E-03
3.830E-03	3.451E-03	3.048E-03	2.406E-03	1.965E-03	1.659E-03	1.449E-03	1.236E-03
1.176E-03	1.164E-03	1.164E-03	1.164E-03				

EGAD DOSE INTEGRALS (RAD*METERS**2 PER CURIE*SEC)

STACK HEIGHT = 120.0 METERS
LID HEIGHT = 620.0 METERS
SGMX = 2500.0 METERS
RHO = 1293.0 GM/M**3

NGAM=22 NSIG=24

DOSE INTEGRALS FOR SIGMA Z = (METERS)

1.0	1.5	2.0	3.0	4.0	5.0	6.0	8.0
10.0	15.0	20.0	30.0	40.0	50.0	60.0	80.0
100.0	150.0	200.0	300.0	400.0	500.0	600.0	800.0

DOSE INTEGRALS FOR 0.010 MEV

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	1.480E-08	3.374E-07	1.269E-06	2.381E-06	3.708E-06
3.756E-06	2.412E-06	1.793E-06	1.323E-06	1.051E-06	9.256E-07	8.821E-07	8.685E-07

DOSE INTEGRALS FOR 0.015 MEV

0.0	0.0	0.0	0.0	0.0	0.0	3.157E-16	1.059E-14
6.246E-14	1.399E-12	3.648E-11	3.747E-08	7.559E-07	2.870E-06	5.589E-06	9.652E-06
1.120E-05	1.028E-05	8.585E-06	6.332E-06	5.032E-06	4.432E-06	4.224E-06	4.158E-06

DOSE INTEGRALS FOR 0.020 MEV

2.840E-09	2.857E-09	2.882E-09	2.954E-09	3.056E-09	3.193E-09	3.368E-09	3.885E-09
4.789E-09	1.001E-08	2.321E-08	1.476E-07	1.298E-06	4.307E-06	8.138E-06	1.399E-05
1.638E-05	1.573E-05	1.341E-05	9.893E-06	7.863E-06	6.926E-06	6.601E-06	6.499E-06

DOSE INTEGRALS FOR 0.030 MEV

8.147E-07	8.231E-07	8.242E-07	8.402E-07	8.483E-07	8.508E-07	8.674E-07	8.784E-07
9.167E-07	1.028E-06	1.221E-06	2.075E-06	4.556E-06	9.139E-06	1.445E-05	2.238E-05
2.583E-05	2.516E-05	2.166E-05	1.601E-05	1.274E-05	1.123E-05	1.071E-05	1.054E-05

DOSE INTEGRALS FOR 0.040 MEV

5.010E-06	5.013E-06	5.018E-06	5.031E-06	5.050E-06	5.075E-06	5.104E-06	5.182E-06
5.275E-06	5.615E-06	6.144E-06	7.962E-06	1.150E-05	1.686E-05	2.264E-05	3.117E-05
3.484E-05	3.363E-05	2.902E-05	2.152E-05	1.716E-05	1.515E-05	1.445E-05	1.423E-05

DOSE INTEGRALS FOR 0.050 MEV

1.261E-05	1.262E-05	1.262E-05	1.264E-05	1.267E-05	1.271E-05	1.275E-05	1.286E-0
1.301E-05	1.351E-05	1.424E-05	1.661E-05	2.061E-05	2.610E-05	3.188E-05	4.021E-0
4.354E-05	4.152E-05	3.615E-05	2.692E-05	2.153E-05	1.904E-05	1.818E-05	1.790E-0

DOSE INTEGRALS FOR 0.060 MEV

2.164E-05	2.164E-05	2.165E-05	2.168E-05	2.172E-05	2.176E-05	2.181E-05	2.195E-0
2.212E-05	2.273E-05	2.359E-05	2.627E-05	3.048E-05	3.610E-05	4.170E-05	5.005E-0
5.303E-05	5.014E-05	4.330E-05	3.237E-05	2.596E-05	2.300E-05	2.197E-05	2.165E-0

DOSE INTEGRALS FOR 0.080 MEV

3.962E-05	3.963E-05	3.964E-05	3.967E-05	3.971E-05	3.977E-05	3.983E-05	3.999E-
4.019E-05	4.089E-05	4.191E-05	4.492E-05	4.944E-05	5.548E-05	6.125E-05	6.958E-

