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Interactive Rapid Dose Assessment Model (IRDAM)

Reactor Accident Assessment Methods

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Pacific Northwest Laboratory
Operated by
Battelle Memorial Institute

Prepared for
U.S. Nuclear Regulatory
Commission

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ABSTRACT

As part of the continuing emphasis on emergency preparedness, the U.S. Nuclear Regulatory Commission (NRC) sponsored the development of a rapid dose assessment system by Pacific Northwest Laboratory (PNL). This system, the Interactive Rapid Dose Assessment Model (IRDAM) is a micro-computer based program for rapidly assessing the radiological impact of accidents at nuclear power plants.

This document describes the technical bases for IRDAM including methods, models and assumptions used in calculations. IRDAM calculates whole body (5-cm depth) and infant thyroid doses at six fixed downwind distances between 500 and 20,000 meters. Radionuclides considered primarily consist of noble gases and radioiodines. In order to provide a rapid assessment capability consistent with the capacity of the Osborne-1 computer, certain simplifying approximations and assumptions are made. These are described, along with default values (assumptions used in the absence of specific input) in the text of this document. Appendices provided include a code listing (Appendix I), flowcharts (Appendix II), and results of quality assurance comparisons (Appendix III).

Two companion volumes to this one provide additional information on IRDAM. The User's Guide (NUREG/CR-3012, Volume 1) describes the setup and operation of equipment necessary to run IRDAM. Scenarios for Comparing Dose Assessment Models (NUREG/CR-3012, Volume 3) provides the results of calculations made by IRDAM and other models for specific accident scenarios.

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INTRODUCTION

As part of the continuing emphasis on emergency preparedness, the U.S. Nuclear Regulatory Commission (NRC) sponsored the development of a rapid dose assessment system called IRDAM at Pacific Northwest Laboratory (PNL). IRDAM, an acronym for Interactive Rapid Dose Assessment Model, is a micro-computer based program for rapidly assessing the radiological impact of an accident at a nuclear power plant.

IRDAM can handle a variety of accidental release scenarios. Information on meteorological conditions, source term mixture, and time periods for decay and plume passage are all incorporated into the calculations. The activity or quantity of the release can be identified in several ways and both elevated and ground-level releases can be accommodated. Dose equivalents are calculated for the whole body (5-cm depth) and thyroid (infant) at six fixed downwind distances between 500 and 20,000 m.

The IRDAM system is highly interactive and assumes that an operator has expertise in radiation protection, but has little or no computer experience. By answering questions posed by IRDAM, an operator is guided through the input requirements for the calculations. The model has site-specific information and pre-programmed defaults that will enable the operator to make radiological dose estimates with a minimum of information.

RELEASE OPTIONS

IRDAM provides four basic options for the input of information regarding the release source term. These options provide a range of specificity in describing the release and also provide for the input of source term information from different sources (e.g., plant parameter information vs. stack monitor data). The four release options are described below.

1. Isotopic Release

In choosing this option, the user is provided with the following list of radionuclides:

(1) Kr-83m	(11) Xe-135
(2) Kr-85m	(12) Xe-137
(3) Kr-85	(13) Xe-138
(4) Kr-87	(14) Cs-134
(5) Kr-88	(15) Cs-137
(6) Kr-89	(16) I-131
(7) Xe-131m	(17) I-132
(8) Xe-133m	(18) I-133
(9) Xe-133	(19) I-134
(10) Xe-135m	(20) I-135

The user provides information on a particular radionuclide by specifying its corresponding number and an associated release rate in curies/second. Any or all of the radionuclides may be specified in any order desired. This is the only option which includes consideration of radionuclides other than noble gases and radioiodines.

IRDAM contains semi-infinite dose conversion factors from U.S. NRC Regulatory Guide 1.109 (U.S. NRC 1977) corresponding to the first 13 radionuclides in the IRDAM library, as well as dose conversion factors derived from Kocher (Kocher 1980) for isotopes of cesium. These are listed below:

<u>Radionuclide</u>	<u>rem-m³/Ci-hr</u>
83mKr	8.62E-3
85mKr	1.33E+2
85Kr	1.84E0
87Kr	6.75E+2
88Kr	1.68E+3
89Kr	1.89E+3
131mXe	1.04E+1
133mXe	2.89E+1
133Xe	3.36E+1
135mXe	3.56E+2
135Xe	2.06E+2
137Xe	1.62E+2
138Xe	1.01E+3
134Cs	9.66E+2
137Cs	3.70E+2

Inhalation dose conversion factors from Regulatory Guide 1.109 are provided for the five radioiodines, based on infant thyroid dose:

<u>Radionuclide</u>	<u>rem-m³/Ci-hr</u>
131 _I	1.06E+7
132 _I	1.21E+5
133 _I	2.54E+6
134 _I	3.18E+4
135 _I	4.97E+5

The isotopic release completely describes the makeup and activity of the source term and is probably not representative of the type of option that would be chosen in the initial phases of an accident. It is useful for comparison purposes, however, or for making estimates based on single radionuclides.

2. Gross Release

Much less specific information is required for input into the gross release option. The only essential piece of information for this method is a gross release rate in Ci/s. Information on the relative fraction of iodine and noble gas radionuclides can be input to further characterize the gross release.

3. Containment Leakage

This method does not require input of information on release rate of radioactivity. Instead, this information is generated from input on the containment leak rate and the type of accident involved. It assumes that the source term is bottled in containment and is leaking at the specified rate. Three source terms based on accident type are available. They are fuel melt, gap release, and coolant release. In a fourth case the source term in containment is calculated from containment monitor readings. The source terms based on accident type represent noble gas and iodine inventory for the given type of accident and are calculated using the following:

$$\text{fuel melt: } \frac{\text{Ci}}{\text{s}} = (\text{MWe}) (7.2 \times 10^{-2}) (\text{LR})$$

$$\text{gap release: } \frac{\text{Ci}}{\text{s}} = (\text{MWe}) (7.2 \times 10^{-4}) (\text{LR})$$

$$\text{coolant inventory: } \frac{\text{Ci}}{\text{s}} = (\text{MWe}) (7.2 \times 10^{-8}) (\text{LR})$$

where LR = percentage of containment leak rate per day

Note that the fuel melt represents release of 100% of the core inventory of noble gases, the gap release represents 1% and coolant inventory $1 \times 10^{-4}\%$. The containment monitor equation is based on a release of 1% of core inventory being equal to 10^4 R/hr for a PWR or BWR--Mark III and 10^3 R/hr for a BWR--Mark I or II.

For source terms based on containment monitor readings, the following method is used:

$$Ci/s = (MWe) (7.2 \times 10^{-4}) (LR) (R/hr)/A$$

where

$A = 10^4$ in the case of a PWR or BWR--Mark III

$A = 10^3$ in the case of a BWR--Mark I or II

R/hr = the containment monitor reading

4. Coolant Leakage

For cases where coolant is leaking outside of containment (e.g., the Ginna accident), the coolant leakage option is appropriate. This method calculates an equivalent gross release based on input values for coolant activity and coolant leak rate.

Source Term Adjustments

With the exception of the isotopic case, all the options in the previous section are based on noble gas and iodine source terms. IRDAM provides methods for modifying these source terms to account for such factors as relative iodine fraction present and the effectiveness of filtration. As described later, decay during holdup and transit are factored in for some but not all cases.

Stability Class Calculation

The atmospheric stability class may be input directly or may be calculated using one of three methods (lapse rate, sigma theta or theta spread).

1. Lapse Rate

The lapse rate method for stability class calculation requires input of height and temperature differences between two points of measurement and calculates the temperature lapse rate in $^{\circ}\text{C}/100 \text{ m}$. Stability class is assigned on the basis of the following table from Regulatory Guide 1.23 (U.S. NRC 1980).

<u>$\Delta T/\Delta Z$ ($^{\circ}\text{C}/100\text{ m}$)</u>	<u>Class</u>
$\Delta T/\Delta Z < -1.9$	A
$-1.9 < \Delta T/\Delta Z < -1.7$	B
$-1.7 < \Delta T/\Delta Z < -1.5$	C
$-1.5 < \Delta T/\Delta Z < -0.5$	D
$-0.5 < \Delta T/\Delta Z < 1.5$	E
$1.5 < \Delta T/\Delta Z < 4$	F
$4 < \Delta T/\Delta Z$	G

2. Sigma Theta

The sigma theta method assigns stability class based on the standard deviation of the wind direction (U.S. NRC 1980)

<u>σ_{θ} (degrees)</u>	<u>Class</u>
$\sigma_{\theta} > 22.5$	A
$22.5 > \sigma_{\theta} > 17.5$	B
$17.5 > \sigma_{\theta} > 12.5$	C
$12.5 > \sigma_{\theta} > 7.5$	D
$7.5 > \sigma_{\theta} > 3.8$	E
$3.8 > \sigma_{\theta} > 2.1$	F
$2.1 > \sigma_{\theta}$	G

3. Theta Spread

This method calculates sigma theta by dividing the theta spread by six. It then assigns stability class according to the sigma theta method.

Certain combinations of stability class and windspeed are incompatible. Specifically, windspeeds greater than or equal to 5 m/s are not compatible with Classes F or G. With the exception of the case of a user-specified stability class, IROAM takes the windspeed and stability class into consideration and alerts the user to mismatch of input, either choosing a compatible default value or rerunning the stability class calculation. If the user makes a direct input of stability class which is inconsistent with the windspeed already input no warning is provided.

Default Values

IRDAM provides default values (i.e., assumptions to be used in the absence of other data) for a number of cases where input is important to the calculations. In choosing a default value, IRDAM will inform the user of the nature of the default and provide the opportunity to change it if so desired. The following default values are built into IRDAM:

Windspeed:	2 m/s
Release Height:	Ground Level
Effective Stack Height:	50 m
Stability Class F:	(for Windspeed < 5 m/s)
E:	(for Windspeed > 5 m/s)
Wind Direction:	No Predominant Direction
Containment Inventory (Release Rate for Containment Leakage):	Fuel Melt
Coolant Activity (for Coolant Leakage):	10 μ Ci/cc
Iodine to Noble Gas Ratio:	0.02
Time Between Shutdown and Release:	0 hr
Age of Material:	<1 day
Iodine Filter Efficiency:	95%
Containment Leak Rate:	0.1%/d (PWR or BWR--Mark III) 0.5%/d (BWR--Mark I or II)
Duration of Release:	8 hr

Ground Level Release

Calculations for the ground level release case are performed using the following equation:

$$DR = (Q)(\lambda/Q)(CF)$$

Where Q is the release rate, CF is the semi-infinite dose conversion factor and λ/Q is the atmospheric dispersion factor. For whole body doses

the conversion factors are based on a semi-infinite cloud geometry. For thyroid doses, a breathing rate for infants is included ($0.25 \text{ m}^3/\text{hr}$).

Values for X/Q are calculated from the following matrix of $X \bar{u} / Q$ values (in units of $1/\text{m}^2$) in IRDAM where $\bar{u}$ is the mean windspeed:

PASQUILL STABILITY CLASS

Normalized Dispersion Factors

Distance							
m	A	B	C	D	E	F	G
500	2.25E-5	7.35E-5	1.70E-4	4.53E-4	8.74E-4	2.26E-3	5.07E-3
1,000	2.38E-6	1.59E-5	4.69E-5	1.34E-4	2.78E-4	6.55E-4	1.47E-3
2,000	4.30E-7	2.80E-6	1.40E-5	4.59E-5	1.28E-4	2.24E-4	5.06E-4
3,000	3.00E-7	8.94E-7	6.77E-6	2.40E-5	4.84E-5	1.21E-4	2.73E-4
8,000	1.26E-7	1.66E-7	1.24E-6	5.49E-6	1.24E-5	3.17E-5	7.13E-5
20,000	5.68E-8	7.44E-8	2.82E-7	1.67E-6	4.07E-6	9.27E-6	2.09E-5

X/Q values are calculated by dividing the tabulated value for a specific combination of distance and stability class by the windspeed in m/s. It is important to note that using lower windspeeds will result in higher dose rates. Using very low windspeeds ($<1 \text{ m/s}$) will result in very high X/Q values.

For ground level cases calculated under the Isotopic Release Rate option, the X/Q values and semi-infinite dose conversion factors are employed directly for each specific radionuclide under consideration. Note that since IRDAM's dose conversion factor library does not include any factors for iodines (except for inhalation), no whole body dose contribution from radioiodines is explicitly calculated.

In the case of other ground level releases (gross, containment leakage and coolant leakage) IRDAM compensates for the lack of an explicit calculation of whole body dose from radioiodines by assuming that the noble gas source term (for the purposes of whole body dose calculations) is equal to the noble gas activity plus the activity of any radioiodines present.

For these types of release, the age of the material is taken into consideration to correct for the different relative fractions of radionuclides present in the noble gas and radioiodine components as a function of time since shutdown. If the specified age of the material is greater than or equal to 24 hr, all the noble gas activity is assumed to be ^{133}Xe and all the radioiodine is assumed to be ^{131}I . If the age of the material is less than 24 hr,

the calculated doses are still based on ^{133}Xe and ^{131}I , but are corrected by a time variant function. This function represents the ratio of doses received from the actual radionuclide mix to those received from a single radionuclide (^{133}Xe or ^{131}I) of the same activity, as a function of time since shutdown.

For noble gases during the first 24 hr since shutdown, the dose rate from the radionuclide mix (DR_2) is related to the dose rate from an equal activity of ^{133}Xe (DR_1) by the equation:

$$\text{DR}_2 = (\text{DR}_1) 11.0 \exp (-t/10)$$

where t is the interval between reaction shutdown and the initiation of the release.

For radioiodines, the corresponding equation is:

$$\text{DR}_2 = (\text{DR}_1) 0.34 \exp (+t/22)$$

IRDAM ground level release calculations include corrections for relative decay and ingrowth during holdup in containment as well as during the time since a measurement was made, but decay during plume transit is not calculated.

IRDAM does not include finite plume corrections for ground level releases. For these cases, an approximate correction can be made by multiplying calculated whole body doses by the appropriate factor from the following table, adapted from Meteorology and Atomic Energy 1968.

Ground Level
Finite Plume Correction Factors

Distance	Atmospheric Stability Class						
	A	B	C	D	E	F	G
500 m	0.65	0.43	0.30	0.20	0.14	0.09	0.06
1000 m	0.88	0.66	0.50	0.33	0.25	0.16	0.11
2000 m	0.94	0.85	0.70	0.50	0.35	0.27	0.19
3000 m	0.95	0.90	0.78	0.60	0.50	0.36	0.25
8000 m	1.0	1.0	0.90	0.80	0.70	0.57	0.43
20000 m	1.0	1.0	1.0	0.90	0.83	0.73	0.64

Elevated Releases - Whole Body Dose Calculation

Whole body doses from elevated releases are calculated by modeling the plume as a set of two concentric cylinders. For each of the six distances for which doses are calculated, it is assumed that only that portion of the plume between 100 m upwind and 100 m downwind will contribute to the dose received. It is further assumed for each distance that the plume is made up of two concentric cylinders, one of radius σ_z and one of radius $2\sigma_z$ (where σ_z is the Gaussian dispersion coefficient in the z direction). Each of these two nested cylinders is centered at the release height (see Figure 1).

The total activity in the cylinders is given by

$$S = \frac{Q}{\bar{u}} (200)$$

where

- S = the cylinder source activity in curies
- Q = the release rate in Ci/s
- $\bar{u}$ = the windspeed in m/s
- 200 = the cylinder length in meters

The activity is divided between the two nested cylinders so that 56% is in the inner cylinder and 44% is in the larger cylinder. This approximates a Gaussian distribution between the smaller cylinder and the surrounding annulus.

Blizzard et al. provide methods for collapsing a cylindrical source to an equivalent line source at some distance (z) inside the cylinder. IRDAM uses these methods, employing mathematical expressions of the curves in Blizzard, et. al., to calculate gamma flux at the point P from each of the two cylinders.

The equation which provides the photon flux at Point P by collapsing the cylindrical source to an equivalent line source is (Blizzard et al. 1968):

$$\phi = \frac{B \cdot Sv \cdot F(\theta, b_2) \cdot R^2}{2 \cdot (a + z)}$$

where

- Sv = source gamma activity per unit volume
- ϕ = the photon flux (photons/cm² sec)
- B = the buildup factor
- a = distance from the ground to the edge of the cylinder, which is the difference between the effective stack height and the radius of the cylinder

FIGURE 1. Cylindrical Source Geometry

R = the radius of the plume

z = the distance from the edge of the cylinder to the equivalent line source

The term $F(\theta, b_2)$ is the Secant Integral, defined by:

$$F(\theta, b_2) = \int_0^\theta e^{-b_2 \sec \theta'} d\theta'$$

where θ is 1/2 the angle shown in Figure 1 and can be described as:

$$\theta = \arctan(100/a)$$

The variable b_2 is defined as:

$$b_2 = b_1 + \mu_s \cdot z$$

where μ_s is the self-absorption coefficient of the source at the energy of the isotope's emitted radiation and b_1 is the product $\mu \cdot a$ where μ is the linear attenuation coefficient for the energy of the radiation being emitted. Since the Secant Integral is extremely difficult to solve using analytical methods, a numerical integration scheme, Simpson's Approximation, using 10 segments was used to evaluate this integral. The buildup factor, B, is determined from a family of polynomial equations generated with a least squares fit from tabulated values (Blizzard et al. 1968) which depends on the energy of the emitted radiation and b_1 . Likewise, the linear attenuation coefficient, μ , and the source self absorption coefficient, μ_s , are calculated using equations as a function of energy derived from a least squares fit. The average energy, $\bar{E}$ for each radionuclide considered was determined using the equation:

$$\bar{E} = \frac{\sum_{i=1}^n E_i f_i e^{-\mu_i(5000)}}{\sum_{i=1}^n f_i e^{-\mu_i(5000)}}$$

where E_i is the energy of photons emitted from radionuclide i, f_i is the frequency of emission of radiation with energy E_i , and μ_i is the linear attenuation coefficient in air calculated for energy E_i . The calculation of the value of z, the distance from the collapsed equivalent line source to the leading edge of the plume as shown in Figure 1, is complicated, so polynomial least square fits were generated from calculated values in order to match the calculations in IRDAM to the processing power of a micro-computer.

One difference between the ground level and elevated release calculations is that the elevated case includes explicit contributions from radioiodines in the whole body dose calculation. In cases other than the Isotopic Release Rate option, IRDAM does this by breaking the total source term into noble gas and radioiodine components and further dividing each of these components into fractions representing the individual radionuclides. For an elevated gross release, for example, IRDAM will calculate the whole body dose due to each of the 13 noble gases and 5 radioiodines and sum the results for each distance involved until the plume touches down (see Plume Touchdown).

The fractional makeup of the source term is based on relative fractions of radionuclides present at shutdown. These fractions are derived from calculations made using the computer code ISOSHL and WASH-1400 (U.S. NRC 1975) core parameters. The fractions at shutdown are adjusted by IRDAM to account for changes due to differential decay during holdup and transit. Unlike the ground level methods, the elevated case makes no simplifying single-radionuclide approximations for times greater than 24 hr. Whole body doses continue instead to be calculated using the sum of individual radionuclide contributions as long as the plume is elevated (see Plume Touchdown).