7.242E-05	6.782E-05	5.871E-05	4.416E-05	3.558E-05	3.161E-05	3.023E-05	2.980E-05

DOSE INTEGRALS FOR 0.100 MEV

5.698E-05	5.699E-05	5.700E-05	5.704E-05	5.709E-05	5.714E-05	5.722E-05	5.740E-05
5.762E-05	5.843E-05	5.956E-05	6.295E-05	6.777E-05	7.443E-05	8.125E-05	8.983E-05
9.334E-05	8.710E-05	7.556E-05	5.707E-05	4.613E-05	4.107E-05	3.931E-05	3.875E-05

DOSE INTEGRALS FOR 0.150 MEV

9.418E-05	9.420E-05	9.421E-05	9.426E-05	9.432E-05	9.440E-05	9.449E-05	9.474E-05
9.504E-05	9.607E-05	9.757E-05	1.020E-04	1.085E-04	1.168E-04	1.262E-04	1.387E-04
1.418E-04	1.319E-04	1.160E-04	8.813E-05	7.155E-05	6.386E-05	6.119E-05	6.035E-05

DOSE INTEGRALS FOR 0.200 MEV

1.295E-04	1.295E-04	1.295E-04	1.296E-04	1.297E-04	1.298E-04	1.299E-04	1.302E-04
1.305E-04	1.318E-04	1.336E-04	1.386E-04	1.473E-04	1.580E-04	1.688E-04	1.862E-04
1.901E-04	1.768E-04	1.542E-04	1.175E-04	9.571E-05	8.559E-05	8.207E-05	8.097E-05

DOSE INTEGRALS FOR 0.300 MEV

1.952E-04	1.952E-04	1.953E-04	1.953E-04	1.955E-04	1.956E-04	1.957E-04	1.961E-04
1.966E-04	1.983E-04	2.007E-04	2.078E-04	2.179E-04	2.342E-04	2.512E-04	2.719E-04
2.794E-04	2.613E-04	2.291E-04	1.753E-04	1.431E-04	1.282E-04	1.231E-04	1.214E-04

DOSE INTEGRALS FOR 0.400 MEV

2.602E-04	2.603E-04	2.603E-04	2.604E-04	2.605E-04	2.607E-04	2.609E-04	2.613E-04
2.620E-04	2.641E-04	2.669E-04	2.740E-04	2.901E-04	3.090E-04	3.317E-04	3.616E-04
3.704E-04	3.453E-04	3.022E-04	2.321E-04	1.901E-04	1.706E-04	1.638E-04	1.617E-04

DOSE INTEGRALS FOR 0.500 MEV

3.235E-04	3.235E-04	3.235E-04	3.236E-04	3.238E-04	3.240E-04	3.242E-04	3.248E-04
3.255E-04	3.278E-04	3.311E-04	3.410E-04	3.578E-04	3.846E-04	4.096E-04	4.467E-04
4.584E-04	4.294E-04	3.765E-04	2.898E-04	2.379E-04	2.138E-04	2.054E-04	2.028E-04

DOSE INTEGRALS FOR 0.600 MEV

3.878E-04	3.878E-04	3.878E-04	3.880E-04	3.882E-04	3.884E-04	3.887E-04	3.893E-04
3.901E-04	3.926E-04	3.953E-04	4.061E-04	4.276E-04	4.587E-04	4.914E-04	5.355E-04
5.491E-04	5.115E-04	4.490E-04	3.465E-04	2.849E-04	2.564E-04	2.465E-04	2.434E-0

DOSE INTEGRALS FOR 0.800 MEV

5.154E-04	5.154E-04	5.155E-04	5.157E-04	5.159E-04	5.161E-04	5.163E-04	5.164E-0
5.165E-04	5.190E-04	5.226E-04	5.394E-04	5.658E-04	6.070E-04	6.483E-04	7.060E-0
7.232E-04	6.760E-04	5.957E-04	4.615E-04	3.808E-04	3.434E-04	3.304E-04	3.263E-0

DOSE INTEGRALS FOR 1.000 MEV

6.403E-04	6.407E-04	6.399E-04	6.382E-04	6.395E-04	6.399E-04	6.403E-04	6.414E-0
6.424E-04	6.433E-04	6.503E-04	6.692E-04	7.064E-04	7.549E-04	8.055E-04	8.736E-0
8.938E-04	8.360E-04	7.387E-04	5.744E-04	4.755E-04	4.295E-04	4.136E-04	4.086E-0

DOSE INTEGRALS FOR 1.500 MEV

9.432E-04	9.433E-04	9.434E-04	9.439E-04	9.448E-04	9.453E-04	9.471E-04	9.485E-
9.504E-04	9.592E-04	9.689E-04	9.988E-04	1.048E-03	1.112E-03	1.180E-03	1.273E-
1.298E-03	1.214E-03	1.075E-03	8.431E-04	7.028E-04	6.377E-04	6.151E-04	6.080E-

DOSE INTEGRALS FOR 2.000 MEV

1.244E-03	1.244E-03	1.244E-03	1.244E-03	1.245E-03	1.245E-03	1.246E-03	1.248E-03
1.250E-03	1.258E-03	1.269E-03	1.304E-03	1.362E-03	1.439E-03	1.520E-03	1.629E-03
1.658E-03	1.551E-03	1.379E-03	1.089E-03	9.131E-04	8.314E-04	8.031E-04	7.942E-04

DOSE INTEGRALS FOR 3.000 MEV

1.805E-03	1.805E-03	1.805E-03	1.805E-03	1.806E-03	1.807E-03	1.808E-03	1.810E-03
1.812E-03	1.822E-03	1.836E-03	1.880E-03	1.952E-03	2.052E-03	2.154E-03	2.291E-03
2.325E-03	2.177E-03	1.945E-03	1.552E-03	1.313E-03	1.201E-03	1.163E-03	1.151E-03

DOSE INTEGRALS FOR 4.000 MEV

2.311E-03	2.311E-03	2.311E-03	2.312E-03	2.312E-03	2.313E-03	2.314E-03	2.317E-03
2.320E-03	2.331E-03	2.348E-03	2.399E-03	2.485E-03	2.603E-03	2.723E-03	2.884E-03
2.921E-03	2.738E-03	2.455E-03	1.974E-03	1.681E-03	1.545E-03	1.497E-03	1.482E-03

DOSE INTEGRALS FOR 5.000 MEV

2.785E-03	2.785E-03	2.786E-03	2.787E-03	2.788E-03	2.789E-03	2.790E-03	2.793E-03
2.796E-03	2.811E-03	2.829E-03	2.889E-03	2.987E-03	3.121E-03	3.259E-03	3.442E-03
3.484E-03	3.268E-03	2.936E-03	2.372E-03	2.027E-03	1.867E-03	1.812E-03	1.794E-03

EGAD DOSE INTEGRALS (RAD*METERS**2 PER CURIE*SEC)

STACK HEIGHT = 150.0 METERS
LID HEIGHT = 760.0 METERS
SGMX = 2500.0 METERS
RHO = 1293.0 GM/M**3

NGAM=22 NSIG=24

DOSE INTEGRALS FOR SIGMA Z = (METERS)

1.0	1.5	2.0	3.0	4.0	5.0	6.0	8.0
10.0	15.0	20.0	30.0	40.0	50.0	60.0	80.0
100.0	150.0	200.0	300.0	400.0	500.0	600.0	800.0

DOSE INTEGRALS FOR 0.010 MEV

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	2.524E-08	2.356E-07	7.294E-07	1.812E-06
2.299E-06	1.843E-06	1.103E-06	8.340E-07	6.628E-07	5.575E-07	5.027E-07	4.708E-07

DOSE INTEGRALS FOR 0.015 MEV

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	7.846E-16	6.338E-14	1.100E-10	6.224E-08	5.684E-07	1.797E-06	5.049E-06
7.347E-06	8.394E-06	7.147E-06	5.534E-06	4.398E-06	3.700E-06	3.336E-06	3.124E-06

DOSE INTEGRALS FOR 0.020 MEV

1.486E-10	1.495E-10	1.508E-10	1.545E-10	1.598E-10	1.669E-10	1.760E-10	2.014E-10
2.395E-10	4.399E-10	1.080E-09	9.436E-09	1.362E-07	9.223E-07	2.727E-06	7.441E-06
1.089E-05	1.302E-05	1.173E-05	9.136E-06	7.262E-06	6.109E-06	5.509E-06	5.160E-06

DOSE INTEGRALS FOR 0.030 MEV

3.140E-07	3.143E-07	3.148E-07	3.162E-07	3.182E-07	3.207E-07	3.236E-07	3.306E-07
3.388E-07	3.598E-07	4.014E-07	5.684E-07	1.147E-06	2.762E-06	5.623E-06	1.253E-05
1.756E-05	2.099E-05	1.936E-05	1.509E-05	1.200E-05	1.011E-05	9.116E-06	8.541E-06