The relative fractions of radionuclides used by IRDAM (at shutdown) are as follows:

<u>Noble Gas</u>	<u>Fraction of Total</u>	<u>Radioiodine</u>	<u>Fraction of Total</u>
^{83m}Kr	0.013	^{131}I	0.116
^{85m}Kr	0.038	^{132}I	0.164
^{85}Kr	0.000231	^{133}I	0.222
^{87}Kr	0.070	^{134}I	0.271
^{88}Kr	0.097	^{135}I	<u>0.227</u>
^{89}Kr	0.120	TOTAL	1.00
^{131m}Xe	0.00074		
^{133m}Xe	0.00376		
^{133}Xe	0.198		
^{135m}Xe	0.052		
^{135}Xe	0.048		
^{137}Xe	0.190		
^{138}Xe	<u>0.169</u>		
TOTAL	1.00		

Elevated Releases - Thyroid Dose Calculation

For elevated release, the thyroid dose is calculated in much the same way as it is for the ground level case. The primary difference is that the X/Q values for the elevated case are calculated differently. In particular,

$$(X/Q)_E = (X/Q)_G \cdot \exp(-h^2/2\sigma_z^2)$$

where

$(X/Q)_E$ = the ground level X/Q from the elevated release

$(X/Q)_G$ = the X/Q for a ground level release

h = the effective release height

σ_z = the Gaussian atmospheric dispersion parameter in the z direction

The same breathing rate and internal dose conversion factors that are used for ground level releases are used for elevated cases. As with the whole body calculation, the elevated release method in all cases deals with releases by breakdown according to radionuclide, either input (in the isotopic release option) or calculated from relative fractions at shutdown (for gross, containment leakage, and coolant leakage options).

Elevated Release - Plume Touchdown

As the plume proceeds downwind, its radius is increasing. At some point the radius of the outer of the two concentric cylinders at a given distance will equal or exceed the effective release height (i.e., $2\sigma_z > h$). At this point IRDAM considers the plume to have reached ground level. Before plume touchdown, whole body and thyroid doses are calculated as described above. After plume touchdown the calculations are performed as if the release occurred at ground level with one important difference. Instead of using X/Q values for a ground level release, values for (X/Q) for an elevated release are used. The purpose of this change is to compensate for that fact that semi-infinite dose conversion factors are being used in circumstances that are not necessarily well modeled by the semi-infinite condition. This method allows IRDAM to approximate finite cloud calculations under conditions that are otherwise beyond the micro-computer's processing power.

For gross releases, calculations for distances after plume touchdown incorporate the IRDAM simplifications regarding material age, radionuclide makeup, and decay during plume transit.

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APPENDIX I

IRDAM PROGRAM LISTING

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10 PROGRAM IRDM - START
15 'Interactive Rapid Dose Assessment Model
20 DIM RIQUE(21)
25 COMMON IHEL, SNAME, SDATE, STIME, SRNAM, IPWR, RLK, RVOL, IRUN, ILU, IG, IE, RWIND, SDIR,
RSTACK, SPASQ, ICLAS, IFLAG, ISO
26 COMMON RIQUE(), RQUE, IPROG, RPERCO, RACTIV, RSTERM, RRATE, RING, RI, RNG, RILEF, RIRF, R
IREL, RDUR, RPOST, IAGEFL, IFIX
29 DEFINT I
30 DEFSTR S,N,Y
35 DEFSNG R
40 DEFOBL O
51 '*****
52 '* IRDM.COM *
53 '*****
300 IHEL=4;SNAME="";SDATE="";STIME="";SRNAM="";IPWR=0;RVOL=4;RLK=0
305 IRUN=1;ILU=0;IG=2;IE=2;RWIND=0;SDIR="";RSTACK=0;SPASQ="";ICLAS=0;IFLAG=0;ISO
=0;RIQUE(0)=0;RQUE=0;IPROG=0
306 RPERCO=0;RACTIV=0;RSTERM=0;RRATE=0;RING=0;RI=0;RNG=0;RILEF=0;RIRF=0;RIREL=0;
RDUR=0;RPOST=0;IAGEFL=0;IFIX=0;ICAL=0
310 FOR I=1 TO 22
315 PRINT
319 NEXT I
320 PRINT TAB(3)"*****"
325 PRINT TAB(3)"*
330 PRINT TAB(3)"* THIS IS THE INTERACTIVE RAPID DOSE
335 PRINT TAB(3)"*
340 PRINT TAB(3)"* ASSESSMENT MODEL (IRDM). FOLLOW
345 PRINT TAB(3)"*
350 PRINT TAB(3)"* THE RESPONSE INSTRUCTIONS EXPLICITLY TO
355 PRINT TAB(3)"*
360 PRINT TAB(3)"* OPERATE THE PROGRAM. YOU WILL HAVE AN
365 PRINT TAB(3)"*
370 PRINT TAB(3)"* OPPORTUNITY TO REVIEW AND CHANGE ALL
375 PRINT TAB(3)"*
380 PRINT TAB(3)"* INPUTS PRIOR TO ANY CALCULATIONS.
385 PRINT TAB(3)"*
410 PRINT TAB(3)"*****"
415 PRINT;PRINT;PRINT
420 CHAIN"B:IRDMONE.COM",25
425 END
10 PROGRAM IRDM - PART ONE
15 'Interactive Rapid Dose Assessment Model
20 DIM RIQUE(21)
25 COMMON IHEL, SNAME, SDATE, STIME, SRNAM, IPWR, RLK, RVOL, IRUN, ILU, IG, IE, RWIND, SDIR,
RSTACK, SPASQ, ICLAS, IFLAG, ISO
26 COMMON RIQUE(), RQUE, IPROG, RPERCO, RACTIV, RSTERM, RRATE, RING, RI, RNG, RILEF, RIRF, R
IREL, RDUR, RPOST, IAGEFL, IFIX
29 DEFINT I
30 DEFSTR S,N,Y
35 DEFSNG R
40 DEFOBL O
45 DATA"Y","X","N","n"
50 READ Y,YL,N,NL
51 '*****
52 '* IRDMONE.COM *
53 '*****
300 IF(IRUN<>0)THEN GOTO 310

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305 IRUN=1;ILU=0;IG=2;IE=2;RWIND=0;SDIR="";RSTACK=0;SPASQ="";ICLAS=0;IFLAG=0;ISO
=0;RIQUE(0)=0;RQUE=0;IPROG=0
306 RPERCO=0;RACTIV=0;RSTERM=0;RRATE=0;RING=0;RI=0;RNG=0;RILEF=0;RIRF=0;RIREL=0;
RDUR=0;RPOST=0;IAGEFL=0;IFIX=0;ICAL=0
310 FOR I=1 TO 22
315 PRINT
319 NEXT I
320 IF(IRUN<>1)THEN 345
321 /*****
322 /* USER/REACTOR SPECIFICS. *
323 /*****
325 PRINT"INPUT HELP LEVEL."
330 PRINT TAB(5)"(+ ) MOST HELP"
331 PRINT TAB(5)"(0 ) SOME HELP"
332 PRINT TAB(5)"(- ) LITTLE HELP"
335 INPUT"(RESPOND +,0 OR -): ",S
336 IF (LEFT$(S,1)="+") THEN IHEL=1 : GOTO 345
337 IF ((LEFT$(S,1)="0")OR(LEFT$(S,1)="O")) THEN IHEL=2 : GOTO 345
340 IF (LEFT$(S,1)="-") THEN IHEL=3 ELSE GOSUB 13000 : GOTO 325
345 PRINT
350 PRINT"INPUT USER NAME."
355 INPUT"(EX: JOHN DOE): ",SNAME
360 PRINT
365 PRINT"INPUT TODAY'S DATE."
370 LINE INPUT"(EX: 5/20/82 OR 20 MAY 82): ",SDATE
375 PRINT
380 PRINT"INPUT CURRENT TIME."
385 INPUT"(EX: 1735 OR 5:35 PM EST): ",STIME
390 PRINT
395 PRINT"IDENTIFY NRC REGIONAL LOCATION OF PLANT SITE."
400 PRINT TAB(5)"(1) REGION 1 - NORTHEAST"
405 PRINT TAB(5)"(2) REGION 2 - SOUTH"
410 PRINT TAB(5)"(3) REGION 3 - MIDWEST"
415 PRINT TAB(5)"(4) REGION 4 - SOUTHWEST"
420 PRINT TAB(5)"(5) REGION 5 - WEST & NORTHWEST"
425 PRINT TAB(5)"(6) MANUAL INPUT FORMAT"
430 INPUT"(RESPOND 1,2,3,...6): ",I1
435 IF ((I1 <1)OR(I1 >6))THEN GOSUB 12000: GOTO 395
440 ON I1 GOTO 460,755,1050,1345,1440,1590
445 /*****
450 /* REGION 1. *
455 /*****
460 PRINT:PRINT:PRINT
465 PRINT"IDENTIFY NRC REGION 1 NUCLEAR POWER PLANT.":PRINT
470 PRINT TAB(5)"(1) BEAVER VALLEY"TAB(29)"(15) NINE MILE POINT 1"
472 PRINT TAB(5)"(2) CALVERT CLIFFS"TAB(29)"(16) NINE MILE POINT 1"
474 PRINT TAB(5)"(3) FITZPATRICK"TAB(29)"(17) OYSTER CREEK"
476 PRINT TAB(5)"(4) GINNA"TAB(29)"(18) PEACH BOTTOM"
478 PRINT TAB(5)"(5) HADDAM NECK"TAB(29)"(19) PILGRIM"
480 PRINT TAB(5)"(6) HOPE CREEK"TAB(29)"(20) SALEM 1"
482 PRINT TAB(5)"(7) INDIAN POINT 1"TAB(29)"(21) SALEM 2"
484 PRINT TAB(5)"(8) INDIAN POINT 2"TAB(29)"(22) SEABROOK"
486 PRINT TAB(5)"(9) INDIAN POINT 3"TAB(29)"(23) SHOREHAM"
488 PRINT TAB(4)"(10) LIMERICK"TAB(29)"(24) SUSQUAHANNA"
490 PRINT TAB(4)"(11) MAINE YANKEE"TAB(29)"(25) THREE MILE ISLAND 1"
492 PRINT TAB(4)"(12) MILLSTONE 1"TAB(29)"(26) THREE MILE ISLAND 2"
494 PRINT TAB(4)"(13) MILLSTONE 2"TAB(29)"(27) VERMONT YANKEE"
496 PRINT TAB(4)"(14) MILLSTONE 3"TAB(29)"(28) YANKEE ROWE"
498 PRINT TAB(14)"(29) ABORT AND RETURN"
510 PRINT:INPUT"(RESPOND 1,2,3,...29): ",I1

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515 IF ((I1<1)OR(I1>29)) THEN GOSUB 12000 : GOTO 460
520 IF(I1<15)THEN ON I1 GOTO 525,530,535,540,545,550,555,560,565,570,575,580,585
,590 ELSE I1=I1-14:GOTO 660
525 SRNAM="BEAVER VALLEY":IPOWER=852:RVOL=1:GOTO 1800
530 SRNAM="CALVERT CLIFFS":IPOWER=850:RVOL=1:GOTO 1800
535 SRNAM="FITZPATRICK":IPOWER=821:RVOL=2:GOTO 1800
540 SRNAM="GINNA":IPOWER=490:RVOL=1:GOTO 1800
545 SRNAM="HADDAM NECK":IPOWER=575:RVOL=1:GOTO 1800
550 SRNAM="HOPE CREEK":IPOWER=1067:RVOL=2:GOTO 1800
555 SRNAM="INDIAN POINT 1":IPOWER=265:RVOL=1:GOTO 1800
560 SRNAM="INDIAN POINT 2":IPOWER=873:RVOL=1:GOTO 1800
565 SRNAM="INDIAN POINT 3":IPOWER=965:RVOL=1:GOTO 1800
570 SRNAM="LIMERICK":IPOWER=1055:RVOL=2:GOTO 1800
575 SRNAM="MAINE YANKEE":IPOWER=790:RVOL=1:GOTO 1800
580 SRNAM="MILLSTONE 1":IPOWER=652:RVOL=2:GOTO 1800
585 SRNAM="MILLSTONE 2":IPOWER=828:RVOL=1:GOTO 1800
590 SRNAM="MILLSTONE 3":IPOWER=1150:RVOL=1:GOTO 1800
660 ON I1 GOTO 665,670,675,680,685,690,695,700,710,715,720,725,730,735,390
665 SRNAM="NINE MILE POINT 1":IPOWER=610:RVOL=2:GOTO 1800
670 SRNAM="NINE MILE POINT 2":IPOWER=1100:RVOL=2:GOTO 1800
675 SRNAM="OYSTER CREEK":IPOWER=650:RVOL=2:GOTO 1800
680 SRNAM="PEACH BOTTOM":IPOWER=1065:RVOL=2:GOTO 1800
685 SRNAM="PILGRIM":IPOWER=670:RVOL=2:GOTO 1800
690 SRNAM="SALEM 1":IPOWER=1090:RVOL=1:GOTO 1800
695 SRNAM="SALEM 2":IPOWER=1115:RVOL=1:GOTO 1800
700 SRNAM="SEABROOK":IPOWER=1200:RVOL=1:GOTO 1800
710 SRNAM="SHOREHAM":IPOWER=820:RVOL=2:GOTO 1800
715 SRNAM="SUSQUEHANNA":IPOWER=1050:RVOL=2:GOTO 1800
720 SRNAM="THREE MILE ISLAND 1":IPOWER=818:RVOL=1:GOTO 1800
725 SRNAM="THREE MILE ISLAND 2":IPOWER=906:RVOL=1:GOTO 1800
730 SRNAM="VERMONT YANKEE":IPOWER=515:RVOL=2:GOTO 1800
735 SRNAM="YANKEE ROWE":IPOWER=175:RVOL=1:GOTO 1800
740 '*****
745 '* REGION 2. *
750 '*****
755 PRINT:PRINT:PRINT
760 PRINT"IDENTIFY NRC REGION II NUCLEAR POWER PLANT.":PRINT
765 PRINT TAB(5)"(1) BELLEFONTE"TAB(29)"(13) NORTH ANNA 2"
770 PRINT TAB(5)"(2) BROWNS FERRY"TAB(29)"(14) OCONEE"
775 PRINT TAB(5)"(3) BRUNSWICK"TAB(29)"(15) PHIPPS BEND"
780 PRINT TAB(5)"(4) CATAWBA"TAB(29)"(16) ROBINSON"
785 PRINT TAB(5)"(5) CHEROKEE"TAB(29)"(17) SEQUOYAH"
790 PRINT TAB(5)"(6) CRYSTAL RIVER"TAB(29)"(18) ST. LUCIE"
795 PRINT TAB(5)"(7) FARLEY"TAB(29)"(19) SUMMER"
797 PRINT TAB(5)"(8) GRAND GULF"TAB(29)"(20) SURRY"
799 PRINT TAB(5)"(9) HARRIS"TAB(29)"(21) TURKEY POINT"
801 PRINT TAB(4)"(10) HATCH"TAB(29)"(22) WATTS BAR"
803 PRINT TAB(4)"(11) MCGUIRE"TAB(29)"(23) VOGTLE"
804 PRINT TAB(4)"(12) NORTH ANNA 1"
805 PRINT TAB(14)"(24) ABORT AND RETURN"
810 PRINT:INPUT"(RESPOND 1,2,3...24): ",I1
815 IF ((I1<1)OR(I1>24)) THEN GOSUB 12000 : GOTO 760
820 IF(I1<15)THEN ON I1 GOTO 825,830,835,840,845,850,855,860,865,875,880,885,890
,895 ELSE I1=I1-14: GOTO 960
825 SRNAM="BELLEFONTE":IPOWER=1213:RVOL=1:GOTO 1800
830 SRNAM="BROWNS FERRY":IPOWER=1067:RVOL=2:GOTO 1800
835 SRNAM="BRUNSWICK":IPOWER=790:RVOL=2:GOTO 1800
840 SRNAM="CATAWBA":IPOWER=1153:RVOL=1:GOTO 1800
845 SRNAM="CHEROKEE":IPOWER=1280:RVOL=1:GOTO 1800
850 SRNAM="CRYSTAL RIVER":IPOWER=855:RVOL=1:GOTO 1800

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955 SRNAM="FARLEY":IPOWER=860:RVOL=1:GOTO 1800
960 SRNAM="GRAND GULF":IPOWER=1250:RVOL=2:GOTO 1800
965 SRNAM="HARRIS":IPOWER=900:RVOL=1:GOTO 1800
975 SRNAM="HATCH":IPOWER=786:RVOL=2:GOTO 1800
980 SRNAM="MCGUIRE":IPOWER=1180:RVOL=1:GOTO 1800
985 SRNAM="NORTH ANNA 1":IPOWER=865:RVOL=1:GOTO 1800
990 SRNAM="NORTH ANNA 2":IPOWER=890:RVOL=1:GOTO 1800
995 SRNAM="OCONEE":IPOWER=871:RVOL=1:GOTO 1800
900 PRINT
905 PRINT"IDENTIFY NUCLEAR POWER PLANT."
925 PRINT TAB(5)"(1) PHIPPS BEND"SPC(10)"(6) SURRY"
930 PRINT TAB(5)"(2) ROBINSON"SPC(13)"(7) TURKEY POINT"
935 PRINT TAB(5)"(3) SEQUOYAH"SPC(13)"(8) WATTS BAR"
940 PRINT TAB(5)"(4) ST. LUCIE"SPC(12)"(9) VOGTLE"
942 PRINT TAB(5)"(5) SUMMER"
945 PRINT TAB(18)"(10) HELP"
950 INPUT"(RESPOND 1,2,3...10): ",I1
955 IF ((I1<1)OR(I1>10)) THEN GOSUB 12000 : GOTO 905
960 ON I1 GOTO 980,985,990,995,1000,1005,1010,1020,1025,390
975 SRNAM="OCONEE":IPOWER=871:RVOL=1:GOTO 1800
980 SRNAM="PHIPPS BEND":IPOWER=1233:RVOL=2:GOTO 1800
985 SRNAM="ROBINSON":IPOWER=665:RVOL=1:GOTO 1800
990 SRNAM="SEQUOYAH":IPOWER=1148:RVOL=1:GOTO 1800
995 SRNAM="ST. LUCIE":IPOWER=802:RVOL=1:GOTO 1800
1000 SRNAM="SUMMER":IPOWER=900:RVOL=1:GOTO 1800
1005 SRNAM="SURRY":IPOWER=775:RVOL=1:GOTO 1800
1010 SRNAM="TURKEY POINT":IPOWER=666:RVOL=1:GOTO 1800
1020 SRNAM="WATTS BAR":IPOWER=1177:RVOL=1:GOTO 1800
1025 SRNAM="VOGTLE":IPOWER=1100:RVOL=1:GOTO 1800
1035 '*****
1040 '* REGION 3. *
1045 '*****
1050 PRINT:PRINT:PRINT
1055 PRINT"IDENTIFY NRC REGION III NUCLEAR POWER PLANT.":PRINT
1060 PRINT TAB(5)"(1) BIG ROCK POINT"TAB(29)"(14) LA CROSSE"
1065 PRINT TAB(5)"(2) BRAIDWOOD"TAB(29)"(15) LA SALLE"
1070 PRINT TAB(5)"(3) BYRON"TAB(29)"(16) MARBLE HILL"
1075 PRINT TAB(5)"(4) CALLOWAY"TAB(29)"(17) MIDLAND 1"
1080 PRINT TAB(5)"(5) CLINTON"TAB(29)"(18) MIDLAND 2"
1085 PRINT TAB(5)"(6) COOK 1"TAB(29)"(19) MONTICELLO"
1090 PRINT TAB(5)"(7) COOK 2"TAB(29)"(20) PALISADES"
1091 PRINT TAB(5)"(8) DAVIS-BESSE"TAB(29)"(21) PERRY"
1092 PRINT TAB(5)"(9) DRESDEN 1"TAB(29)"(22) POINT BEACH"
1093 PRINT TAB(4)"(10) DRESDEN 2 OR 3"TAB(29)"(23) PRAIRIE ISLAND"
1094 PRINT TAB(4)"(11) QUANE ARNOLD"TAB(29)"(24) QUAD CITIES"
1095 PRINT TAB(4)"(12) FERMI"TAB(29)"(25) ZIMMER"
1096 PRINT TAB(4)"(13) KAWAUNEE"TAB(29)"(26) ZION"
1097 PRINT TAB(14)"(27) ABORT AND RETURN"
1100 PRINT:INPUT"(RESPOND 1,2,3...27): ",I1
1105 IF ((I1<1)OR(I1>27)) THEN GOSUB 12000 : GOTO 1055
1110 IF(I1<13)THEN ON I1 GOTO 1120,1125,1130,1135,1140,1145,1150,1160,1165,1170,
1172,1175 ELSE I1=11-12:GOTO 1250
1120 SRNAM="BIG ROCK POINT":IPOWER=63:RVOL=2:GOTO 1800
1125 SRNAM="BRAIDWOOD":IPOWER=1120:RVOL=1:GOTO 1800
1130 SRNAM="BYRON":IPOWER=1150:RVOL=1:GOTO 1800
1135 SRNAM="CALLOWAY":IPOWER=1150:RVOL=1:GOTO 1800
1140 SRNAM="CLINTON":IPOWER=950:RVOL=2:GOTO 1800
1145 SRNAM="COOK 1":IPOWER=1054:RVOL=1:GOTO 1800
1150 SRNAM="COOK 2":IPOWER=1094:RVOL=1:GOTO 1800
1160 SRNAM="DAVIS-BESSE":IPOWER=906:RVOL=1:GOTO 1800