DOSE INTEGRALS FOR 0.040 MEV

1.996E-06	1.997E-06	2.009E-06	2.013E-06	2.020E-06	2.028E-06	2.039E-06	2.067E-06
2.105E-06	2.239E-06	2.434E-06	3.097E-06	4.421E-06	6.898E-06	1.056E-05	1.870E-05
2.452E-05	2.845E-05	2.634E-05	2.058E-05	1.640E-05	1.382E-05	1.247E-05	1.169E-05

DOSE INTEGRALS FOR 0.050 MEV

6.075E-06	6.077E-06	6.080E-06	6.090E-06	6.103E-06	6.120E-06	6.141E-06	6.193E-06
6.260E-06	6.497E-06	6.851E-06	7.950E-06	9.854E-06	1.289E-05	1.701E-05	2.574E-05
3.190E-05	3.589E-05	3.321E-05	2.600E-05	2.075E-05	1.751E-05	1.583E-05	1.484E-05

DOSE INTEGRALS FOR 0.060 MEV

1.160E-05	1.160E-05	1.161E-05	1.162E-05	1.164E-05	1.166E-05	1.169E-05	1.176E-0
1.186E-05	1.218E-05	1.265E-05	1.409E-05	1.639E-05	1.986E-05	2.434E-05	3.358E-0
4.003E-05	4.395E-05	4.062E-05	3.186E-05	2.548E-05	2.153E-05	1.948E-05	1.828E-0

DOSE INTEGRALS FOR 0.080 MEV

2.380E-05	2.381E-05	2.381E-05	2.383E-05	2.386E-05	2.389E-05	2.393E-05	2.402E-0
2.415E-05	2.459E-05	2.521E-05	2.706E-05	2.991E-05	3.396E-05	3.905E-05	4.932E-0

5.639E-05	6.014E-05	5.546E-05	4.364E-05	3.500E-05	2.965E-05	2.686E-05	2.524E-05

DOSE INTEGRALS FOR 0.100 MEV

3.627E-05	3.628E-05	3.629E-05	3.631E-05	3.634E-05	3.638E-05	3.642E-05	3.654E-05
3.669E-05	3.721E-05	3.794E-05	4.012E-05	4.342E-05	4.809E-05	5.391E-05	6.563E-05
7.363E-05	7.741E-05	7.130E-05	5.623E-05	4.520E-05	3.836E-05	3.479E-05	3.271E-05

DOSE INTEGRALS FOR 0.150 MEV

6.380E-05	6.381E-05	6.382E-05	6.385E-05	6.389E-05	6.394E-05	6.400E-05	6.415E-05
6.435E-05	6.503E-05	6.600E-05	6.884E-05	7.321E-05	7.944E-05	8.730E-05	1.032E-04
1.140E-04	1.184E-04	1.090E-04	8.624E-05	6.953E-05	5.914E-05	5.372E-05	5.056E-05

DOSE INTEGRALS FOR 0.200 MEV

9.023E-05	9.024E-05	9.025E-05	9.029E-05	9.034E-05	9.040E-05	9.048E-05	9.067E-05
9.092E-05	9.177E-05	9.296E-05	9.650E-05	1.019E-04	1.097E-04	1.196E-04	1.398E-04
1.534E-04	1.585E-04	1.459E-04	1.157E-04	9.350E-05	7.966E-05	7.243E-05	6.822E-05

DOSE INTEGRALS FOR 0.300 MEV

1.394E-04	1.394E-04	1.394E-04	1.394E-04	1.395E-04	1.396E-04	1.397E-04	1.400E-04
1.403E-04	1.414E-04	1.431E-04	1.479E-04	1.553E-04	1.661E-04	1.801E-04	2.086E-04
2.279E-04	2.347E-04	2.161E-04	1.718E-04	1.391E-04	1.187E-04	1.081E-04	1.019E-04

DOSE INTEGRALS FOR 0.400 MEV

1.893E-04	1.894E-04	1.894E-04	1.894E-04	1.895E-04	1.896E-04	1.898E-04	1.901E-04
1.905E-04	1.919E-04	1.939E-04	1.999E-04	2.092E-04	2.229E-04	2.408E-04	2.775E-04
3.022E-04	3.106E-04	2.862E-04	2.280E-04	1.850E-04	1.582E-04	1.442E-04	1.360E-04

DOSE INTEGRALS FOR 0.500 MEV

2.381E-04	2.382E-04	2.382E-04	2.383E-04	2.384E-04	2.385E-04	2.386E-04	2.390E-04
2.395E-04	2.412E-04	2.436E-04	2.508E-04	2.619E-04	2.786E-04	3.002E-04	3.449E-04
3.749E-04	3.848E-04	3.549E-04	2.833E-04	2.302E-04	1.971E-04	1.798E-04	1.698E-04