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1165 SRNAM="DRESDEN 1":IPOWER=207:RVOL=2:GOTO 1800
1170 SRNAM="DRESDEN 2 OR 3":IPOWER=794:RVOL=2:GOTO 1800
1172 SRNAM="DUANE ARNOLD":IPOWER=545:RVOL=2:GOTO 1800
1175 SRNAM="FERMI":IPOWER=1100:RVOL=2:GOTO 1800
1250 ON I1 GOTO 1255,1260,1265,1270,1275,1280,1285,1290,1295,1300,1305,1310,1320
,1325,390
1255 SRNAM="KEWAUNEE":IPOWER=535:RVOL=1:GOTO 1800
1260 SRNAM="LA CROSSE":IPOWER=50:RVOL=2:GOTO 1800
1265 SRNAM="LA SALLE":IPOWER=1078:RVOL=2:GOTO 1800
1270 SRNAM="MARBLE HILL":IPOWER=1130:RVOL=1:GOTO 1800
1275 SRNAM="MIDLAND 1":IPOWER=530:RVOL=1:GOTO 1800
1280 SRNAM="MIDLAND 2":IPOWER=605:RVOL=1:GOTO 1800
1285 SRNAM="MONTICELLO":IPOWER=536:RVOL=2:GOTO 1800
1290 SRNAM="PALISADES":IPOWER=740:RVOL=1:GOTO 1800
1295 SRNAM="PERRY":IPOWER=1205:RVOL=2:GOTO 1800
1300 SRNAM="POINT BEACH":IPOWER=497:RVOL=1:GOTO 1800
1305 SRNAM="PRAIRIE ISLAND":IPOWER=520:RVOL=1:GOTO 1800
1310 SRNAM="QUAD CITIES":IPOWER=789:RVOL=2:GOTO 1800
1320 SRNAM="ZIMMER":IPOWER=810:RVOL=2:GOTO 1800
1325 SRNAM="ZION":IPOWER=1100:RVOL=1:GOTO 1800
1330 '*****
1335 '* REGION 4. *
1340 '*****
1345 PRINT:PRINT:PRINT
1350 PRINT"IDENTIFY NRC REGION IV NUCLEAR POWER PLANT."
1355 PRINT TAB(5)"(1) ARKANSAS NO 1"TAB(30)"(6) FT. ST. URAIN"
1360 PRINT TAB(5)"(2) ARKANSAS NO 2"TAB(30)"(7) RIVER BEND"
1365 PRINT TAB(5)"(3) COMANCHE PEAK"TAB(30)"(8) SOUTH TEXAS"
1370 PRINT TAB(5)"(4) COOPER"TAB(30)"(9) WATERFORD"
1375 PRINT TAB(5)"(5) FORT CALHOUN"TAB(29)"(10) WOLF CREEK"
1380 PRINT TAB(14)"(11) ABORT AND RETURN"
1385 PRINT:INPUT"(RESPOND 1,2,3...11): ",I1
1390 IF ((I1<1)OR(I1>11)) THEN GOSUB 12000 : GOTO 1350
1395 ON I1 GOTO 1400,1405,1410,1415,1416,1417,1418,1420,1421,1422,390
1400 SRNAM="ARKANSAS NO 1":IPOWER=636:RVOL=1:GOTO 1800
1405 SRNAM="ARKANSAS NO 2":IPOWER=658:RVOL=1:GOTO 1800
1410 SRNAM="COMANCHE PEAK":IPOWER=1150:RVOL=1:GOTO 1800
1415 SRNAM="COOPER":IPOWER=778:RVOL=2:GOTO 1800
1416 SRNAM="FORT CALHOUN":IPOWER=478:RVOL=1:GOTO 1800
1417 SRNAM="FT. ST. URAIN":IPOWER=330:RVOL=4:GOTO 1800
1418 SRNAM="RIVER BEND":IPOWER=940:RVOL=2:GOTO 1800
1420 SRNAM="SOUTH TEXAS":IPOWER=1250:RVOL=1:GOTO 1800
1421 SRNAM="WATERFORD":IPOWER=1165:RVOL=1:GOTO 1800
1422 SRNAM="WOLF CREEK":IPOWER=1150:RVOL=1:GOTO 1800
1425 '*****
1430 '* REGION 5. *
1435 '*****
1440 PRINT:PRINT:PRINT
1445 PRINT"IDENTIFY NRC REGION V NUCLEAR POWER PLANT."
1450 PRINT TAB(5)"(1) DIABLO CANYON 1"TAB(30)"(8) SAN ONOFRE 2 OR 3"
1455 PRINT TAB(5)"(2) DIABLO CANYON 2"TAB(30)"(9) SKAGIT-HANFORD"
1465 PRINT TAB(5)"(3) HANFORD-N"TAB(29)"(10) TROJAN"
1470 PRINT TAB(5)"(4) PALO VERDE"TAB(29)"(11) WNP-1"
1475 PRINT TAB(5)"(5) PEBBLE SPRINGS"TAB(29)"(12) WNP-2"
1480 PRINT TAB(5)"(6) RANCHO SECO"TAB(29)"(13) WNP-3"
1482 PRINT TAB(5)"(7) SAN ONOFRE 1"
1485 PRINT TAB(14)"(14) ABORT AND RETURN"
1490 PRINT:INPUT"(RESPOND 1,2,3...14): ",I1
1495 IF ((I1<1)OR(I1>14)) THEN GOSUB 12000 : GOTO 1440

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1500 ON I1 GOTO 1505,1510,1520,1525,1530,1535,1540,1545,1550,1555,1560,1565,1570
1505 SRNAM="DIABLO CANYON 1":IPWR=1084:RVOL=1:GOTO 1800
1510 SRNAM="DIABLO CANYON 2":IPWR=1108:RVOL=1:GOTO 1800
1520 SRNAM="HANFORD-N":IPWR=860:RVOL=5:GOTO 1800
1525 SRNAM="PALO VERDE":IPWR=1270:RVOL=1:GOTO 1800
1530 SRNAM="PEBBLE SPRINGS":IPWR=1260:RVOL=1:GOTO 1800
1535 SRNAM="RANCHO SECO":IPWR=913:RVOL=1:GOTO 1800
1540 SRNAM="SAN ONOFRE 1":IPWR=436:RVOL=1:GOTO 1800
1545 SRNAM="SAN ONOFRE 2 OR 3":IPWR=1100:RVOL=1:GOTO 1800
1550 SRNAM="SKAGIT-HANFORD":IPWR=1288:RVOL=2:GOTO 1800
1555 SRNAM="TPOJAN":IPWR=1130:RVOL=1:GOTO 1800
1560 SRNAM="WNP-1":IPWR=1250:RVOL=1:GOTO 1800
1565 SRNAM="WNP-2":IPWR=1100:RVOL=2:GOTO 1800
1570 SRNAM="WNP-3":IPWR=1240:RVOL=1:GOTO 1800
1575 *****
1580 * MANUAL INPUT FORMAT. *
1585 *****
1590 PRINT
1595 PRINT"INPUT REACTOR NAME."
1600 INPUT"(EX: ZION 1, TMI 2): ",SRNAM
1605 PRINT
1610 PRINT"INPUT NET ELECTRICAL OUTPUT."
1615 INPUT"(EX: 513, 1210): ",IPWR
1620 PRINT
1621 PRINT"IDENTIFY REACTOR TYPE."
1625 PRINT TAB(5)"(1) PWR"
1630 PRINT TAB(5)"(2) BWR"
1635 PRINT TAB(5)"(3) BWR-MARK I"
1640 PRINT TAB(5)"(4) BWR-MARK II"
1645 PRINT TAB(5)"(5) BWR-MARK III"
1650 PRINT TAB(5)"(6) DEFAULT"
1655 INPUT"(RESPOND 1,2,3,...6): ",I1
1660 IF (I1(1)OR(I1(2))) THEN GOSUB 12000 : GOTO 1625
1665 ON I1 GOTO 1670,1670,1675,1675,1675,1670,1670
1670 RVOL=1:GOTO 1800
1675 RVOL=2
1680 *****
1685 * REACTOR NAME AND SPECIFICS. *
1690 *****
1800 PRINT:PRINT"*****":PRINT:PRINT USING"USER NAME: &":$NAME
1801 PRINT:PRINT USING"DATE: &":$DATE
1802 PRINT:PRINT USING"CURRENT TIME: &":$TIME
1805 PRINT:PRINT USING"REACTOR NAME: &":SRNAM
1815 PRINT:PRINT USING"NET ELECTRICAL OUTPUT:####":IPWR
1816 PRINT
1817 IF(RVOL=1)THEN PRINT"CONTAINMENT TYPE: EITHER A PWR OR BWR - MARK III":$L$
1818 IF(RVOL=2)THEN PRINT"CONTAINMENT TYPE: BWR - EITHER A MARK I OR II":$L$
1820 ON IHEL GOTO 1825,1825,1846
1825 PRINT
1830 PRINT"ARE ENTRIES CORRECT?"
1835 INPUT"(RESPOND YES OR NO): ",S
1840 IF(LEFT$(S,1)=Y)OR(LEFT$(S,1)=N)THEN 1850
1845 IF(LEFT$(S,1)=N)OR(LEFT$(S,1)=NL)THEN 390 ELSE GOSUB 13000:GOTO 1820
1846 PRINT:INPUT"* HIT CARRIAGE RETURN. *",S
1850 FOR I=1 TO 9
1855 PRINT
1860 NEXT I
1865 PRINT TAB(8)"*****"
1870 PRINT TAB(8)"* WAIT - RED LIGHT ON DISK DRIVE *"

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1875 PRINT TAB(8)"* B INDICATES IRDAM SEARCHING FOR *"
1880 PRINT TAB(8)"* THE NEXT PIECE OF THE PROGRAM. *"
1885 PRINT TAB(8)"*****"
1890 FOR I=1 TO 9
1895   PRINT
1900 NEXT I
1901 IF (IRUN=1) THEN 1906
1905 CHAIN "B:IRDAMTWO.COM",20
1906 CHAIN "B:IRDAMTHR.COM",20
11995 END
12000 PRINT
12005 PRINT"ENTRY OUT OF RANGE - PLEASE TRY AGAIN."
12010 PRINT
12015 RETURN
13000 PRINT
13005 PRINT"ENTRY NOT UNDERSTOOD - PLEASE TRY AGAIN."
13010 PRINT
13015 RETURN
10  PROGRAM IRDAM - PART TWO
15  Interactive Rapid Dose Assessment Model
20  COMMON /HEL,SNAM,SDATE,STIME,SRNAM,IPOUR,PLX,RVOL,IRUN,ILU,IG,IE,RMIND,SOIR,
RSTACK,SPASQ,ICLAS,IFLAG,ISO
21  COMMON /RQUE,/,RQUE,IPROG,RPERCO,RACTIV,RSTERM,RPATE,RING,RI,RNG,RILEF,RIRF,R
IREL,RDUP,RPOST,IAGEFL,IFIX.
25  DEFINT I
30  DEFSTR S,N,Y
35  DEFNG R
40  DEFDBL D
45  DATA Y,"Y","N","n"
50  READ Y,YL,N,NL
1835 *****
1840  * IRDAMTWO.COM *
1845 *****
1846 FOR I=1 TO 20
1847   PRINT
1848   NEXT I
1850 ON IRUN GOTO 1870,1851
1851 ON IFIX GOTO 5995,1880,1852,4135,5995,5455
1852 IF (IG=1) THEN 1955 ELSE 2460
1855 *****
1860  * SELECT TYPE OF RELEASE. *
1865 *****
1870 ILU=0:IG=0:IE=0
1880 PRINT
1885 PRINT"SELECT TYPE OF RELEASE."
1890 PRINT TAB(5)"(1) GROUND"
1895 PRINT TAB(5)"(2) ELEVATED"
1900 PRINT TAB(5)"(3) DEFAULT"
1905 INPUT"(RESPOND 1,2 OR 3): ",I1
1910 IF (I1<1) OR (I1>3) THEN GOSUB 12000 : GOTO 1835
1915 ON I1 GOTO 1950,2235,1920
1920 PRINT
1925 PRINT"DEFAULT IS THE CONSERVATIVE SELECTION"
1930 PRINT TAB(2)"OF A GROUND LEVEL RELEASE."
1935 *****
1940  * GROUND RELEASE SENAPIQ. *
1945 *****
1950 IF (IG=0) THEN 1980
1955 PRINT
1960 PRINT"IS WIND SPEED CORRECT?"

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1965 INPUT"(RESPOND YES OR NO): ",S
1970 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 2115
1975 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 1980 ELSE GOSUB 13000 : GOTO 1960
1980 PRINT
1985 PRINT"SELECT FOR WIND SPEED."
1990 PRINT TAB(5)"(1) M/SEC"
1995 PRINT TAB(5)"(2) MI/HR"
2000 PRINT TAB(5)"(3) NAUTICAL MI/HR"
2005 PRINT TAB(5)"(4) DEFAULT"
2010 INPUT"(RESPOND 1,2,3 OR 4): ",I1
2015 IF((I1=1)OR(I1=4))THEN GOSUB 12000 : GOTO 1985
2020 ON I1 GOTO 2025,2045,2065,2095
2025 PRINT
2030 PRINT"INPUT GROUND LEVEL WIND SPEED IN M/SEC."
2035 INPUT"(EX: 12.0, 5.4, 0.1): ",RWIND
2040 GOTO 2110
2045 PRINT
2050 PRINT"INPUT GROUND LEVEL WIND SPEED IN MI/HR."
2055 INPUT"(EX: 12.0,5.4, 0.1): ",RWIND
2060 RWIND=RWIND*.44704:ON IHEL GOTO 2085,2085,2110
2065 PRINT
2070 PRINT"INPUT GROUND LEVEL WIND SPEED IN KNOTS."
2075 INPUT"(EX: 12.0, 5.4, 0.1): ",RWIND
2080 RWIND=RWIND*.51444:ON IHEL GOTO 2085,2085,2110
2085 PRINT
2090 PRINT USING"IN M/SEC, EQUIVALENT WIND SPEED IS ####.##":RWIND:GOTO 2110
2095 PRINT
2100 PRINT"GROUND LEVEL WIND SPEED DEFAULTS TO 2.0 M/SEC."
2105 RWIND=2!
2110 IF(IG=0)THEN 2140
2115 PRINT
2120 PRINT"IS WIND DIRECTION CORRECT?"
2125 INPUT"(RESPOND YES OR NO): ",S
2130 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL)) THEN 2165
2135 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL)) THEN 2140 ELSE GOSUB 13000 : GOTO 2120
2140 PRINT
2145 PRINT"INPUT DOWNWIND (TO) GROUND LEVEL WIND DIRECTION"
2150 PRINT"OR HIT CARRIAGE RETURN FOR WIND DIRECTION DEFAULT."
2155 INPUT"(EX: NORTH, ESE, 72 DEGREES WNW): ",SDIR
2160 IF(SDIR<>"") THEN 2195
2165 SDIR="NO PREDOMINANT DIRECTION"
2170 PRINT
2175 PRINT"GROUND LEVEL WIND DIRECTION DEFAULTS TO"
2180 PRINT"NO PREDOMINANT DIRECTION."
2185 IG=1:IE=0
2195 PRINT
2200 PRINT USING"THE GROUND LEVEL WIND SPEED(M/SEC): ####.##":RWIND
2205 PRINT TAB(2)"AND THE DOWNWIND (TO) WIND DIRECTION"
2206 PRINT USING" IS %":SDIR
2210 ON IHEL GOTO 2215,2215,2725
2215 PRINT:PRINT"ARE ENTRIES CORRECT?"
2220 INPUT"(RESPOND YES OR NO): ",S
2225 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 2725
2230 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 1990 ELSE GOSUB 13000 : GOTO 2215
2231 *****
2232 ** ELEVATED RELEASE SCENARIO. *
2233 *****
2235 PRINT
2240 PRINT"SELECT FOR EFFECTIVE STACK HEIGHT."
2245 PRINT TAB(5)"(1) METERS"

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2250 PRINT TAB(5)"(2) FEET"
2255 PRINT TAB(5)"(3) DEFAULT FOR STACK HEIGHT"
2260 INPUT"(RESPOND 1,2 OR 3): ",I1
2265 IF((I1<1)OR(I1>3))THEN GOSUB 13000 : GOTO 2240
2270 ON I1 GOTO 2390,2320,2275
2275 RSTACK=50!
2280 PRINT
2285 PRINT"EFFECTIVE STACK HEIGHT DEFAULTS TO 50 METERS."
2290 ON IHEL GOTO 2295,2455,2455
2295 PRINT
2300 PRINT"IS DEFAULT ACCEPTABLE?"
2305 INPUT"(RESPOND YES OR NO): ",S
2310 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 2455
2315 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 2295 ELSE GOSUB 13000 : GOTO 2300
2320 PRINT
2325 PRINT"INPUT EFFECTIVE STACK HEIGHT IN FEET."
2330 INPUT"(EX: 1234.5): ",RSTACK
2335 ON IHEL GOTO 2340,2340,2370
2340 PRINT
2345 PRINT USING"EFFECTIVE STACK HEIGHT(FT)= #####.##";RSTACK
2350 PRINT"IS ENTRY CORRECT?"
2355 INPUT"(RESPOND YES OR NO): ",S
2360 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 2370
2365 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 2320 ELSE GOSUB 13000 : GOTO 2345
2370 RSTACK=RSTACK*.3048
2375 PRINT
2376 PRINT"IN METERS, CORRESPONDING"
2380 PRINT USING"EFFECTIVE STACK HEIGHT = ###.###^";RSTACK
2385 GOTO 2455
2390 PRINT
2395 PRINT"INPUT EFFECTIVE STACK HEIGHT IN METERS."
2400 INPUT"(EX: 1234.5): ",RSTACK
2405 ON IHEL GOTO 2410,2410,2455
2410 PRINT
2415 PRINT USING"EFFECTIVE STACK HEIGHT(M)= #####.##";RSTACK
2420 PRINT"IS ENTRY CORRECT?"
2425 INPUT"(RESPOND YES OR NO): ",S
2430 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 2455
2435 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 2390 ELSE GOSUB 13000 : GOTO 2415
2455 IF(IE=0)THEN 2485
2460 PRINT
2465 PRINT"IS WIND SPEED CORRECT?"
2470 INPUT"(RESPOND YES OR NO): ",S
2475 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 2620
2480 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 2485 ELSE GOSUB 13000 : GOTO 2465
2485 PRINT
2490 PRINT"SELECT FOR WIND SPEED."
2495 PRINT TAB(5)"(1) M/SEC"
2500 PRINT TAB(5)"(2) MI/HR"
2505 PRINT TAB(5)"(3) NAUTICAL MI/HR"
2510 PRINT TAB(5)"(4) DEFAULT"
2515 INPUT"(RESPOND 1,2,3 OR 4): ",I1
2520 IF((I1<1)OR(I1>4))THEN GOSUB 12000 : GOTO 2490
2525 ON I1 GOTO 2530,2550,2570,2600
2530 PRINT
2535 PRINT"INPUT ELEVATED LEVEL WIND SPEED IN M/SEC."
2540 INPUT"(EX: 12.0, 5.4, 0.1): ",RWIND
2545 GOTO 2615
2550 PRINT
2555 PRINT"INPUT ELEVATED LEVEL WIND SPEED IN MI/HR."