DOSE INTEGRALS FOR 0.600 MEV

2.882E-04	2.882E-04	2.882E-04	2.883E-04	2.884E-04	2.886E-04	2.887E-04	2.892E-04
2.897E-04	2.917E-04	2.945E-04	3.027E-04	3.158E-04	3.352E-04	3.607E-04	4.132E-04
4.484E-04	4.598E-04	4.242E-04	3.391E-04	2.761E-04	2.367E-04	2.161E-04	2.041E-04

DOSE INTEGRALS FOR 0.800 MEV

3.883E-04	3.883E-04	3.884E-04	3.885E-04	3.886E-04	3.888E-04	3.890E-04	3.896E-04
3.903E-04	3.928E-04	3.963E-04	4.067E-04	4.232E-04	4.480E-04	4.804E-04	5.474E-04
5.921E-04	6.058E-04	5.594E-04	4.485E-04	3.661E-04	3.146E-04	2.877E-04	2.720E-04

DOSE INTEGRALS FOR 1.000 MEV

4.909E-04	4.909E-04	4.910E-04	4.911E-04	4.913E-04	4.915E-04	4.918E-04	4.924E-0
4.933E-04	4.962E-04	5.004E-04	5.128E-04	5.326E-04	5.621E-04	6.009E-04	6.808E-0
7.340E-04	7.492E-04	6.923E-04	5.566E-04	4.555E-04	3.922E-04	3.592E-04	3.400E-0

DOSE INTEGRALS FOR 1.500 MEV

7.475E-04	7.476E-04	7.476E-04	7.478E-04	7.481E-04	7.483E-04	7.487E-04	7.496E-0
7.507E-04	7.547E-04	7.603E-04	7.771E-04	8.036E-04	8.433E-04	8.953E-04	1.002E-0
1.073E-03	1.089E-03	1.008E-03	8.151E-04	6.709E-04	5.805E-04	5.333E-04	5.058E-0

DOSE INTEGRALS FOR 2.000 MEV

9.910E-04	9.911E-04	9.912E-04	9.914E-04	9.917E-04	9.920E-04	9.925E-04	9.935E-04
9.949E-04	9.997E-04	1.006E-03	1.027E-03	1.058E-03	1.106E-03	1.168E-03	1.296E-03
1.379E-03	1.395E-03	1.293E-03	1.051E-03	8.694E-04	7.554E-04	6.959E-04	6.612E-04

DOSE INTEGRALS FOR 3.000 MEV

1.456E-03	1.456E-03	1.456E-03	1.456E-03	1.457E-03	1.457E-03	1.458E-03	1.459E-03
1.461E-03	1.467E-03	1.476E-03	1.502E-03	1.543E-03	1.604E-03	1.684E-03	1.847E-03
1.953E-03	1.966E-03	1.824E-03	1.495E-03	1.247E-03	1.090E-03	1.008E-03	9.606E-04

DOSE INTEGRALS FOR 4.000 MEV

1.886E-03	1.886E-03	1.886E-03	1.886E-03	1.886E-03	1.887E-03	1.888E-03	1.889E-03
1.891E-03	1.899E-03	1.909E-03	1.940E-03	1.988E-03	2.061E-03	2.155E-03	2.347E-03
2.471E-03	2.480E-03	2.306E-03	1.901E-03	1.595E-03	1.402E-03	1.301E-03	1.242E-03

DOSE INTEGRALS FOR 5.000 MEV

2.287E-03	2.287E-03	2.288E-03	2.288E-03	2.288E-03	2.289E-03	2.290E-03	2.292E-03
2.294E-03	2.302E-03	2.314E-03	2.350E-03	2.406E-03	2.489E-03	2.597E-03	2.817E-03
2.958E-03	2.965E-03	2.759E-03	2.283E-03	1.922E-03	1.694E-03	1.575E-03	1.506E-03

EGAD DOSE INTEGRALS (RAD*METERS**2 PER CURIE*SEC)

STACK HEIGHT = 200.0 METERS
LID HEIGHT = 760.0 METERS
SGMX = 2500.0 METERS
RHO = 1293.0 GM/M**3

NGAM=22 NSIG=24

DOSE INTEGRALS FOR SIGMA Z = (METERS)

1.0	1.5	2.0	3.0	4.0	5.0	6.0	8.0
10.0	15.0	20.0	30.0	40.0	50.0	60.0	80.0
100.0	150.0	200.0	300.0	400.0	500.0	600.0	800.0

DOSE INTEGRALS FOR 0.010 MEV

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	6.410E-09	5.613E-08	4.014E-07
8.312E-07	1.076E-06	8.599E-07	7.568E-07	6.287E-07	5.424E-07	4.968E-07	4.703E-07

DOSE INTEGRALS FOR 0.015 MEV

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	2.785E-15	7.571E-12	1.745E-08	1.566E-07	1.263E-06
2.998E-06	5.521E-06	5.706E-06	5.022E-06	4.171E-06	3.599E-06	3.297E-06	3.120E-06

DOSE INTEGRALS FOR 0.020 MEV

9.149E-13	9.006E-13	9.025E-13	9.326E-13	9.670E-13	1.022E-12	1.095E-12	1.307E-12
1.578E-12	3.050E-12	7.220E-12	8.168E-11	1.250E-09	3.639E-08	2.602E-07	1.924E-06
4.553E-06	8.737E-06	9.423E-06	8.291E-06	6.888E-06	5.943E-06	5.444E-06	5.154E-06

DOSE INTEGRALS FOR 0.030 MEV

3.927E-08	3.949E-08	3.941E-08	3.972E-08	3.984E-08	3.962E-08	3.969E-08	4.020E-08
4.210E-08	4.706E-08	5.484E-08	8.169E-08	1.388E-07	3.119E-07	8.500E-07	3.648E-06
7.713E-06	1.434E-05	1.560E-05	1.370E-05	1.139E-05	9.832E-06	9.010E-06	8.531E-06

DOSE INTEGRALS FOR 0.040 MEV

5.207E-07	5.206E-07	5.211E-07	5.223E-07	5.240E-07	5.261E-07	5.287E-07	5.343E-07
5.413E-07	5.633E-07	5.979E-07	7.164E-07	9.726E-07	1.478E-06	2.466E-06	6.395E-06
1.152E-05	1.976E-05	2.134E-05	1.870E-05	1.556E-05	1.345E-05	1.233E-05	1.168E-05

DOSE INTEGRALS FOR 0.050 MEV

1.832E-06	1.833E-06	1.834E-06	1.837E-06	1.841E-06	1.846E-06	1.853E-06	1.869E-06
1.884E-06	1.963E-06	2.068E-06	2.390E-06	2.930E-06	3.817E-06	5.277E-06	1.012E-05
1.601E-05	2.534E-05	2.705E-05	2.366E-05	1.970E-05	1.705E-05	1.564E-05	1.483E-05

DOSE INTEGRALS FOR 0.060 MEV

4.070E-06	4.071E-06	4.073E-06	4.077E-06	4.085E-06	4.095E-06	4.105E-06	4.135E-0
4.168E-06	4.285E-06	4.459E-06	4.969E-06	5.787E-06	7.038E-06	8.894E-06	1.456E-0
2.115E-05	3.146E-05	3.326E-05	2.903E-05	2.420E-05	2.097E-05	1.926E-05	1.826E-0

DOSE INTEGRALS FOR 0.080 MEV

1.006E-05	1.006E-05	1.006E-05	1.007E-05	1.008E-05	1.009E-05	1.011E-05	1.015E-0
1.020E-05	1.040E-05	1.067E-05	1.149E-05	1.272E-05	1.451E-05	1.697E-05	2.398E-0

3.181E-05	4.389E-05	4.575E-05	3.983E-05	3.328E-05	2.888E-05	2.656E-05	2.521E-05

DOSE INTEGRALS FOR 0.100 MEV

1.688E-05	1.688E-05	1.688E-05	1.689E-05	1.691E-05	1.693E-05	1.695E-05	1.699E-05
1.706E-05	1.731E-05	1.767E-05	1.873E-05	2.029E-05	2.251E-05	2.551E-05	3.385E-05
4.306E-05	5.716E-05	5.910E-05	5.139E-05	4.299E-05	3.737E-05	3.440E-05	3.267E-05

DOSE INTEGRALS FOR 0.150 MEV

3.302E-05	3.302E-05	3.303E-05	3.304E-05	3.306E-05	3.309E-05	3.312E-05	3.320E-05
3.331E-05	3.368E-05	3.419E-05	3.569E-05	3.789E-05	4.095E-05	4.509E-05	5.659E-05
6.931E-05	8.864E-05	9.088E-05	7.895E-05	6.618E-05	5.764E-05	5.313E-05	5.051E-05