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2560 INPUT"(EX: 12.0, 5.4, 0.1): ",RWIND
2565 RWIND=RWIND*.44704:ON IHEL GOTO 2590,2590,2615
2570 PRINT
2575 PRINT"INPUT ELEVATED LEVEL WIND SPEED IN KNOTS."
2580 INPUT"(EX: 12.0, 5.4, 0.1): ",RWIND
2585 RWIND=RWIND*.5444:ON IHEL GOTO 2590,2590,2615
2590 PRINT
2595 PRINT USING"IN M/SEC, EQUIVALENT WIND SPEED IS ####.#":RWIND:GOTO 2615
2600 PRINT
2605 PRINT"ELEVATED LEVEL WIND SPEED DEFAULTS TO 2.0 M/SEC."
2610 RWIND=2'
2615 IF(IE=0)THEN 2645
2620 PRINT
2625 PRINT"IS WIND DIRECTION CORRECT?"
2630 INPUT"(RESPOND YES OR NO): ",S
2635 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 2675
2640 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 2645 ELSE GOSUB 13000 : GOTO 2625
2645 PRINT
2650 PRINT"INPUT DOWNWIND (TO) ELEVATED WIND DIRECTION"
2655 PRINT"OR HIT CARRIAGE RETURN FOR WIND DIRECTION DEFAULT."
2660 INPUT"(EX: NORTH, ESE, 72 DEGREES WNW): ",SDIR
2665 IF(SDIR="")THEN 2675
2670 SDIR="NO PREDOMINANT DIRECTION."
2671 PRINT
2672 PRINT"GROUNDLEVEL WIND DIRECTION DEFAULTS TO"
2673 PRINT TAB(2)"NO PREDOMINANT DIRECTION."
2675 IE=1:IG=0
2685 PRINT:PRINT"EFFECTIVE STACK HEIGHT(M): ",RSTACK
2690 PRINT USING" THE ELEVATED WIND SPEED(M/SEC): ####.#":RWIND
2695 PRINT TAB(2)"AND THE DOWNWIND (TO) WIND DIRECTION"
2696 PRINT USING" IS &":SDIR
2700 ON IHEL GOTO 2705,2705,2705
2705 PRINT:PRINT"ARE ENTRIES CORRECT?"
2710 INPUT"(RESPOND YES OR NO): ",S
2715 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 2725
2720 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 1980 ELSE GOSUB 13000 : GOTO 2705
2725 IF(IFIX=3)THEN 2745 ELSE ON IRUN GOTO 2745,5995
2730 *****
2735 * DETERMINE STABILITY CLASS. *
2740 *****
2745 PRINT
2750 PRINT"SELECT METHOD FOR DETERMINING STABILITY CLASS."
2755 PRINT TAB(5)"(1) LAPSE RATE METHOD"
2760 PRINT TAB(5)"(2) THETA SPREAD METHOD"
2765 PRINT TAB(5)"(3) SIGMA THETA METHOD"
2770 PRINT TAB(5)"(4) STABILITY CLASS KNOWN"
2775 PRINT TAB(5)"(5) DEFAULT FOR STABILITY CLASS"
2780 INPUT"(RESPOND 1,2,3,4 OR 5): ",I1
2785 IF((I1<1)OR(I1>5))THEN GOSUB 12000 : GOTO 2750
2790 ON IHEL GOTO 2795,2825,2825
2795 PRINT
2800 PRINT USING"ENTRY SELECTION IS ##":I1
2805 PRINT"IS ENTRY CORRECT?"
2810 INPUT"(RESPOND YES OR NO): ",S
2815 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 2825
2820 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 2745 ELSE GOSUB 13000 : GOTO 2800
2825 ON I1 GOTO 2845,3725,3795,3925,4055
2830 *****
2835 * LAPSE RATE. *
2840 *****

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2845 ON IHEL GOTO 2850,2850,2890
2850 PRINT:PRINT
2855 PRINT"THE LAPSE RATE HAS BEEN SELECTED."
2860 PRINT"THE TEMPERATURE DIFFERENCE WILL BE INPUT"
2865 PRINT"FIRST FOLLOWED BY THE HEIGHT DIFFERENCE."
2890 PRINT:PRINT
2895 PRINT"SELECT FORMAT FOR ENTERING TEMPERATURE DIFFERENCE."
2896 PRINT
2900 PRINT TAB(5)"(1) INPUT ELEVATED AND GROUND TEMPERATURES"
2905 PRINT TAB(9)"IN CENTIGRADE."
2910 PRINT
2915 PRINT TAB(5)"(2) INPUT ELEVATED AND GROUND TEMPERATURES"
2920 PRINT TAB(9)"IN FAHRENHEIT."
2925 PRINT
2930 PRINT TAB(5)"(3) INPUT TEMPERATURE DIFFERENCE"
2935 PRINT TAB(9)"IN CENTIGRADE."
2940 PRINT
2945 PRINT TAB(5)"(4) INPUT TEMPERATURE DIFFERENCE"
2950 PRINT TAB(9)"IN FAHRENHEIT."
2955 PRINT
2960 PRINT TAB(5)"(5) ABORT AND RETURN."
2965 PRINT
2970 INPUT"(RESPOND 1,2,3,4 OR 5): ",I1
2975 IF((I1<1)OR(I1>5))THEN GOSUB 12000 : GOTO 2895
2980 ON I1 GOTO 3045,3135,2985,3225,2745
2985 PRINT
2990 PRINT"INPUT TEMPERATURE DIFFERENCE IN DEGREES CENTIGRADE."
2995 PRINT"INPUT NEGATIVE NUMBER IF TEMP ELEVATED > TEMP GROUND."
3000 INPUT"(EX: 123.4, 9.7, -0.2): ",RTEMP
3005 PRINT
3010 PRINT USING"TEMP(C) DIFFERENCE= #####.##";RTEMP
3015 ON IHEL GOTO 3020,3020,3295
3020 PRINT
3025 PRINT"IS ENTRY CORRECT?"
3030 INPUT"(RESPOND YES OR NO): ",S
3035 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 3295
3040 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 2985 ELSE GOSUB 13000 : GOTO 3025
3045 PRINT
3050 PRINT"INPUT TEMPERATURE AT ELEVATED POINT"
3055 PRINT"IN DEGREES CENTIGRADE."
3060 INPUT"(EX: 123.5, 9.7, -0.2): ",RTEME
3065 PRINT
3070 PRINT"INPUT TEMPERATURE AT GROUND LEVEL"
3075 PRINT"IN DEGREES CENTIGRADE."
3080 INPUT"(EX: 123.4, 9.7, -0.2): ",RTEMG
3085 PRINT
3090 PRINT USING"INPUT VALUES ARE: TEMP(C) ELEVATED= #####.##";RTEME
3095 PRINT USING "                TEMP(C) GROUND= #####.##";RTEMG
3100 RTEMP=RTEME-RTEMG
3105 ON IHEL GOTO 3110,3110,3295
3110 PRINT
3115 PRINT"ARE ENTRIES CORRECT?"
3120 INPUT"(RESPOND YES OR NO): ",S
3125 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 3295
3130 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 3045 ELSE GOSUB 13000 : GOTO 3115
3135 PRINT
3140 PRINT"INPUT TEMPERATURE AT ELEVATED POINT IN"
3145 PRINT"DEGREES FAHRENHEIT."
3150 INPUT"(EX: 123.4, 9.7, -0.2): ",RTEME
3155 PRINT

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3160 PRINT"INPUT TEMPERATURE AT GROUND LEVEL IN"
3165 PRINT"DEGREES FAHRENHEIT."
3170 INPUT"(EX: 123.4, 9.7, -0.2): ",RTEMG
3175 PRINT
3180 PRINT USING"INPUT VALUES ARE: TEMP(F) ELEVATED= ####.##";RTEME
3185 PRINT USING "                TEMP(F) GROUND= #####.##";RTEMG
3190 RTEMP=RTEME-RTEMG
3195 ON IHEL GOTO 3200,3200,3290
3200 PRINT
3205 PRINT"ARE ENTRIES CORRECT?"
3210 INPUT"(RESPOND YES OR NO): ",S
3215 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 3290
3220 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 3135 ELSE GOSUB 13000 : GOTO 3205
3225 PRINT
3230 PRINT"INPUT TEMPERATURE DIFFERENCE IN DEGREES FAHRENHEIT."
3235 PRINT"INPUT NEGATIVE NUMBER IF TEMP ELEVATED > TEMP GROUND."
3240 INPUT"(EX: 123.4, 9.7, -0.2): ",RTEMP
3245 PRINT
3250 PRINT USING"TEMP(F) DIFFERENCE= ###.##";RTEMP
3255 ON IHEL GOTO 3260,3260,3290
3260 PRINT
3265 PRINT"IS ENTRY CORRECT?"
3270 INPUT"(RESPOND YES OR NO): ",S
3275 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 3290
3280 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 3225 ELSE GOSUB 13000 : GOTO 3265
3285 '*** CONVERT FROM FAHRENHEIT TO CENTIGRADE. ***
3290 RTEMP=RTEMP*.556
3295 PRINT;PRINT
3300 PRINT"SELECT FORMAT FOR ENTERING HEIGHT DIFFERENCE."
3305 PRINT
3310 PRINT TAB(5)"(1) INPUT ELEVATED AND GROUND LEVEL HEIGHTS"
3315 PRINT TAB(9)"IN METERS."
3320 PRINT
3325 PRINT TAB(5)"(2) INPUT ELEVATED AND GROUND LEVEL HEIGHTS"
3330 PRINT TAB(9)"IN FEET."
3335 PRINT
3340 PRINT TAB(5)"(3) INPUT HEIGHT DIFFERENCE IN METERS."
3345 PRINT
3350 PRINT TAB(5)"(4) INPUT HEIGHT DIFFERENCE IN FEET."
3355 PRINT
3360 PRINT TAB(5)"(5) ABORT AND RETURN."
3365 PRINT
3370 INPUT"(RESPOND 1,2,3,4 OR 5): ",I1
3375 IF((I1<1)OR(I1>5))THEN GOSUB 12000 : GOTO 3300
3380 ON I1 GOTO 3435,3515,3385,3595,2745
3385 PRINT
3390 PRINT"INPUT HEIGHT DIFFERENCE IN METERS."
3395 INPUT"(EX: 123.4): ",RHYT
3400 PRINT
3405 PRINT USING"HEIGHT DIFFERENCE(M)= ####.##";RHYT
3410 ON IHEL GOTO 3415,3415
3415 PRINT;PRINT"IS ENTRY CORRECT?"
3420 INPUT"(RESPOND YES OR NO): ",S
3425 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 3660
3430 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 3385 ELSE GOSUB 13000 : GOTO 3415
3435 PRINT
3440 PRINT"INPUT HEIGHT AT ELEVATED POINT IN METERS."
3445 INPUT"(EX: 123.4): ",RHYTE
3450 PRINT
3455 PRINT"INPUT HEIGHT AT GROUND LEVEL IN METERS."

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3460 INPUT*(EX: 123.4): ",RHYTG
3465 PRINT
3470 PRINT USING*INPUT VALUES ARE: HEIGHT ELEVATED(M)= #####.##";RHYTE
3475 PRINT USING "                HEIGHT GROUND(M)= #####.##";RHYTG
3480 RHYT=RHYTE-RHYTG
3485 ON IHCL GOTO 3490,3490,3660
3490 PRINT
3495 PRINT"ARE ENTRIES CORRECT?"
3500 INPUT*(RESPOND YES OR NO): ",S
3505 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 3660
3510 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 3435 ELSE GOSUB 13000 : GOTO 3495
3515 PRINT
3520 PRINT"INPUT HEIGHT AT ELEVATED POINT IN FEET."
3525 INPUT*(EX: 1234.5): ",RHYTE
3530 PRINT
3535 PRINT"INPUT HEIGHT AT GROUND LEVEL IN FEET."
3540 INPUT*(EX: 1234.5): ",RHYTG
3545 PRINT
3550 PRINT USING*INPUT VALUES ARE: HEIGHT ELEVATED(FT)= #####.##";RHYTE
3555 PRINT USING "                HEIGHT GROUND(FT)= #####.##";RHYTG
3560 RHYT=RHYTE-RHYTG
3565 ON IHCL GOTO 3570,3570,3650
3570 PRINT
3575 PRINT"ARE ENTRIES CORRECT?"
3580 INPUT*(RESPOND YES OR NO): ",S
3585 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 3650
3590 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 3515 ELSE GOSUB 13000 : GOTO 3575
3595 PRINT
3600 PRINT"INPUT HEIGHT DIFFERENCE IN FEET."
3605 INPUT*(EX: 1234.5): ",RHYT
3610 PRINT
3615 PRINT USING*HEIGHT DIFFERENCE(FT)= #####.##";RHYT
3620 ON IHCL GOTO 3625,3625,3650
3625 PRINT:PRINT"IS ENTRY CORRECT?"
3630 INPUT*(RESPOND YES OR NO): ",S
3635 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 3650
3640 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 3595 ELSE GOSUB 13000 : GOTO 3625
3645 'CONVERT FEET TO METERS.
3650 RHYT=RHYT*.3048
3655 '*** DETERMINE STABILITY CLASS FROM TEMP & HEIGHT DIFFERENCE. ***
3660 ON IHCL GOTO 3665,3665,3690
3665 PRINT
3670 PRINT"IS METHOD ACCEPTABLE?"
3675 INPUT*(RESPOND YES OR NO): ",S
3680 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 3690
3685 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 2745 ELSE GOSUB 13000 : GOTO 3670
3690 RLAPS=(RTEMP*100!)/RHYT
3695 IF(RLAPS>-.5)THEN 3715
3700 IF(RLAPS>-1.9)THEN 3705 ELSE SPASQ="A":ICLAS=1:GOTO 4105
3705 IF(RLAPS>-1.7)THEN 3710 ELSE SPASQ="B":ICLAS=2:GOTO 4105
3710 IF(RLAPS>-1.5)THEN SPASQ="D":ICLAS=4:GOTO 4105 ELSE SPASQ="C":ICLAS=3:GOTO 4105
3715 IF(RLAPS>1.5)THEN 3720 ELSE SPASQ="E":ICLAS=5:GOTO 4105
3720 IF(RLAPS>4!)THEN SPASQ="G":ICLAS=7:GOTO 4105 ELSE SPASQ="F":ICLAS=6:GOTO 4105
3721 '*****
3722 '* THETA SPREAD. *
3723 '*****
3725 PRINT
3726 PRINT"INPUT THETA SPREAD IN DEGREES."

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3730 INPUT"(EX: 22.5, 3.8, 0.4): ",RTHE
3735 PRINT
3740 PRINT USING"THETA SPREAD= ####.#";RTHE
3745 ON IHEL GOTO 3750,3750,3775
3750 PRINT"IS ENTRY CORRECT?"
3755 INPUT"(RESPOND YES OR NO): ",S
3760 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 3775
3765 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 3725 ELSE GOSUB 13000 : GOTO 3750
3770 :CALCULATE SIGMA THETA FROM THETA SPREAD.
3775 RSIGT=RTHE/6: GOTO 3845
3780 *****
3785 * SIGMA THETA. *
3790 *****
3795 PRINT
3800 PRINT"INPUT SIGMA THETA IN DEGREES."
3805 INPUT"(EX: 10.05, 1.23, 0.01): ",RSIGT
3810 PRINT
3815 PRINT USING"SIGMA THETA= ###.##";RSIGT
3820 ON IHEL GOTO 3825,3825,3845
3825 PRINT"IS ENTRY CORRECT?"
3830 INPUT"(RESPOND YES OR NO): ",S
3835 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 3845
3840 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 3795 ELSE GOSUB 13000 : GOTO 3825
3845 ON IHEL GOTO 3850,3850,3880
3850 PRINT
3855 PRINT"IS METHOD ACCEPTABLE?"
3860 INPUT"(RESPOND YES OR NO): ",S
3865 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 3880
3870 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 2745 ELSE GOSUB 13000: GOTO 3855
3875 *** DETERMINE STABILITY CLASS FROM SIGMA THETA. ***
3880 IF(RSIGT<7.5)THEN 3900
3885 IF(RSIGT<22.5)THEN 3890 ELSE SPASQ="A":ICLAS=1:GOTO 4105
3890 IF(RSIGT<17.5)THEN 3895 ELSE SPASQ="B":ICLAS=2:GOTO 4105
3895 IF(RSIGT<12.5)THEN SPASQ="D":ICLAS=4:GOTO 4105 ELSE SPASQ="C":ICLAS=3:GOTO
4105
3900 IF(RSIGT<3.8)THEN 3905 ELSE SPASQ="E":ICLAS=5:GOTO 4105
3905 IF(RSIGT<2.1)THEN SPASQ="G":ICLAS=7:GOTO 4105 ELSE SPASQ="F":ICLAS=6:GOTO 4
105
3910 *****
3915 * STABILITY CLASS KNOWN. *
3920 *****
3925 PRINT
3930 PRINT"SELECT STABILITY CLASS."
3935 PRINT TAB(5)"(A) CLASS A - EXTREMELY UNSTABLE"
3940 PRINT TAB(5)"(B) CLASS B - MODERATELY UNSTABLE"
3945 PRINT TAB(5)"(C) CLASS C - SLIGHTLY UNSTABLE"
3950 PRINT TAB(5)"(D) CLASS D - NEUTRAL"
3955 PRINT TAB(5)"(E) CLASS E - SLIGHTLY STABLE"
3960 PRINT TAB(5)"(F) CLASS F - MODERATELY STABLE"
3965 PRINT TAB(5)"(G) CLASS G - EXTREMELY STABLE"
3970 INPUT"(RESPOND A,B,C,D,E,F OR G): ",S
3971 SPASQ=S
3975 IF(LEFT$(S,1)="A")OR(LEFT$(S,1)="a")THEN ICLAS=1:GOTO 4010
3980 IF(LEFT$(S,1)="B")OR(LEFT$(S,1)="b")THEN ICLAS=2:GOTO 4010
3985 IF(LEFT$(S,1)="C")OR(LEFT$(S,1)="c")THEN ICLAS=3:GOTO 4010
3990 IF(LEFT$(S,1)="D")OR(LEFT$(S,1)="d")THEN ICLAS=4:GOTO 4010
3995 IF(LEFT$(S,1)="E")OR(LEFT$(S,1)="e")THEN ICLAS=5:GOTO 4010
4000 IF(LEFT$(S,1)="F")OR(LEFT$(S,1)="f")THEN ICLAS=6:GOTO 4010
4005 IF(LEFT$(S,1)="G")OR(LEFT$(S,1)="g")THEN ICLAS=7:GOTO 4010 ELSE GOSUB 130
00: GOTO 3930