DOSE INTEGRALS FOR 0.200 MEV

4.941E-05	4.942E-05	4.942E-05	4.944E-05	4.947E-05	4.950E-05	4.955E-05	4.965E-05
4.978E-05	5.024E-05	5.088E-05	5.274E-05	5.549E-05	5.931E-05	6.450E-05	7.899E-05
9.516E-05	1.196E-04	1.221E-04	1.061E-04	8.904E-05	7.766E-05	7.165E-05	6.815E-05

DOSE INTEGRALS FOR 0.300 MEV

7.973E-05	7.974E-05	7.975E-05	7.978E-05	7.982E-05	7.987E-05	7.992E-05	8.007E-05
8.025E-05	8.089E-05	8.179E-05	8.441E-05	8.820E-05	9.351E-05	1.007E-04	1.211E-04
1.439E-04	1.783E-04	1.814E-04	1.576E-04	1.325E-04	1.158E-04	1.069E-04	1.018E-04

DOSE INTEGRALS FOR 0.400 MEV

1.125E-04	1.125E-04	1.126E-04	1.126E-04	1.126E-04	1.127E-04	1.128E-04	1.130E-04
1.132E-04	1.140E-04	1.151E-04	1.183E-04	1.230E-04	1.296E-04	1.386E-04	1.644E-04
1.935E-04	2.374E-04	2.410E-04	2.094E-04	1.764E-04	1.543E-04	1.427E-04	1.359E-04

DOSE INTEGRALS FOR 0.500 MEV

1.453E-04	1.453E-04	1.453E-04	1.454E-04	1.454E-04	1.455E-04	1.456E-04	1.458E-04
1.460E-04	1.469E-04	1.482E-04	1.520E-04	1.576E-04	1.654E-04	1.762E-04	2.073E-04
2.424E-04	2.954E-04	2.995E-04	2.604E-04	2.196E-04	1.924E-04	1.780E-04	1.696E-04

DOSE INTEGRALS FOR 0.600 MEV

1.789E-04	1.789E-04	1.789E-04	1.790E-04	1.790E-04	1.791E-04	1.792E-04	1.795E-04
1.798E-04	1.808E-04	1.824E-04	1.868E-04	1.932E-04	2.023E-04	2.149E-04	2.512E-04
2.924E-04	3.543E-04	3.587E-04	3.120E-04	2.634E-04	2.310E-04	2.139E-04	2.039E-04

DOSE INTEGRALS FOR 0.800 MEV

2.480E-04	2.480E-04	2.480E-04	2.481E-04	2.481E-04	2.482E-04	2.484E-04	2.487E-04
2.490E-04	2.504E-04	2.522E-04	2.577E-04	2.658E-04	2.772E-04	2.931E-04	3.392E-04
3.915E-04	4.697E-04	4.746E-04	4.131E-04	3.496E-04	3.072E-04	2.848E-04	2.718E-04

DOSE INTEGRALS FOR 1.000 MEV

3.202E-04	3.202E-04	3.202E-04	3.203E-04	3.204E-04	3.205E-04	3.207E-04	3.210E-0
3.215E-04	3.231E-04	3.253E-04	3.318E-04	3.414E-04	3.551E-04	3.740E-04	4.289E-0
4.913E-04	5.843E-04	5.892E-04	5.133E-04	4.352E-04	3.831E-04	3.556E-04	3.396E-0

DOSE INTEGRALS FOR 1.500 MEV

5.070E-04	5.070E-04	5.070E-04	5.071E-04	5.073E-04	5.074E-04	5.076E-04	5.081E-0
5.087E-04	5.109E-04	5.139E-04	5.226E-04	5.356E-04	5.540E-04	5.794E-04	6.533E-0
7.368E-04	8.598E-04	8.635E-04	7.536E-04	6.419E-04	5.675E-04	5.282E-04	5.053E-0

DOSE INTEGRALS FOR 2.000 MEV

6.908E-04	6.908E-04	6.908E-04	6.910E-04	6.911E-04	6.913E-04	6.915E-04	6.921E-04
6.929E-04	6.955E-04	6.991E-04	7.097E-04	7.253E-04	7.474E-04	7.780E-04	8.667E-04
9.667E-04	1.112E-03	1.114E-03	9.739E-04	8.329E-04	7.390E-04	6.894E-04	6.606E-04