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4010 ON IHEL GOTO 4015,4015,4105
4015 PRINT
4020 PRINT"IS METHOD ACCEPTABLE?"
4025 INPUT"(RESPOND YES OR NO): ",S
4030 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 4105
4035 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 2745 ELSE GOSUB 13000 : GOTO 4020
4040 '*****
4045 '* STABILITY CLASS DEFAULT. *
4050 '*****
4055 IF(RWIND<5)THEN SPASQ="F":ICLAS=6 ELSE SPASQ="E":ICLAS=5
4060 PRINT
4065 PRINT"STABILITY CLASS DEFAULTS"
4070 IF(ICLAS=6)THEN PRINT"TO F OR MODERATELY STABLE." ELSE PRINT"TO E OR SLIGHT
LY STABLE"
4075 ON IHEL GOTO 4080,4080,4115
4080 PRINT
4085 PRINT"IS DEFAULT ACCEPTABLE?"
4090 INPUT"(RESPOND YES OR NO): ",S
4095 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 4115
4100 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 3925 ELSE GOSUB 13000 : GOTO 4085
4105 PRINT
4106 PRINT USING"STABILITY CLASS= &";SPASQ
4111 IF(RWIND<5)THEN 4115
4112 IF((ICLAS>0)AND(ICLAS<6))THEN 4115
4113 PRINT;PRINT"*****":PRINT"* WIND SPEED IS INCOMPAT
BLE *"
4114 PRINT"* WITH STABILITY CLASS. *":PRINT"*****"
:GOTO 2745
4115 ON IRUN GOTO 4135,5995
4120 '*****
4125 '* SELECT METHOD OF RELEASE RATE. *
4130 '*****
4135 PRINT
4140 PRINT"SELECT METHOD FOR INPUT OF RELEASE RATE."
4145 PRINT TAB(5)*(1) ISOTOPIC RELEASE RATE."
4150 PRINT TAB(5)*(2) GROSS RELEASE RATE."
4155 PRINT TAB(5)*(3) CONTAINMENT LEAKAGE."
4160 PRINT TAB(5)*(4) COOLANT LEAKAGE."
4165 PRINT TAB(5)*(5) DEFAULT."
4170 INPUT"(RESPOND 1,2,3,4 OR 5): ",I1
4175 IF((I1<1)OR(I1>5))THEN GOSUB 12000 : GOTO 4135
4180 IPRG=0:ON I1 GOTO 4225,4720,4810,5060,4185
4185 PRINT
4190 PRINT"CONTAINMENT LEAKAGE AND COOLANT LEAKAGE SELECTIONS"
4195 PRINT"EACH HAVE DEFAULTS. SELECT ONE OF THEM."
4200 INPUT"* HIT CARRIAGE RETURN. *",S
4205 GOTO 4135
4210 '*****
4215 '* ISOTOPIC RELEASE RATE. *
4220 '*****
4225 IF(ILU<0)THEN 4260 ELSE PRINT
4230 PRINT"IS A PRINTER HOOKED UP PROPERLY"
4235 PRINT"TO THE COMPUTER?"
4240 INPUT"(RESPOND YES OR NO): ",S
4245 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN ILU=2:GOTO 4260
4250 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN ILU=1 ELSE GOSUB 13000:GOTO 4225
4260 IF((IRUN<1)AND(IFLAG=1))THEN 4264
4261 FOR I=1 TO 20
4262 RIQUE(I)=0!:PRINT
4263 NEXT I

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4264 PRINT:PRINT"*****"
4265 PRINT"*      TO INPUT THE RELEASE RATE (CI/SEC) FOR A      *"
4270 PRINT"*  RADIONUCLIDE, RESPOND WITH THE CORRESPONDING  *"
4275 PRINT"* NUMBER FROM THE RADIONUCLIDE REFERENCE LIBRARY, *"
4280 PRINT"*****"
4285 PRINT
4290 PRINT"TO REPRINT THE RADIONUCLIDE REFERENCE LIBRARY."
4291 PRINT"RESPOND -99"
4295 PRINT
4300 PRINT"WHEN FINISHED RESPOND +99."
4305 ON IHEL GOTO 4310,4340,4340
4310 PRINT
4315 PRINT"IS THE ISOTOPIC RELEASE RATE KNOWN AND"
4320 PRINT"IS THIS METHOD ACCEPTABLE?"
4325 INPUT"(RESPOND YES OR NO): ",S
4330 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 4340
4335 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 4310 ELSE GOSUB 13000 : GOTO 4310
4340 PRINT
4345 PRINT"HIT CARRIAGE RETURN WHEN READY"
4346 INPUT"FOR RADIONUCLIDE REFERENCE LIBRARY. ",S
4347 SITOP="      KR83M KR85M KR85  KR87  KR88  KR89  XE131MXE133MXE133 XE135MXE1
35 XE137 XE138 CS134 CS137 I131  I132  I133  I134  I
135  "
4355 PRINT:PRINT:PRINT:PRINT:PRINT
4360 PRINT TAB(3)"*****"
4365 PRINT TAB(3)"*  RADIONUCLIDE REFERENCE LIBRARY,  *"
4370 PRINT TAB(3)"*****"
4375 PRINT
4380 PRINT TAB(8)"(1) KR83M";TAB(22);"(11) XE135"
4385 PRINT TAB(8)"(2) KR85M";TAB(22);"(12) XE137"
4390 PRINT TAB(8)"(3) KR85";TAB(22);"(13) XE138"
4395 PRINT TAB(8)"(4) KR87";TAB(22);"(14) CS134"
4400 PRINT TAB(8)"(5) KR88";TAB(22);"(15) CS137"
4405 PRINT TAB(8)"(6) KR89";TAB(22);"(16) I131"
4410 PRINT TAB(8)"(7) XE131M";TAB(22);"(17) I132"
4415 PRINT TAB(8)"(8) XE133M";TAB(22);"(18) I133"
4420 PRINT TAB(8)"(9) XE133";TAB(22);"(19) I134"
4425 PRINT TAB(7)"(10) XE135M";TAB(22);"(20) I135"
4430 PRINT
4435 PRINT TAB(6)"(-99) REPRINT";TAB(22);"(99) FINISHED"
4440 PRINT
4445 PRINT TAB(3)"*****"
4450 ON ILU GOTO 4550,4455
4455 LPRINT
4460 LPRINT TAB(3)"*****"
4465 LPRINT TAB(3)"*  RADIONUCLIDE REFERENCE LIBRARY,  *"
4470 LPRINT TAB(3)"*****"
4475 LPRINT
4480 LPRINT TAB(8)"(1) KR83M";TAB(22);"(11) XE135"
4485 LPRINT TAB(8)"(2) KR85M";TAB(22);"(12) XE137"
4490 LPRINT TAB(8)"(3) KR85";TAB(22);"(13) XE138"
4495 LPRINT TAB(8)"(4) KR87";TAB(22);"(14) CS134"
4500 LPRINT TAB(8)"(5) KR88";TAB(22);"(15) CS137"
4505 LPRINT TAB(8)"(6) KR89";TAB(22);"(16) I131"
4510 LPRINT TAB(8)"(7) XE131M";TAB(22);"(17) I132"
4515 LPRINT TAB(8)"(8) XE133M";TAB(22);"(18) I133"
4520 LPRINT TAB(8)"(9) XE133";TAB(22);"(19) I134"
4525 LPRINT TAB(7)"(10) XE135M";TAB(22);"(20) I135"
4530 LPRINT
4535 LPRINT TAB(6)"(-99) REPRINT";TAB(22);"(99) FINISHED"

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4540 LPRINT
4545 LPRINT TAB(3)*"*****"
4546 LPRINT:LPRINT:LPRINT:LPRINT:LPRINT:LPRINT:LPRINT:LPRINT:LPRINT:LPRINT
4550 PRINT
4555 INPUT"(RESPOND -99, 1,2,3,...20, 99): ",I1
4560 ON IHEL GOTO 4565,4595,4595
4565 PRINT
4570 IF((I1>0)AND(I1<21))THEN PRINT USING"YOUR SELECTION IS: &";MID$(SITOP,I1*6,
6) ELSE PRINT USING"YOUR ENTRY IS: ###";I1
4575 PRINT"IS ENTRY CORRECT?"
4580 INPUT"(RESPOND YES OR NO): ",S
4585 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 4595
4590 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 4550 ELSE GOSUB 13000 : GOTO 4570
4595 IF((I1=-99)AND(I1U=1))THEN 4355
4600 IF((I1=-99)AND(I1U=2))THEN 4455
4605 IF(I1=99)THEN 4670
4610 IF((I1<1)OR(I1>20))THEN GOSUB 12000 : GOTO 4550
4615 PRINT
4620 PRINT USING"FOR &";MID$(SITOP,I1*6,6)
4625 PRINT"INPUT RELEASE RATE IN CURIES PER SECOND."
4630 INPUT"(EX: 2.18E+07, 0.01E-12, 7.30E+10): ",RIQUE(I1)
4635 PRINT
4640 PRINT USING"FOR &";MID$(SITOP,I1*6,6)
4645 PRINT USING"THE RELEASE RATE IN CI/SEC IS ##.##^";RIQUE(I1)
4646 ON IHEL GOTO 4650,4550,4550
4650 PRINT:PRINT"IS ENTRY CORRECT?"
4655 INPUT"(RESPOND YES OR NO): ",S
4660 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 4550
4665 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 4615 ELSE GOSUB 13000 : GOTO 4640
4670 ON IHEL GOTO 4675,4675,4700
4675 PRINT
4680 PRINT"ARE ENTRIES AND METHOD CORRECT?"
4685 INPUT"(RESPOND YES OR NO): ",S
4690 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 4700
4695 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 4135 ELSE GOSUB 13000 : GOTO 4680
4700 IFLAG=1:ISO=1:GOTO 5995
4705 '*****
4710 '* GROSS RELEASE RATE. *
4715 '*****
4720 ON IHEL GOTO 4725,4750,4750
4725 PRINT
4730 PRINT"IS GROSS RELEASE RATE (CI/SEC) KNOWN?"
4735 INPUT"(RESPOND YES OR NO): ",S
4740 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 4750
4745 IF((LEFT$(S,1)<>N)AND(LEFT$(S,1)<>NL))THEN GOSUB 13000 : GOTO 4730
4746 PRINT"THIS INFORMATION IS ESSENTIAL"
4747 PRINT"TO THE CALCULATIONS. PLEASE"
4748 PRINT"SELECT ANOTHER METHOD." : GOTO 4135
4750 PRINT
4755 PRINT"INPUT GROSS RELEASE RATE IN CI/SEC."
4760 INPUT"(EX: 2.18E+07, 0.01E-12, 7.30E+10): ",RQUE
4765 PRINT
4770 PRINT USING"THE GROSS RELEASE RATE IS ##.##^";RQUE
4775 PRINT"IS ENTRY CORRECT?"
4780 INPUT"(RESPOND YES OR NO): ",S
4785 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN IFLAG=2:GOTO 5435
4790 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 4750 ELSE GOSUB 13000 : GOTO 4770
4795 '*****
4800 '* CONTAINMENT LEAKAGE. *
4805 '*****

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4810 PRINT
4815 PRINT"IS THE PERCENTAGE OF CONTAINMENT"
4816 PRINT"RELEASED PER DAY KNOWN?"
4820 INPUT"(RESPOND YES OR NO): ",S
4825 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 4835
4830 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 4880 ELSE GOSUB 13000 : GOTO 4815
4835 PRINT
4840 PRINT"INPUT PERCENTAGE OF CONTAINMENT RELEASED PER DAY."
4845 INPUT"(EX: 100.0, 0.1, 1234.5): ",RPERCO
4850 PRINT
4855 PRINT"PERCENTAGE OF CONTAINMENT RELEASED"
4856 PRINT USING"PER DAY IS ##.####";RPERCO
4860 PRINT"IS ENTRY CORRECT?"
4865 INPUT"(RESPOND YES OR NO): ",S
4870 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 4900
4875 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 4835 ELSE GOSUB 13000 : GOTO 4855
4880 PRINT
4885 PRINT"THE DEFAULT FOR THE CONTAINMENT LEAKAGE RATE"
4890 PRINT USING"IS #.### CONTAINMENT VOLUMES PER DAY.";RLK
4895 PPERCO=RLK:IPROG=1
4900 PRINT
4905 PRINT"CHARACTERIZE SOURCE MAGNITUDE."
4910 PRINT TAB(5)"(1) COOLANT INVENTORY"
4915 PRINT TAB(5)"(2) GAP INVENTORY"
4920 PRINT TAB(5)"(3) FUEL MELT"
4925 PRINT TAB(5)"(4) CONTAINMENT MONITOR READING"
4930 PRINT TAB(5)"(5) DEFAULT"
4935 INPUT"(RESPOND 1,2,3,4 OR 5): ",I1
4940 IF((I1<1)OR(I1>5))THEN GOSUB 12000 : GOTO 4905
4945 ON I1 GOTO 4990,4995,4985,5000,4950
4950 PRINT
4955 PRINT"THE DEFAULT IS FUEL MELT."
4960 ON I1 GOTO 4965,4985,4985
4965 PRINT"IS DEFAULT ACCEPTABLE?"
4970 INPUT"(RESPOND YES OR NO): ",S
4975 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 4985
4980 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 4900 ELSE GOSUB 13000 : GOTO 4965
4985 IFLAG=5:GOTO 5435
4990 IFLAG=3:GOTO 5435
4995 IFLAG=4:GOTO 5435
5000 PRINT
5005 PRINT"INPUT CONTAINMENT MONITOR READING IN ROENTGENS/HOUR."
5010 INPUT"(EX: 1.23E+12, 0.01E-01): ",RACTIV
5015 PRINT
5020 PRINT USING"CONTAINMENT MONITOR READING (R/HR) IS ##.####";RACTIV
5025 PRINT"IS ENTRY CORRECT?"
5030 INPUT"(RESPOND YES OR NO): ",S
5035 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 5045
5040 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 5000 ELSE GOSUB 13000 : GOTO 5020
5045 IFLAG=6
5050 IF(RVOL=1)THEN RSTERM=RACTIV*RPERCO/10000:GOTO 5435
5055 IF(RVOL=2)THEN RSTERM=RACTIV*RPERCO/1000:GOTO 5435
5056 *****
5057 * COOLANT LEAKAGE. *
5058 *****
5060 PRINT
5065 PRINT"SELECT UNITS FOR COOLANT RATE LOSS."
5070 PRINT TAB(5)"(1) LBS./MIN."
5075 PRINT TAB(5)"(2) GALLONS/MIN."
5076 PRINT TAB(5)"(3) ABORT AND RETURN."

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5080 INPUT"RESPOND 1,2 OR 3): ",I1
5085 IF<<I1<1>OR<I1>3>>THEN GOSUB 12000 : GOTO 5065
5090 ON I1 GOTO 5095,5145,4135
5095 PRINT
5100 PRINT"INPUT COOLANT LEAKAGE RATE IN LBS./MIN."
5105 INPUT"(EX: 1.23E+12, 1234.5): ",RRATE
5110 PRINT
5115 PRINT USING"COOLANT LEAKAGE RATE (LBS./MIN) IS ##.##^";RRATE
5116 RRATE=RRATE*7.567
5120 ON IHEL GOTO 5125,5125,5195
5125 PRINT"IS ENTRY CORRECT?"
5130 INPUT"(RESPOND YES OR NO): ",S
5135 IF<<LEFT$(S,1)=Y>OR<LEFT$(S,1)=YL>>THEN 5195
5140 IF<<LEFT$(S,1)=N>OR<LEFT$(S,1)=NL>>THEN 5095 ELSE GOSUB 13000 : GOTO 5125
5145 PRINT
5150 PRINT"INPUT COOLANT LEAKAGE RATE IN GALLONS/MIN."
5155 INPUT"(EX: 1.23E+12, 1234.5): ",RRATE
5160 PRINT
5165 PRINT USING"COOLANT LEAKAGE RATE (GALLONS/MIN.) IS ##.##^";RRATE
5166 RRATE=RRATE*43.07
5170 ON IHEL GOTO 5175,5175,5195
5175 PRINT"IS ENTRY CORRECT?"
5180 INPUT"(RESPOND YES OR NO): ",S
5185 IF<<LEFT$(S,1)=Y>OR<LEFT$(S,1)=YL>>THEN 5195
5190 IF<<LEFT$(S,1)=N>OR<LEFT$(S,1)=NL>>THEN 5145 ELSE GOSUB 13000 : GOTO 5175
5195 PRINT
5200 PRINT"SELECT UNITS OR DEFAULT FOR GROSS"
5205 PRINT"ACTIVITY OF LEAKING COOLANT."
5210 PRINT TAB(5)"(1) MICRO CURIES/GRAM"
5215 PRINT TAB(5)"(2) CURIES/LITER"
5220 PRINT TAB(5)"(3) MICRO CURIES/CC"
5225 PRINT TAB(5)"(4) DEFAULT"
5230 INPUT"(RESPOND 1,2,3 OR 4): ",I1
5235 IF<<I1<1>OR<I1>4>>THEN GOSUB 13000 : GOTO 5195
5240 ON I1 GOTO 5245,5320,5375,5245
5245 PRINT
5250 PRINT"GROSS ACTIVITY OF LEAKING COOLANT"
5255 PRINT"DEFAULTS TO 10 MICRO CURIES/CC."
5260 RACTIV=.00001:GOTO 5430
5265 PRINT
5270 PRINT"INPUT GROSS ACTIVITY OF LEAKING"
5271 PRINT"COOLANT IN MICRO CURIES/GRAM."
5275 INPUT"(EX: 1.23E+12, 1234.5): ",RACTIV
5280 PRINT
5285 PRINT USING"GROSS ACTIVITY (MICRO CURIES/GRAM) IS ##.##^";RACTIV
5290 ON IHEL GOTO 5295,5295,5315
5295 PRINT"IS ENTRY CORRECT?"
5300 INPUT"(RESPOND YES OR NO): ",S
5305 IF<<LEFT$(S,1)=Y>OR<LEFT$(S,1)=YL>>THEN 5315
5310 IF<<LEFT$(S,1)=N>OR<LEFT$(S,1)=NL>>THEN 5265 ELSE GOSUB 13000 : GOTO 5295
5315 RACTIV=RACTIV*.000001 : GOTO 5430
5320 PRINT
5325 PRINT"INPUT GROSS ACTIVITY OF LEAKING"
5326 PRINT"COOLANT IN CURIES/LITER."
5330 INPUT"(EX: 1.23E+12, 1234.5): ",RACTIV
5335 PRINT
5340 PRINT USING"GROSS ACTIVITY (CURIES/LITER) IS ##.##^";RACTIV
5345 ON IHEL GOTO 5350,5350,5370
5350 PRINT"IS ENTRY CORRECT?"
5355 INPUT"(RESPOND YES OR NO): ",S

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5360 IF<<LEFT$(S,1)=Y>OR<LEFT$(S,1)=YL>>THEN 5370
5365 IF<<LEFT$(S,1)=N>OR<LEFT$(S,1)=NL>>THEN 5320 ELSE GOSUB 13000 : GOTO 5350
5370 RACTIV=RACTIV*.001:GOTO 5430
5375 PRINT
5380 PRINT"INPUT GROSS ACTIVITY OF LEAKING"
5381 PRINT"COOLANT IN MICRO CURIES/CC."
5385 INPUT"(EX: 1.23E+12, 1234.5): ",RACTIV
5390 PRINT
5395 PRINT USING"GROSS ACTIVITY (MICRO CURIES/CC) IS ##.##^";RACTIV
5400 ON IHEL GOTO 5405,5405,5425
5405 PRINT"IS ENTRY CORRECT?"
5410 INPUT"(RESPOND YES OR NO): ",S
5415 IF<<LEFT$(S,1)=Y>OR<LEFT$(S,1)=YL>>THEN 5425
5420 IF<<LEFT$(S,1)=N>OR<LEFT$(S,1)=NL>>THEN 5375 ELSE GOSUB 13000 : GOTO 5405
5425 RACTIV=RACTIV*.000001
5430 IFLAG=7
5435 PRINT:PRINT"IS METHOD ACCEPTABLE?":INPUT"(RESPOND YES OR NO): ",S
5436 IF<<LEFT$(S,1)=Y>OR<LEFT$(S,1)=YL>>THEN 5438
5437 IF<<LEFT$(S,1)=N>OR<LEFT$(S,1)=NL>>THEN 4135 ELSE GOSUB 13000:GOTO 5435
5438 IF<<IRUN<>1>>AND<ISO=0>>THEN 5995
5440 '*****
5445 '* IODINE SECTION. *
5450 '*****
5455 PRINT
5460 PRINT"ARE THERE IODINES IN THE RELEASE?"
5465 PRINT TAB(5)"(1) YES"
5470 PRINT TAB(5)"(2) NO"
5475 PRINT TAB(5)"(3) UNCERTAIN"
5480 INPUT"(RESPOND 1,2 OR 3): ",S
5485 IF<<LEFT$(S,1)="1">OR<LEFT$(S,1)=Y>OR<LEFT$(S,1)=YL>>THEN 5495
5487 IF<<LEFT$(S,1)="2">OR<LEFT$(S,1)=N>OR<LEFT$(S,1)=NL>>THEN 5985
5490 IF<<LEFT$(S,1)="3">OR<LEFT$(S,1)="U">>THEN 5830 ELSE GOSUB 13000:GOTO 5460
5495 PRINT
5500 PRINT"IS THE RATIO OF IODINE TO NOBLE GAS"
5505 PRINT"IN THE RELEASED MATERIAL KNOWN?"
5510 INPUT"(RESPOND YES OR NO): ",S
5515 IF<<LEFT$(S,1)=Y>OR<LEFT$(S,1)=YL>>THEN 5525
5520 IF<<LEFT$(S,1)=N>OR<LEFT$(S,1)=NL>>THEN 5830 ELSE GOSUB 13000 : GOTO 5500
5525 PRINT
5530 PRINT"SELECT FOR INPUT OF IODINE TO NOBLE GAS RATIO."
5535 PRINT TAB(5)"(1) INPUT IODINE TO NOBLE GAS RATIO AS A"
5540 PRINT TAB(9)"DECIMAL FRACTION."
5545 PRINT TAB(5)"(2) INPUT % IODINE OF I PLUS NG TOTAL."
5550 PRINT TAB(9)"INPUT % NOBLE GAS OF I PLUS NG TOTAL."
5555 PRINT TAB(5)"(3) INPUT % IODINE IN CORE INVENTORY."
5560 PRINT TAB(9)"INPUT % NOBLE GAS IN CORE INVENTORY."
5565 PRINT
5570 INPUT"(RESPOND 1,2 OR 3): ",I1
5575 IF<<I1<1>OR<I1>3>>THEN GOSUB 12000 : GOTO 5530
5580 ON I1 GOTO 5585,5635,5705
5585 PRINT
5590 PRINT"INPUT IODINE TO NOBLE GAS AS A DECIMAL FRACTION."
5591 PRINT"(NOTE RANGE: 0 =< DECIMAL FRACTION =< 1)"
5595 INPUT"(EX: 1.23E-12, 0.01): ",RING
5596 IF<<RING<0>OR<RING>1>>THEN GOSUB 12000: GOTO 5590
5600 PRINT
5605 PRINT USING"IODINE TO NOBLE GAS RATIO IS ##.##^";RING
5606 RI=(100*RING)/(1+RING):RNG=100!-RI
5610 ON IHEL GOTO 5615,5615,5785
5615 PRINT"IS ENTRY CORRECT?"

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5620 INPUT"(RESPOND YES OR NO): ",S
5625 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 5785
5630 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 5585 ELSE GOSUB 13000 : GOTO 5615
5635 PRINT
5640 PRINT"INPUT % IODINE OF IODINE PLUS NOBLE GAS TOTAL."
5645 INPUT"(EX: 100.0, 0.1): ",RI
5650 RNG=100/-RI
5655 RING=RI/RNG
5660 PRINT
5665 PRINT USING"INPUT VALUES ARE: % IODINE= ##.###^";RI
5670 PRINT USING"          % NOBLE GAS= ##.###^";100-RI
5675 ON IHEL GOTO 5680,5680,5785
5680 PRINT
5685 PRINT"ARE ENTRIES CORRECT?"
5690 INPUT"(RESPOND YES OR NO): ",S
5695 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 5785
5700 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 5635 ELSE GOSUB 13000 : GOTO 5685
5705 PRINT
5710 PRINT"INPUT % OF IODINE IN CORE INVENTORY."
5715 INPUT"(EX: 100.0, 0.1): ",RI
5720 PRINT
5725 PRINT"INPUT % OF NOBLE GAS IN CORE INVENTORY."
5730 INPUT"(EX: 100.0, 0.1): ",RNG
5735 PRINT
5740 PRINT"INPUT VALUES ARE: % IODINE= ",RI
5745 PRINT TAB(14)"% NOBLE GAS= ",RNG
5750 RING=RI/RNG;RI=100/*RI/(RI+RNG);RNG=100/-RI
5755 ON IHEL GOTO 5760,5760,5785
5760 PRINT
5765 PRINT"ARE ENTRIES CORRECT?"
5770 INPUT"(RESPOND YES OR NO): ",S
5775 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 5785
5780 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 5705 ELSE GOSUB 13000 : GOTO 5765
5785 PRINT
5790 PRINT"AT WHAT POINT IN THE RELEASE PATHWAY"
5795 PRINT"IS THE RATIO MEASURED?"
5800 PRINT TAB(5)"(1) BEFORE FILTRATION"
5805 PRINT TAB(5)"(2) AFTER FILTRATION"
5810 PRINT TAB(5)"(3) NO FILTERS IN RELEASE PATHWAY"
5815 INPUT"(RESPOND 1,2 OR 3): ",I1
5820 IF((I1<1)OR(I1>3))THEN GOSUB 12000 : GOTO 5790
5825 ON I1 GOTO 5895,5875,5875
5830 PRINT
5835 PRINT"THE DEFAULT RATIO FOR IODINE TO NOBLE GAS"
5840 PRINT"IS 0.02 OR 1.96% IODINE TO 98.04% NOBLE GAS."
5845 RING=.02;RI=1.96;RNG=98.04
5850 PRINT
5855 PRINT"WOULD THE IODINES BE FILTERED?"
5860 INPUT"(RESPOND YES OR NO): ",S
5865 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 5895
5870 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 5875 ELSE GOSUB 13000 : GOTO 5850
5875 RILEF=0!
5880 PRINT
5885 PRINT"ASSUME NO FILTRATION."
5890 GOTO 5990
5895 PRINT
5900 PRINT"IS THE FILTER EFFICIENCY KNOWN?"
5905 INPUT"(RESPOND YES OR NO): ",S
5910 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 5920
5915 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 5970 ELSE GOSUB 13000 : GOTO 5900

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5920 PRINT
5925 PRINT"INPUT FILTER EFFICIENCY AS % OF IODINE REMOVED."
5930 INPUT"(EX: 100.0, 0.1): ".RILEF
5935 PRINT
5940 PRINT USING"FILTER EFFICIENCY(%)= ####.##";RILEF
5945 ON IHEL GOTO 5950,5950,5990
5950 PRINT"IS ENTRY CORRECT?"
5955 INPUT"(RESPOND YES OR NO): ".S
5960 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 5990
5965 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 5920 ELSE GOSUB 13000 : GOTO 5950
5970 PRINT
5975 PRINT"FILTER EFFICIENCY DEFAULTS TO 95%."
5976 ON IHEL GOTO 5977,5977,5980
5977 PRINT:INPUT"* HIT CARRIAGE RETURN TO CONTINUE. * ".S
5980 RILEF=95!:GOTO 5990
5985 RING=0:RILEF=100!:RI=0:RNG=100
5990 RIRF=((RING/(1+RING))*(100!-RILEF)/100!)
5991 -END OF THIS PIECE OF CODE.
5995 FOR I=1 TO 10
6000 PRINT
6005 NEXT I
6010 PRINT TAB(8)"*****"
6015 PRINT TAB(8)"* WAIT-IRDM IS SEARCHING FOR *"
6020 PRINT TAB(8)"* THE NEXT PIECE OF THE CODE. *"
6025 PRINT TAB(8)"*****"
6030 FOR I=1 TO 9
6035 PRINT
6040 NEXT I
6045 CHAIN "B:IRDMTHR.COM",20
6050 END
10000 PRINT
11995 END
12000 PRINT
12005 PRINT"ENTRY OUT OF RANGE - PLEASE TRY AGAIN."
12010 PRINT
12015 RETURN
13000 PRINT
13005 PRINT"ENTRY NOT UNDERSTOOD - PLEASE TRY AGAIN."
13010 PRINT
13015 RETURN
10 PROGRAM IRDM - PART THREE
15 Interactive Rapid Dose Assessment Model
20 COMMON IHEL,SNAME,SDATE,STIME,SRNAM,IPOWR,RLK,RVOL,IRUN,ILU,IG,IE,RWIND,SDIR,
RSTACK,SPASQ,ICLAS,IFLAG,ISO
21 COMMON RIQUE(),RQUE,IPOG,RPERCO,RACTIV,RSTERM,PRATE,RING,RI,RNG,RILEF,RIRF,R
IREL,RDUR,RPOST,IAGEFL,IFIX
25 DEFINT I
30 DEFSTR S,N,Y
35 DEFNG R
40 DEFDBL D
45 DATA"Y","Y","N","n"
50 READ Y,YL,N,NL
55 SITOP=" KR83M KR85M KR85 KR87 KR88 KR89 XE131MXE133MXE133 XE135MXE135
XE137 XE138 CS134 CS137 I131 I132 I133 I134 I13
5 "
6055 *****
6060 * IRDMTHR.COM *
6065 *****
6066 FOR I=1 TO 24
6067 PRINT

```

```

6068 NEXT I
6069 IF((IFLAG<>1)AND(ISO=1))THEN 6080
6070 ON IRUN GOTO 6075,10895
6075 IF(ISO=1)GOTO 6205
6080 PRINT
6085 PRINT"IS THE TIME INTERVAL FROM REACTOR SHUTDOWN"
6090 PRINT"TO INITIATION OF RELEASE KNOWN?"
6095 INPUT"(RESPOND YES OR NO): ",S
6100 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 6110
6105 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 6165 ELSE GOSUB 13000 : GOTO 6085
6110 PRINT
6115 PRINT"INPUT TIME INTERVAL FROM REACTOR SHUTDOWN TO"
6120 PRINT"INITIATION OF RELEASE IN HOURS."
6125 INPUT"(EX: 1.75, 36.00): ",RIREL
6130 PRINT
6135 PRINT USING"IN HOURS, INPUT TIME INTERVAL IS####.##";RIREL
6140 ON IHEL GOTO 6145,6200,6200
6145 PRINT"IS ENTRY CORRECT?"
6150 INPUT"(RESPOND YES OR NO): ",S
6155 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 6200
6160 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 6110 ELSE GOSUB 13000 : GOTO 6145
6165 PRINT
6170 PRINT"TIME INTERVAL DEFAULTS TO ZERO.":RIREL=0:
6175 ON IHEL GOTO 6180,6200,6200
6180 PRINT"IS DEFAULT ACCEPTABLE?"
6185 INPUT"(RESPOND YES OR NO): ",S
6190 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 6200
6195 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 6110 ELSE GOSUB 13000 : GOTO 6180
6200 ISO=0
6205 PRINT:PRINT"IS AN ESTIMATE FOR THE TOTAL DURATION"
6210 PRINT"OF THE RELEASE KNOWN?"
6215 INPUT"(RESPOND YES OR NO): ",S
6220 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 6230
6225 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 6285 ELSE GOSUB 13000 : GOTO 6205
6230 PRINT
6235 PRINT"INPUT ESTIMATE FOR TOTAL DURATION"
6240 PRINT"OF RELEASE IN HOURS."
6245 INPUT"(EX: 1.75, 36.00): ",RDUR
6250 PRINT
6255 PRINT USING"IN HOURS, INPUT TIME INTERVAL IS####.##";RDUR
6260 ON IHEL GOTO 6265,6316,6316
6265 PRINT"IS ENTRY CORRECT?"
6270 INPUT"(RESPOND YES OR NO): ",S
6275 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 6316
6280 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 6230 ELSE GOSUB 13000 : GOTO 6265
6285 PRINT
6290 PRINT"DURATION OF RELEASE DEFAULTS TO 9 HOURS.":RDUR=9:
6295 ON IHEL GOTO 6300,6316,6316
6300 PRINT"IS DEFAULT ACCEPTABLE?"
6305 INPUT"(RESPOND YES OR NO): ",S
6310 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 6316
6315 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 6230 ELSE GOSUB 13000 : GOTO 6300
6316 IF((IG=1)OR((ISO<>1)AND(IFLAG<>6)))THEN 6375
6320 PRINT:PRINT"INPUT IN HOURS THE TIME INTERVAL FROM"
6331 PRINT"WHEN THE RADIATION MEASUREMENT WAS MADE"
6332 PRINT"TO THE MATERIAL'S PROJECTED TIME OF RELEASE."
6335 INPUT"(EX: 24.00, 0.25): ",RPOST
6346 PRINT:PRINT"IN HOURS, THE TIME INTERVAL FROM WHEN"
6347 PRINT"THE RADIATION MEASUREMENT WAS MADE TO THE"
6348 PRINT USING"MATERIAL'S PROJECTED TIME OF RELEASE IS####.##";RPOST

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6350 ON IHEL GOTO 6355,6375,6375
6355 PRINT:PRINT"IS ENTRY CORRECT?"
6360 INPUT"(RESPOND YES OR NO): ",S
6365 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 6375
6370 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 6316 ELSE GOSUB 13000 : GOTO 6355
6375 IF(IFIX<>5)THEN ON IRUN GOTO 6380,10895
6380 PRINT:PRINT"IDENTIFY AGE OF RELEASED MATERIAL."
6385 PRINT TAB(5)"(1) AGE < 1 DAY"
6390 PRINT TAB(5)"(2) AGE >= 1 DAY"
6395 PRINT TAB(5)"(3) DEFAULT"
6400 INPUT"(RESPOND 1,2 OR 3): ",I1
6405 IF((I1<1)OR(I1>3))THEN GOSUB 12000 : GOTO 6380
6410 ON I1 GOTO 6430,6445,6415
6415 PRINT
6420 PRINT"AGE DEFAULT IS THE CONSERVATIVE ASSUMPTION"
6425 PRINT"THAT AGE < 1 DAY."
6430 PRINT
6435 PRINT"AGE < 1 DAY."
6440 IAGEFL=1:GOTO 6460
6445 PRINT
6450 PRINT"AGE >= 1 DAY."
6455 IAGEFL=0
6460 ON IHEL GOTO 6465,6485,6515
6465 PRINT"IS ENTRY OR ASSUMPTION CORRECT?"
6470 INPUT"(RESPOND YES OR NO): ",S
6475 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 6485
6480 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 6380 ELSE GOSUB 13000 : GOTO 6465
6485 ON IHEL GOTO 6490,6490,6515
6490 PRINT
6495 PRINT"ARE DURATION AND AGE INPUTS CORRECT?"
6500 INPUT"(RESPOND YES OR NO): ",S
6505 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 6515
6510 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 6069 ELSE GOSUB 13000 : GOTO 6495
6515 IF(IRUN<>1)GOTO 10895
6520 '*****
6525 '* PRINT INPUT AND MAKE CHANGES. *
6530 '*****
10000 IRUN=2:I3=0
10005 IF(ILU<>0)THEN 10040
10010 PRINT
10015 PRINT"IS A PRINTER HOOKED UP TO"
10020 PRINT"THE COMPUTER PROPERLY."
10025 INPUT"(RESPOND YES OR NO): ",S
10030 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN ILU=2:GOTO 10040
10035 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN ILU=1:GOTO 10040 ELSE GOSUB 13000
: GOTO 10015
10040 ON ILU GOTO 10470,10045
10041 'OUTPUT ON PRINTER.
10045 FOR I1=1 TO 24
10050 PRINT
10055 NEXT I1
10060 LPRINT"*****"
10065 LPRINT"* REVIEW THE FOLLOWING INPUT INFORMATION. *"
10070 LPRINT"*****"
10071 IF(I3=0)THEN 10075
10072 LPRINT:LPRINT:LPRINT:LPRINT TAB(29)"*****"
10073 'LPRINT"***** INPUT INFORMATION *****"
*****
10074 LPRINT TAB(29)"*****"
10075 LPRINT

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10080 LPRINT USING"USER NAME: &";SNAME
10085 LPRINT
10090 LPRINT USING"Today's DATE: &";SDATE
10095 LPRINT
10100 LPRINT USING"CURRENT TIME: &";STIME
10105 LPRINT
10110 LPRINT USING"REACTOR NAME: &";SRNAM
10115 LPRINT
10120 LPRINT USING"NET ELECTRICAL OUTPUT:#####";IPOWER
10125 LPRINT
10130 ON RVOL GOTO 10135,10140
10135 LPRINT"CONTAINMENT TYPE: EITHER A PWR OR BWR-TYPE III":GOTO 10145
10140 LPRINT"CONTAINMENT TYPE: BWR-EITHER A TYPE I OR II"
10145 LPRINT
10150 IF(IE=1)THEN 10166
10155 LPRINT USING"GROUND LEVEL WIND SPEED (M/SEC):#####.##";RWIND
10160 LPRINT
10165 LPRINT USING"GROUND LEVEL WIND DIRECTION (TO): &";SDIR:GOTO 10185
10166 LPRINT USING"EFFECTIVE STACK HEIGHT(M):#####.##";RSTACK
10167 LPRINT
10170 LPRINT USING"ELEVATED LEVEL WIND SPEED (M/SEC):#####.##";RWIND
10175 LPRINT
10180 LPRINT USING"ELEVATED LEVEL WIND DIRECTION (TO): &";SDIR
10185 LPRINT
10190 LPRINT USING"STABILITY CLASS: &";SPASQ
10191 IF(IPROG=0)THEN 10195
10192 LPRINT
10193 LPRINT"NOTE: * DEFAULT ESTIMATES USED FOR THE RELEASE RATE. *"
10195 LPRINT
10200 ON IFLAG GOTO 10205,10240,10260,10260,10260,10260,10335
10205 LPRINT"INPUTS FOR ISOTOPIC RELEASE RATE:"
10210 FOR I=1 TO 20
10215 IF(RIQUE(I)=0)THEN 10230
10220 LPRINT
10225 LPRINT USING"    FOR &";MID$(SITOP,I*6,6)
10226 LPRINT USING"    THE RELEASE RATE (CI/SEC): ##.##^";RIQUE(I)
10230 NEXT I
10235 GOTO 10425
10240 LPRINT"INPUTS FOR GROSS RELEASE RATE:"
10245 LPRINT
10250 LPRINT USING"    GROSS RELEASE RATE (CI/SEC): ##.##^";RQUE
10255 GOTO 10360
10260 LPRINT"INPUTS FOR CONTAINMENT LEAKAGE:"
10265 LPRINT
10270 LPRINT USING"    PERCENTAGE OF CONTAINMENT RELEASED PER DAY: ##.##^";RPE
RCD
10275 LPRINT
10280 IF(IFLAG<>3)THEN 10295
10285 LPRINT TAB(4)"SOURCE MAGNITUDE: COOLANT INVENTORY"
10290 GOTO 10360
10295 IF(IFLAG<>4)THEN 10310
10300 LPRINT TAB(4)"SOURCE MAGNITUDE: GAP INVENTORY"
10305 GOTO 10360
10310 IF(IFLAG<>5)THEN 10325
10315 LPRINT TAB(4)"SOURCE MAGNITUDE: FUEL MELT"
10320 GOTO 10360
10325 LPRINT USING"    CONTAINMENT MONITOR READING (R/HR): ##.##^";RACTIV
10330 GOTO 10360
10335 LPRINT"INPUTS FOR COOLANT LEAKAGE:"
10340 LPRINT