DOSE INTEGRALS FOR 3.000 MEV

1.049E-03	1.049E-03	1.049E-03	1.049E-03	1.050E-03	1.050E-03	1.050E-03	1.051E-03
1.052E-03	1.055E-03	1.060E-03	1.074E-03	1.094E-03	1.123E-03	1.162E-03	1.276E-03
1.405E-03	1.589E-03	1.584E-03	1.390E-03	1.196E-03	1.068E-03	9.995E-04	9.598E-04

DOSE INTEGRALS FOR 4.000 MEV

1.388E-03	1.388E-03	1.389E-03	1.389E-03	1.389E-03	1.389E-03	1.390E-03	1.391E-03
1.392E-03	1.396E-03	1.401E-03	1.418E-03	1.442E-03	1.476E-03	1.523E-03	1.658E-03
1.809E-03	2.024E-03	2.014E-03	1.772E-03	1.533E-03	1.374E-03	1.290E-03	1.241E-03

DOSE INTEGRALS FOR 5.000 MEV

1.705E-03	1.705E-03	1.705E-03	1.705E-03	1.705E-03	1.706E-03	1.706E-03	1.707E-03
1.709E-03	1.713E-03	1.720E-03	1.739E-03	1.766E-03	1.805E-03	1.859E-03	2.015E-03
2.188E-03	2.433E-03	2.417E-03	2.131E-03	1.849E-03	1.661E-03	1.562E-03	1.505E-03

☆U S GOVERNMENT PRINTING OFFICE 1974 546-318/365 1-3

THE ABSTRACT CARDS accompanying this report are designed to facilitate information retrieval. They provide suggested key words, bibliographic information, and an abstract. The key word concept of reference material filing is readily adaptable to a variety of filing systems ranging from manual-visual to electronic data processing. The cards are furnished in triplicate to allow for flexibility in their use.

A COMPUTER CODE FOR CALCULATING DOSES, POPULATION DOSES, AND GROUND DEPOSITIONS DUE TO ATMOSPHERIC EMISSIONS OF RADIONUCLIDES, EPA-520/1-74-004, May 1974. J. A. Martin, Jr., C. B. Nelson, and P. A. Cuny.

ABSTRACT: A computer code useful for the calculation of doses to the general population due to atmospheric emissions of radionuclides is presented and discussed. The code is written in Fortran IV, requires 188k storage, and runs in about 20 seconds on an IBM 370 system. A standard sector-averaged gaussian-diffusion equation is solved repeatedly for each radionuclide, wind sector, stability class and downwind distance. Radionuclide contributions to doses to up to four critical organs are summed and printed by sector and downwind

(over)

A COMPUTER CODE FOR CALCULATING DOSES, POPULATION DOSES, AND GROUND DEPOSITIONS DUE TO ATMOSPHERIC EMISSIONS OF RADIONUCLIDES, EPA-520/1-74-004, May 1974. J. A. Martin, Jr., C. B. Nelson, and P. A. Cuny.

ABSTRACT: A computer code useful for the calculation of doses to the general population due to atmospheric emissions of radionuclides is presented and discussed. The code is written in Fortran IV, requires 188k storage, and runs in about 20 seconds on an IBM 370 system. A standard sector-averaged gaussian-diffusion equation is solved repeatedly for each radionuclide, wind sector, stability class and downwind distance. Radionuclide contributions to doses to up to four critical organs are summed and printed by sector and downwind

(over)

A COMPUTER CODE FOR CALCULATING DOSES, POPULATION DOSES, AND GROUND DEPOSITIONS DUE TO ATMOSPHERIC EMISSIONS OF RADIONUCLIDES, EPA-520/1-74-004, May 1974. J. A. Martin, Jr., C. B. Nelson, and P. A. Cuny.

ABSTRACT: A computer code useful for the calculation of doses to the general population due to atmospheric emissions of radionuclides is presented and discussed. The code is written in Fortran IV, requires 188k storage, and runs in about 20 seconds on an IBM 370 system. A standard sector-averaged gaussian-diffusion equation is solved repeatedly for each radionuclide, wind sector, stability class and downwind distance. Radionuclide contributions to doses to up to four critical organs are summed and printed by sector and downwind

(over)

distance. Population doses (man-rem) are also calculated.

KEY WORDS: Atmospheric diffusion; computer code; computer program; dose; dry deposition; population dose; radionuclide; rainout.

distance. Population doses (man-rem) are also calculated.

KEY WORDS: Atmospheric diffusion; computer code; computer program; dose; dry deposition; population dose; radionuclide; rainout.

distance. Population doses (man-rem) are also calculated.

KEY WORDS: Atmospheric diffusion; computer code; computer program; dose; dry deposition; population dose; radionuclide; rainout.