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10345 LPRINT USING"    LEAKAGE RATE (G/SEC):  ##.##^####";RRATE
10350 LPRINT
10355 LPRINT USING"    GROSS ACTIVITY (CI/G):  ##.##^####";RACTIV
10360 LPRINT
10365 LPRINT"IODINE, NOBLE GAS, AND FILTER EFFICIENCY INPUTS:"
10370 LPRINT
10375 LPRINT USING"    PERCENTAGE IODINE:#####.##";RI
10380 LPRINT
10385 LPRINT USING"    PERCENTAGE NOBLE GAS:#####.##";RNG
10390 LPRINT
10395 LPRINT USING"    IODINE TO NOBLE GAS RATIO:  ##.##^####";RING
10400 LPRINT
10405 LPRINT USING"    PERCENTAGE OF IODINES REMOVED BY FILTRATION:#####.##";RILE
10410 LPRINT
10415 LPRINT"TIME INTERVAL FROM REACTOR SHUTDOWN
10420 LPRINT USING"TO INITIATION OF RELEASE(HR):####.##";RIREL
10425 LPRINT
10430 LPRINT"TIME ESTIMATE FOR TOTAL DURATION"
10435 LPRINT USING"OF RELEASE(HR):####.##";RDUR
10440 IF((ISO<>1)AND(IFLAG<>6))THEN 10455
10451 LPRINT:LPRINT"TIME ESTIMATE FROM RADIATION MEASUREMENT TO"
10452 LPRINT USING"THE MATERIAL'S PROJECTED TIME OF RELEASE(HR):####.##";RPOST
10455 LPRINT
10460 IF(IAGEFL=1)THEN LPRINT"AGE OF RELEASED MATERIAL:  < 1 DAY"ELSE LPRINT"AGE
    OF RELEASED MATERIAL:  >= 1 DAY"
10461 IF(I3=1)THEN 11060 ELSE LPRINT:LPRINT"*****"
10462 LPRINT"* TEAR OFF AND REVIEW. *":PRINT"* REVIEW INPUT INFORMATION. *":PRIN
    T
10463 LPRINT"*****"
10465 LPRINT:LPRINT:LPRINT:LPRINT:LPRINT:LPRINT:LPRINT:LPRINT:GOTO 10875
10466 /OUTPUT ON CRT.
10470 PRINT
10475 PRINT
10476 PRINT"*****"
10477 PRINT"* REVIEW INPUT INFORMATION. *"
10478 PRINT"*****"
10479 PRINT
10480 PRINT USING"USER NAME:  &";SNAME
10485 PRINT
10490 PRINT USING"TODAY'S DATE:  &";SDATE
10495 PRINT
10500 PRINT USING"CURRENT TIME:  &";STIME
10505 PRINT
10510 PRINT USING"REACTOR NAME:  &";SRNAM
10515 PRINT
10520 PRINT USING"NET ELECTRICAL OUTPUT:#####";IPOWER
10525 PRINT
10530 ON RVOL GOTO 10535,10540
10535 PRINT"CONTAINMENT TYPE:  EITHER A PWR OR BWR-TYPE III":GOTO 10545
10540 PRINT"CONTAINMENT TYPE:  BWR-EITHER A TYPE I OR II"
10545 PRINT
10550 IF(IE=1)THEN 10566
10555 PRINT USING"GROUND LEVEL WIND SPEED (M/SEC):#####.##";RWIND
10560 PRINT
10564 PRINT"GROUND LEVEL WIND"
10565 PRINT USING"DIRECTION (TO):  &";SDIR:GOTO 10585
10566 PRINT USING"EFFECTIVE STACK HEIGHT(M):#####.##";RSTACK
10567 PRINT
10570 PRINT USING"ELEVATED LEVEL WIND SPEED (M/SEC):#####.##";RWIND

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10575 PRINT
10580 PRINT"ELEVATED LEVEL WIND"
10581 PRINT USING"DIRECTION (TO):  &";SDIR
10585 PRINT
10586 INPUT"* HIT CARRIAGE RETURN TO CONTINUE. *",S
10587 PRINT
10590 PRINT USING"STABILITY CLASS:  &";SPASQ
10591 IF(IPROG=0)THEN 10595
10592 PRINT
10593 PRINT"NOTE: * DEFAULT ESTIMATES USED FOR RELEASE RATE. *"
10595 PRINT
10600 ON IFLAG GOTO 10605,10640,10660,10660,10660,10660,10735
10605 PRINT"INPUTS FOR ISOTOPIC RELEASE RATE:"
10610 FOR I=1 TO 20
10615 IF(RIQUE(I)=0)THEN 10630
10620 PRINT
10625 PRINT USING"  FOR &";MID$(SITOP,I*6,6)
10626 PRINT USING"  THE RELEASE RATE (CI/SEC):  ##.#####";RIQUE(I)
10627 PRINT:INPUT"* HIT CARRIAGE RETURN TO CONTINUE. *",S
10630 NEXT I
10635 GOTO 10620
10640 PRINT"INPUTS FOR GROSS RELEASE RATE:"
10645 PRINT
10650 PRINT USING"  GROSS RELEASE RATE (CI/SEC):  ##.#####";RQUE
10655 GOTO 10760
10660 PRINT"INPUTS FOR CONTAINMENT LEAKAGE:"
10665 PRINT
10670 PRINT TAB(3)"PERCENTAGE OF CONTAINMENT RELEASED"
10671 PRINT USING"  PER DAY:  ##.#####";RPERCO
10675 PRINT
10680 IF(IFLAG<>3)THEN 10695
10685 PRINT TAB(3)"SOURCE MAGNITUDE:  COOLANT INVENTORY"
10690 GOTO 10760
10695 IF(IFLAG<>4)THEN 10710
10700 PRINT TAB(3)"SOURCE MAGNITUDE:  GAP INVENTORY"
10705 GOTO 10760
10710 IF(IFLAG<>5)THEN 10725
10715 PRINT TAB(3)"SOURCE MAGNITUDE:  FUEL MELT"
10720 GOTO 10760
10725 PRINT USING"  CONTAINMENT MONITOR READING (R/HR):  ##.#####";RACTIV
10730 GOTO 10760
10735 PRINT"INPUTS FOR COOLANT LEAKAGE:"
10740 PRINT
10745 PRINT USING"  LEAKAGE RATE (G/SEC):  ##.#####";RRATE
10750 PRINT
10755 PRINT USING"  GROSS ACTIVITY (CI/G):  ##.#####";RACTIV
10760 PRINT
10761 INPUT"* HIT CARRIAGE RETURN TO CONTINUE. *",S
10762 PRINT
10765 PRINT"IODINE, NOBLE GAS, AND FILTER EFFICIENCY INPUTS:"
10770 PRINT
10775 PRINT USING"  PERCENTAGE IODINE:#####.##";RI
10780 PRINT
10785 PRINT USING"  PERCENTAGE NOBLE GAS:#####.##";RNG
10790 PRINT
10795 PRINT USING"  IODINE TO NOBLE GAS RATIO:  ##.#####";RING
10800 PRINT
10805 PRINT TAB(3)"PERCENTAGE OF IODINES REMOVED"
10806 PRINT USING"  BY FILTRATION:#####.##";RILEF
10810 PRINT:PRINT"TIME INTERVAL FROM REACTOR SHUTDOWN

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10813 PRINT USING"TO INITIATION OF RELEASE(HR):####.##";RIREL
10820 PRINT
10825 PRINT"TIME ESTIMATE FOR TOTAL DURATION
10830 PRINT USING"OF RELEASE(HR):####.##";RDUR
10835 IF((ISO<>1)AND(IFLAG<>6))THEN 10850
10844 PRINT:PRINT"TIME INTERVAL FROM RADIATION MEASUREMENT TO THE"
10847 PRINT USING"MATERIAL'S PROJECTED TIME OF RELEASE(HR):####.##";RPOST
10850 PRINT
10855 IF(IAGEFL=1)THEN PRINT"AGE OF RELEASED MATERIAL: < 1 DAY"ELSE PRINT"AGE O
F RELEASED MATERIAL: >= 1 DAY"
10860 PRINT
10865 INPUT"* HIT CARRIAGE RETURN TO CONTINUE. *",S
10870 PRINT : PRINT
10875 PRINT"IS ALL OF THE INPUT INFORMATION CORRECT?"
10880 INPUT"(RESPOND YES OR NO): ",S
10885 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN 10886 ELSE 10890
10886 IF(ILU=2)THEN I3=1:GOTO 10072 ELSE 11060
10890 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 10900 ELSE GOSUB 13000: GOTO 10880
10895 PRINT : PRINT
10896 PRINT"WAS THAT THE ONLY INFORMATION TO BE CHANGED?"
10897 INPUT"(RESPOND YES OR NO): ",S
10898 IF((LEFT$(S,1)=Y)OR(LEFT$(S,1)=YL))THEN I3=0:GOTO 10040
10899 IF((LEFT$(S,1)=N)OR(LEFT$(S,1)=NL))THEN 10900 ELSE GOSUB 13000: GOTO 10896
10900 PRINT:PRINT
10905 PRINT"SELECT TOPIC WHICH NEEDS TO BE CHANGED."
10910 PRINT:PRINT TAB(5)"(1) USER/REACTOR SPECIFICS"
10915 ON IHEL GOTO 10920,10920,10925
10920 PRINT TAB(9)"(USER NAME, DATE, TIME, REACTOR NAME, ETC.)"
10925 PRINT
10930 PRINT TAB(5)"(2) TYPE OF RELEASE"
10935 ON IHEL GOTO 10940,10940,10945
10940 PRINT TAB(9)"(GROUND OR ELEVATED, WIND SPEED, DIR, ETC.)"
10945 PRINT
10950 PRINT TAB(5)"(3) METEOROLOGICAL DATA"
10955 ON IHEL GOTO 10960,10960,10965
10960 PRINT TAB(9)"(WIND SPEED, DIR, STABILITY CLASS, ETC.)"
10965 PRINT
10970 PRINT TAB(5)"(4) RELEASE RATE"
10975 ON IHEL GOTO 10980,10980,10985
10980 PRINT TAB(9)"(ISOTOPIC, GROSS, CONTAINMENT LEAKAGE, ETC.)"
10985 PRINT
10995 PRINT TAB(5)"(5) AGE OF RELEASED MATERIAL"
11000 ON IHEL GOTO 11005, 11005,11010
11005 PRINT TAB(9)"(TIME INTERVALS- SHUTDOWN, DUR, AGE, ETC.)"
11010 PRINT
11011 IF(ISO=1)THEN 11030
11015 PRINT TAB(5)"(6) IODINE PRESENCE AND FILTER"
11020 ON IHEL GOTO 11025,11025,11030
11025 PRINT TAB(9)"(IODINE TO NOBLE GAS RATIO, FILTER, ETC.)"
11030 PRINT
11035 INPUT"(RESPOND 1,2,3...6) ",IFIX
11040 IF((IFIX<1)OR(IFIX>6))THEN GOSUB 12000 : GOTO 10910
11045 ON IFIX GOTO 11050,11055,11055,11055,6075,11055
11050 GOSUB 14000 : CHAIN "B:IRDAMONE.COM",25
11055 GOSUB 14000 : CHAIN "B:IRDAMTWO.COM",20
11060 GOSUB 14000 : CHAIN "B:IRDAMCAL.COM",19
11065 END
12000 PRINT
12005 PRINT"ENTRY OUT OF RANGE - PLEASE TRY AGAIN."
12010 PRINT

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12015 RETURN
13000 PRINT
13005 PRINT "ENTRY NOT UNDERSTOOD - PLEASE TRY AGAIN."
13010 PRINT
13015 RETURN
14000 FOR I=1 TO 10
14005 PRINT
14010 NEXT I
14015 PRINT TAB(8)"*****"
14020 PRINT TAB(8)"* WAIT-IRDM IS SEARCHING FOR *"
14025 PRINT TAB(8)"* THE NEXT PIECE OF THE CODE. *"
14030 PRINT TAB(8)"*****"
14035 FOR I=1 TO 9
14040 PRINT
14045 NEXT I
14050 RETURN
10 PROGRAM IRDM - CALCULATIONS
15 /Interactive Rapid Dose Assessment Model
19 COMMON IHEL, SNAME, SDATE, STIME, SRNAM, IPQWR, RLK, RVOL, IRUN, ILU, IG, IE, RWIND, SDIR,
RSTACK, SPASQ, ICLAS, IFLAG, ISO
20 COMMON RIQUE(), RQUE, IPROG, RPERCO, RACTIV, RSTERM, RRATE, RING, PI, RNG, RILEF, RIRF, R
IPEL, ROUR, RPOST, IAGEFL, IFIX
21 DEFINT I
22 DEFSTR S
23 DEFSNG R
24 DEFDBL D
25 SITOP=" KR83M KR85M KR85 KR87 KR88 KR89 XE131MXE133MXE133 XE135MXE135
XE137 XE138 CS134 CS137 I131 I132 I133 I134 I13
5 "
1020 DIM RDT(21), RDF(21), RF(21), PLAM(21), RMUS(21), RE(21), RCHI(7), RDIST(7), RDRAT
E(21), R18(21)
1030 DIM RA1(12), RA2(12), RA3(12), RA4(12)
1040 DIM RB1(17), RB2(17), RB3(17), RB4(17)
1050 DIM REB1(13), REB2(13), REB3(13), REB4(13)
1060 DIM RSIGMA(7,8), RSIG2(7,8), RDRWS(7), RDPH(7), RIQUE(21)
1065 DIM RWATT(13), RWETT(13), RBW(13), RDRTIS(21), RWBTIS(7), RHR(7), RMIN(7), RPLUME(
7)
1066 DIM RYLD(21), RQHOLD(21)
1070 DEFINT I
1080 DEFSTR S
1090 DEFSNG R
1100 DEFDBL D
1101 /*****
1102 /* IRDMCAL.COM */
1103 /*****
1104 DATA 0., 500., 1000., 2000., 3000., 8000., 20000.
1105 READ RDIST(0), RDIST(1), RDIST(2), RDIST(3), RDIST(4), RDIST(5), RDIST(6)
1110 DATA 8.62E-03, 1.33E+02, 1.84, 6.75E+02, 1.68E+03, 1.89E+03
1120 READ RDF(1), RDF(2), RDF(3), RDF(4), RDF(5), RDF(6)
1130 DATA 1.04E+01, 2.89E+01, 3.36E+01, 3.56E+02, 2.06E+02, 1.62E+02
1140 READ RDF(7), RDF(8), RDF(9), RDF(10), RDF(11), RDF(12)
1150 DATA 1.01E+03, 9.66E+02, 3.70E+02, 1.06E+07, 1.21E+05, 2.54E+06
1160 READ RDF(13), RDF(14), RDF(15), RDF(16), RDF(17), RDF(18)
1170 DATA 3.19E+04, 4.97E+05
1180 READ RDF(19), RDF(20)
1190 DATA 2.25E-05, 2.38E-06, 4.30E-07, 3.00E-07, 1.26E-07, 5.68E-08
1200 READ RSIGMA(1,1), RSIGMA(2,1), RSIGMA(3,1), RSIGMA(4,1), RSIGMA(5,1), RSIGMA(6,1)
1210 DATA 7.35E-05, 1.59E-05, 2.80E-06, 6.94E-07, 1.66E-07, 7.44E-08

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1220 READ RSIGMA(1,2),RSIGMA(2,2),RSIGMA(3,2),RSIGMA(4,2),RSIGMA(5,2),RSIGMA(6,2)
1230 DATA 1.70E-04,4.69E-05,1.40E-05,6.77E-06,1.24E-06,2.82E-07
1240 READ RSIGMA(1,3),RSIGMA(2,3),RSIGMA(3,3),RSIGMA(4,3),RSIGMA(5,3),RSIGMA(6,3)
1250 DATA 4.53E-04,1.34E-04,4.59E-05,2.40E-05,5.49E-06,1.67E-06
1260 READ RSIGMA(1,4),RSIGMA(2,4),RSIGMA(3,4),RSIGMA(4,4),RSIGMA(5,4),RSIGMA(6,4)
1270 DATA 8.74E-04,2.78E-04,1.28E-04,4.84E-05,1.24E-05,4.07E-06
1280 READ RSIGMA(1,5),RSIGMA(2,5),RSIGMA(3,5),RSIGMA(4,5),RSIGMA(5,5),RSIGMA(6,5)
1290 DATA 2.26E-03,6.55E-04,2.24E-04,1.21E-04,3.17E-05,9.27E-06
1300 READ RSIGMA(1,6),RSIGMA(2,6),RSIGMA(3,6),RSIGMA(4,6),RSIGMA(5,6),RSIGMA(6,6)
1310 DATA 5.07E-03,1.47E-03,5.06E-04,2.73E-04,7.13E-05,2.09E-05
1320 READ RSIGMA(1,7),RSIGMA(2,7),RSIGMA(3,7),RSIGMA(4,7),RSIGMA(5,7),RSIGMA(6,7)
1321 DATA 135.,470.,2000.,2000.,2000.,2000.
1322 READ RSIGZ(1,1),RSIGZ(2,1),RSIGZ(3,1),RSIGZ(4,1),RSIGZ(5,1),RSIGZ(6,1)
1323 DATA 57.,135.,410.,890.,2000.,2000.
1324 READ RSIGZ(1,2),RSIGZ(2,2),RSIGZ(3,2),RSIGZ(4,2),RSIGZ(5,2),RSIGZ(6,2)
1325 DATA 34.,64.,115.,165.,373.33,740.
1326 READ RSIGZ(1,3),RSIGZ(2,3),RSIGZ(3,3),RSIGZ(4,3),RSIGZ(5,3),RSIGZ(6,3)
1327 DATA 19.,33.,51.5,69.,123.33,195.
1328 READ RSIGZ(1,4),RSIGZ(2,4),RSIGZ(3,4),RSIGZ(4,4),RSIGZ(5,4),RSIGZ(6,4)
1329 DATA 13.,22.,35.,45.5,76.,108.
1330 READ RSIGZ(1,5),RSIGZ(2,5),RSIGZ(3,5),RSIGZ(4,5),RSIGZ(5,5),RSIGZ(6,5)
1331 DATA 7.4,13.5,21.35,27.5,43.,59.5
1332 READ RSIGZ(1,6),RSIGZ(2,6),RSIGZ(3,6),RSIGZ(4,6),RSIGZ(5,6),RSIGZ(6,6)
1333 DATA 4.56,8.1,12.81,16.5,25.8,35.7
1334 READ RSIGZ(1,7),RSIGZ(2,7),RSIGZ(3,7),RSIGZ(4,7),RSIGZ(5,7),RSIGZ(6,7)
1339 DATA .013,.038,.000231,.070,.097,.120
1340 READ RF(1),RF(2),RF(3),RF(4),RF(5),RF(6)
1350 DATA .00074,.00376,.198,.052,.048,.190
1360 READ RF(7),RF(8),RF(9),RF(10),RF(11),RF(12)
1370 DATA .169,0.0,0.0,.116,.164,.222
1380 READ RF(13),RF(14),RF(15),RF(16),RF(17),RF(18)
1390 DATA .271,.227
1400 READ RF(19),RF(20)
1410 DATA 0.37,0.16,7.31E-6,0.55,0.25,13.08
1420 READ RLAM(1),RLAM(2),RLAM(3),RLAM(4),RLAM(5),RLAM(6)
1430 DATA 2.41E-3,0.01295,0.00547,2.718,0.0752,10.83
1440 READ RLAM(7),RLAM(8),RLAM(9),RLAM(10),RLAM(11),RLAM(12)
1450 DATA 1.291,3.85E-05,2.64E-07,0.00359,0.303,0.033
1460 READ RLAM(13),RLAM(14),RLAM(15),RLAM(16),RLAM(17),RLAM(18)
1470 DATA 0.799,0.105
1480 READ RLAM(19),RLAM(20)
1481 DATA 0.0005,0.87,0.004,1.35,1.37,1.6
1482 READ RYLD(1),RYLD(2),RYLD(3),RYLD(4),RYLD(5),RYLD(6)
1483 DATA 0.02,0.14,0.37,0.8,0.94,0.33
1484 READ RYLD(7),RYLD(8),RYLD(9),RYLD(10),RYLD(11),RYLD(12)
1485 DATA 1.35,2.26,0.86,0.99,3.07,0.9
1486 READ RYLD(13),RYLD(14),RYLD(15),RYLD(16),RYLD(17),RYLD(18)
1487 DATA 2.22,1.4
1488 READ RYLD(19),RYLD(20)
1490 DATA .00045,.00017,.00011,.000066,.000066,.000074
1500 READ RMUS(1),RMUS(2),RMUS(3),RMUS(4),RMUS(5),RMUS(6)
1510 DATA .00017,.00015,.00021,.00011,.00013,.00012
1520 READ RMUS(7),RMUS(8),RMUS(9),RMUS(10),RMUS(11),RMUS(12)
1530 DATA .000085,.000094,.0001,.00012,.000085,.00009

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1540 READ RMUS(13),RMUS(14),RMUS(15),RMUS(16),RMUS(17),RMUS(18)
1550 DATA .000079,.000079
1560 READ RMUS(19),RMUS(20)
1570 DATA .0322,.273,.514,1.177,1.298,1.135
1580 READ RE(1),RE(2),RE(3),RE(4),RE(5),RE(6)
1590 DATA .164,.233,.081,.526,.263,.455
1600 READ RE(7),RE(8),RE(9),RE(10),RE(11),RE(12)
1610 DATA .832,.705,.462,.384,.708,.881
1620 READ RE(13),RE(14),RE(15),RE(16),RE(17),RE(18)
1630 DATA .910,1.150
1640 READ RE(19),RE(20)
1650 DATA 2.03988E-04,1.10251E-04,6.28777E-04,-5.70207E-04,1.08410E-03,3.00665E-
04
1660 READ RB1(1),RB1(2),RB1(3),RB1(4),RB1(5),RB1(6)
1670 DATA 4.31980E-04,8.17307E-04,-2.94015E-04,-5.74031E-04,-4.90479E-04,1.28432
E-04
1680 READ RB1(7),RB1(8),RB1(9),RB1(10),RB1(11),RB1(12)
1690 DATA 2.72494E-04,5.20521E-04,5.46809E-04,8.59416E-04
1700 READ RB1(13),RB1(14),RB1(15),RB1(16)
1710 DATA 4.99312E-03,-3.32812E-03,-1.15559E-02,3.04618E-03,-1.55232E-02,-3.9014
2E-03
1720 READ RB2(1),RB2(2),RB2(3),RB2(4),RB2(5),RB2(6)
1730 DATA -4.08232E-03,1.74238E-03,7.67312E-03,1.18160E-02,1.01579E-02,-4.15216E
-03
1740 READ RB2(7),RB2(8),RB2(9),RB2(10),RB2(11),RB2(12)
1750 DATA -6.51043E-03,-1.03907E-02,-1.14217E-02,-1.55479E-02
1760 READ RB2(13),RB2(14),RB2(15),RB2(16)
1770 DATA 6.96874E-02,4.51302E-02,5.95301E-02,2.35543E-1,2.83318E-02,-2.45385E-0
2
1780 READ RB3(1),RB3(2),RB3(3),RB3(4),RB3(5),RB3(6)
1790 DATA -3.18502E-02,-5.34563E-02,-7.20190E-02,-8.40507E-02,-7.1117E-02,8.0834
0E-02
1800 READ RB3(7),RB3(8),RB3(9),RB3(10),RB3(11),RB3(12)
1810 DATA 9.68348E-02,1.18477E-01,1.35059E-01,1.53396E-01
1820 READ RB3(13),RB3(14),RB3(15),RB3(16)
1830 DATA 1.27844,1.25165,1.22048,1.09709,1.12251,1.06857
1840 READ RB4(1),RB4(2),RB4(3),RB4(4),RB4(5),RB4(6)
1850 DATA 9.74052E-01,8.70398E-01,7.20806E-01,5.47146E-01,3.23682E-01,1.36398
1860 READ RB4(7),RB4(8),RB4(9),RB4(10),RB4(11),RB4(12)
1870 DATA 1.44678,1.50434,1.55970,1.63100
1880 READ RB4(13),RB4(14),RB4(15),RB4(16)
1890 DATA 2.43541E-04,1.42425E-04,8.01036E-05,-6.21571E-05,-2.81580E-05,-9.57644
E-05
1900 READ RA1(1),RA1(2),RA1(3),RA1(4),RA1(5),RA1(6)
1910 DATA -1.17420E-04,8.14948E-05,1.35875E-07,-4.93753E-05
1920 READ RA1(7),RA1(8),RA1(9),RA1(10)
1930 DATA -8.66841E-03,-5.86079E-03,-3.94526E-03,3.25787E-04,-5.78838E-04,1.2173
2E-03
1940 READ RA2(1),RA2(2),RA2(3),RA2(4),RA2(5),RA2(6)
1950 DATA 2.35355E-03,1.26573E-03,-5.19547E-04,9.78751E-04
1960 READ RA2(7),RA2(8),RA2(9),RA2(10)
1970 DATA .104731,.0835005,.0683118,.0308355,.029255,.0155328
1980 READ RA3(1),RA3(2),RA3(3),RA3(4),RA3(5),RA3(6)
1990 DATA 8.04277E-04,7.47457E-03,1.08332E-02,-3.40910E-03
2000 READ RA3(7),RA3(8),RA3(9),RA3(10)
2010 DATA 1.46008E0,1.37488E0,1.29761E0,1.21455E0,1.11479E0,1.05194E0
2020 READ RA4(1),RA4(2),RA4(3),RA4(4),RA4(5),RA4(6)
2030 DATA 9.30823E-01,7.83191E-01,5.59269E-01,4.52899E-01
2040 READ RA4(7),RA4(8),RA4(9),RA4(10)
2050 DATA .0072975,.0010697,.0010516,.00097167,.0009009,.01782

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2060 READ REB1(1),REB1(2),REB1(3),REB1(4),REB1(5),REB1(6)
2070 DATA .0051224,.001584,.00089293,-.0012368,-.0010444,-.0006157
2080 READ REB1(7),REB1(8),REB1(9),REB1(10),REB1(11),REB1(12)
2090 DATA .372505,-.0471528,-.047268,-.04442,-.041194,.504776
2100 READ REB2(1),REB2(2),REB2(3),REB2(4),REB2(5),REB2(6)
2110 DATA .420224,.3394,.21715,.146454,.068201,.03471
2120 READ REB2(7),REB2(8),REB2(9),REB2(10),REB2(11),REB2(12)
2130 DATA 3.56304,.83624,.86959,.8343,.7633,1.2359
2140 READ REB3(1),REB3(2),REB3(3),REB3(4),REB3(5),REB3(6)
2150 DATA 1.15507,1.13681,1.17594,1.15297,.9964,.87741
2160 READ REB3(7),REB3(8),REB3(9),REB3(10),REB3(11),REB3(12)
2170 DATA .30531,.88934,.58151,.47587,.40017,.7853
2180 READ REB4(1),REB4(2),REB4(3),REB4(4),REB4(5),REB4(6)
2190 DATA .33031,.83191,.75538,.74768,.844705,.89645
2200 READ REB4(7),REB4(8),REB4(9),REB4(10),REB4(11),REB4(12)
2210 DATA 1,5,7,10,11,10,3,4,2,7
2220 READ RIB(1),RIB(2),RIB(3),RIB(4),RIB(5),RIB(6),RIB(7),RIB(8),RIB(9),RIB(10)
2230 DATA 5,7,9,9,8,6,9,9,10,10
2240 READ RIB(11),RIB(12),RIB(13),RIB(14),RIB(15),RIB(16),RIB(17),RIB(18),RIB(19)
2250 DATA .33,.18,.15,.14,.12,.105
2270 READ RWATT(1),RWATT(2),RWATT(3),RWATT(4),RWATT(5),RWATT(6)
2280 DATA .098,.09,.08,.07,.058,.049
2290 READ RWATT(7),RWATT(8),RWATT(9),RWATT(10),RWATT(11),RWATT(12)
2300 DATA 0.150,.0253,.0279,.03,.032,.0329
2310 READ RWETT(1),RWETT(2),RWETT(3),RWETT(4),RWETT(5),RWETT(6)
2320 DATA .033,.0329,.0321,.0311,.0283,.026
2330 READ RWETT(7),RWETT(8),RWETT(9),RWETT(10),RWETT(11),RWETT(12)
2340 DATA 3.05,2.98,2.91,2.84,2.77,2.7
2350 READ RBW(1),RBW(2),RBW(3),RBW(4),RBW(5),RBW(6)
2360 DATA 2.63,2.56,2.41,2.26,2.05,1.84
2370 READ RBW(7),RBW(8),RBW(9),RBW(10),RBW(11),RBW(12)
3000 GOTO 5000:DIM RIQUE(21)
3001 ILU=2:IPDWR=1200:RVOL=2
3002 IE=1:IG=0:RSTACK=100!
3003 RI=1.96:RNG=98.04:RING=.02:RIRF=.0196:RILEF=0!
3004 RWIND=2!:ICLAS=6
3005 RIREL=0!:RDIR=4!:RPOST=0!
3006 IFLAG=2:IAEFL=1
3007 RIQUE(9)=1!:RIQUE(16)=1!
3008 RQUE=1!
3009 RPERCO=.1:IPROG=0
3010 RSTERM=1!
3011 RRATE=150!:RACTIV=10000!
5000 '*****
5005 ' * CENTERLINE DOSE CALCULATIONS. *
5010 '*****
5015 FOR I=1 TO 9
5020 PRINT
5025 NEXT I
5030 PRINT TAB(10)"*****"
5035 PRINT TAB(10)"* INPUT COMPLETED - *"
5040 PRINT TAB(10)"* CALCULATIONS BEING MADE. *"
5045 PRINT TAB(10)"*****"
5050 FOR I=1 TO 9
5055 PRINT
5060 NEXT I
5065 IF(IG=1)THEN 7050
5069 '*****
5070 ' * ELEVATED RELEASE SCENARIO EQUATIONS. *

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5071 /*****
5074 I2=1;RN=1
5075 IF(I2>6)THEN 7050
5080 IF(RN=1)THEN RN=2 ELSE RN=1
5100 RADIUS=RN*RSIGZ(I2,ICLAS)
5105 RA=RSTACK-RADIUS
5106 RCHI(I2)=(RSIGMA(I2,ICLAS)/RWIND)*2.71828^(-(0.5*RSTACK^2)/(RSIGZ(I2,ICLAS)
^2))
5107 /PRINT USING"RCHIQ ##.##^#### RWIND: ##.##^#### RSTACK ##.##^####";RCHI(I2
);RWIND;RSTACK
5108 /PRINT:INPUT"* HIT CARRIAGE RETURN. *",S
5110 IF(RA<0)THEN 7000
5112 RMIN(I2)=RDIST(I2)/RWIND;RPLUME=RMIN(I2)/3600!
5115 ON IFLAG GOTO 5116,5137,5120,5125,5130,5135,5136
5116 RT=RPOST+RPLUME;GOTO 5145
5120 RQUE=IPOWER*7.2E-08*RPERCO;RT=RIREL+RPLUME;GOTO 5145
5125 RQUE=IPOWER*.00072*RPERCO;RT=RIREL+RPLUME;GOTO 5145
5130 RQUE=IPOWER*.072*RPERCO;RT=RIREL+RPLUME;GOTO 5145
5135 RQUE=IPOWER*.00072*RSTERM;RT=RPOST+RPLUME;GOTO 5145
5136 RQUE=RRATE*RACTIV;GOTO 5145
5137 RSUMQN=0;RSUMQI=0
5138 FOR I6=1 TO 20
5139 RQHOLD(I6)=RF(I6)*(2.71828^(-RLAM(I6)*RIREL))
5140 IF(I6<=13)THEN RSUMQN=RSUMQN+RQHOLD(I6)
5141 IF(I6)=16)THEN RSUMQI=RSUMQI+RQHOLD(I6)
5142 NEXT I6
5145 FOR I=1 TO 20
5150 ON IFLAG GOTO 5155,5163,5165,5165,5165,5165,5165
5155 IF(RIQUE(I)=0)THEN 5425
5156 RIQUED(I)=RIQUE(I)*2.71828^(-RLAM(I)*RT);GOTO 5180
5163 IF(I<=13)THEN RIQUED(I)=(RQHOLD(I)/RSUMQN)*RQUE*((1+RING)^-1)*(2.71828^(-RL
AM(I)*RPLUME));GOTO 5180
5164 IF(I)=16)THEN RIQUED(I)=(RQHOLD(I)/RSUMQI)*RQUE*(1-(1/(1+RING)))*(2.71828^(-
RLAM(I)*RPLUME))*((100!-RILEF)/100!);GOTO 5180
5165 IF(I<=13)THEN RIQUED(I)=RQUE*((1+RING)^-1)*RF(I)*(2.71828^(-RLAM(I)*RT));GO
TO 5180
5170 IF(I)=16)THEN RIQUED(I)=((100!-RILEF)/100!)*RQUE*(1-(1/(1+RING)))*RF(I)*(2.
71828^(-RLAM(I)*RT))
5180 RARABS=2.71828^(-3.29152*LOG(RE(I))-20.2284)+2.71828^(5.63835E-03*LOG(RE(I)
)^3-.10327*LOG(RE(I))^2-.1807*LOG(RE(I))-10.3104)
5185 RARABS=RARABS+2.71828^(0.62775*LOG(RE(I))-1.857174*LOG(RE(I))^2+3.98175*LOG(
RE(I))-17.2605)
5190 RARATT=RARABS+2.71828^(-.0702149*LOG(RE(I))^2-.489728*LOG(RE(I))-10.0188)
5195 RBONE=RARATT*RA*100!
5200 RATIO=RA/RADIUS
5201 /PRINT:PRINT"*****"
5202 /PRINT USING"RARABS: ##.##^#### RARATT: ##.##^####";RARABS;RARATT
5203 /PRINT USING"RBONE: ##.##^#### RATIO: ##.##^####";RBONE;RATIO
5204 /PRINT:INPUT"* HIT CARRIAGE RETURN. *",S
5205 IF(RATIO=10)THEN 5350
5210 RM=RMUS(I)*(RADIUS+RA)*100
5215 IF(RM)=8.75)THEN 5260
5220 IF(RM)=5.5)THEN 5245
5225 IF(RM)=1.5)THEN 5230 ELSE I1=11;GOTO 5290
5230 IF(RM)=2.5)THEN 5235 ELSE I1=10;GOTO 5290
5235 IF(RM)=3.5)THEN 5240 ELSE I1=9;GOTO 5290
5240 IF(RM)=4.5)THEN I1=7;GOTO 5290 ELSE I1=8;GOTO 5290
5245 IF(RM)=6.5)THEN 5250 ELSE I1=6;GOTO 5290
5250 IF(RM)=7.5)THEN 5255 ELSE I1=5;GOTO 5290
5255 IF(RM)=8.25)THEN I1=3;GOTO 5290 ELSE I1=4;GOTO 5290

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5260 IF(RM)=15)THEN 5280
5265 IF(RM)=9.5)THEN 5270 ELSE I1=2:GOTO 5290
5270 IF(RM)=11)THEN 5275 ELSE I1=1:GOTO 5290
5275 IF(RM)=13)THEN I1=13:GOTO 5290 ELSE I1=12:GOTO 5290
5280 IF(RM)=17)THEN 5285 ELSE I1=14:GOTO 5290
5285 IF(RM)=19)THEN I1=16:GOTO 5290 ELSE I1=15
5290 RM=RB1(I1)*RATIO^3+RB2(I1)*RATIO^2+RB3(I1)*RATIO+RB4(I1)
5295 IF(RATIO)=3.5)THEN 5325
5300 IF(RATIO)=1.75)THEN 5315
5305 IF(RATIO)=1.25)THEN 5310 ELSE I1=1:GOTO 5340
5310 IF(RATIO)=1.375)THEN I1=3:GOTO 5340 ELSE I1=2:GOTO 5340
5315 IF(RATIO)=2.25)THEN 5320 ELSE I1=4:GOTO 5340
5320 IF(RATIO)=2.75)THEN I1=6:GOTO 5340 ELSE I1=5:GOTO 5340
5325 IF(RATIO)=6)THEN 5335
5330 IF(RATIO)=4.5)THEN I1=8:GOTO 5340 ELSE I1=7:GOTO 5340
5335 IF(RATIO)=8)THEN I1=10:GOTO 5340 ELSE I1=9
5340 RUSZ=RA1(I1)*RBONE^3+RA2(I1)*RBONE^2+RA3(I1)*RBONE+RA4(I1)
5345 RZ=RUSZ*RM/RMUS(I):GOTO 5365
5350 RUSZ=RMUS(I)*RADIUS
5355 RUSZ=8.74611E-04*RUSZ^3-.0349971*RUSZ^2+.568407*RUSZ+.0231329
5360 RZ=RUSZ/RMUS(I)
5365 RTHETA=ATN(10000/(RA*100+RZ))
5366 'PRINT:PRINT USING"I1 ### RUSZ: ##.##^#### RMUS(I): ##.##^####";I1;RUSZ;RMU
S(I)
5367 'PRINT USING"RBONE ##.##^#### RZ: ##.##^#### RTHETA: ##.##^####";RBONE;RZ;RT
HETA
5368 'PRINT USING"RA1(I1) ##.##^#### RA2(I1) ##.##^####";RA1(I1),RA2(I1)
5369 'PRINT USING"RA3(I1) ##.##^#### RA4(I1) ##.##^####";RA3(I1),RA4(I1):PRINT:IN
PUT"* HIT CARRIAGE RETURN. *",S
5370 RBTWO=RMUS(I)*RZ+RBONE
5375 RB=REB1(RIB(I))*RBONE^3+REB2(RIB(I))*RBONE^2+REB3(RIB(I))*RBONE+REB4(RIB(I)
)
5377 IF((RIB(I))=2!)AND(RIB(I)<=4!))THEN RB=2.71828^(RB)
5380 RSU=(RIQUE(I)*3.7E+10*RYLD(I))/(RWIND*314.16*(RADIUS*100)^2)
5385 RH=RTHETA/10
5390 RFING=2.71828^((-RBTWO*(1/COS(0)))+4*2.71828^((-RBTWO*(1/COS(RH)))+2*2.71828^
(-RBTWO*(1/COS(2*RH)))
5395 RFING=RFING+4*2.71828^((-RBTWO*(1/COS(3*RH)))+2*2.71828^((-RBTWO*(1/COS(4*RH)
)))+4*2.71828^((-RBTWO*(1/COS(5*RH)))
5400 RFING=RFING+2*2.71828^((-RBTWO*(1/COS(6*RH)))+4*2.71828^((-RBTWO*(1/COS(7*RH)
)))+2*2.71828^((-RBTWO*(1/COS(8*RH)))
5405 RFING=RFING+4*2.71828^((-RBTWO*(1/COS(9*RH)))+2.71828^((-RBTWO*(1/COS(RTHETA)
))
5410 RFING=RFING*RH/3
5415 RPHI=RB*RSU*(RADIUS*100)^2*RFING/(2!*(RA*100+RZ))
5417 IF(RN=1)THEN 5420
5418 RDRATE(I)=.44*RPHI*RE(I)*RARABS/20.79
5419 RDRTIS(I)=.44*RPHI*RE(I)*RWETT(RIB(I))*RBW(RIB(I))*2.71828^(-RWATT(RIB(I))*
5)/17361:GOTO 5425
5420 RDRATE(I)=RDRATE(I)+.56*RPHI*RE(I)*RARABS/20.79
5422 RDRTIS(I)=RDRTIS(I)+.56*RPHI*RE(I)*RWETT(RIB(I))*RBW(RIB(I))*2.71828^(-RWAT
T(RIB(I))*5)/17361
5425 NEXT I
5427 IF(RN=2)THEN 5080
5430 RDRWB(I2)=0!:RDRTH(I2)=0!:RWBRTIS(I2)=0!
5432 IF((RMIN(I2)/3600!)<1!)THEN 5434
5433 RHR(I2)=RHR(I2)+1!:RMIN(I2)=RMIN(I2)-3600!:GOTO 5432
5434 RMIN(I2)=RMIN(I2)/60!:ON ILU GOTO 5450,5450
5435 IF(RDIST(I2)<>500!)THEN INPUT"* HIT CARRIAGE RETURN TO CONTINUE. *",S
5436 PRINT:PRINT"***** RESULTS *****"

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5437 PRINT:PRINT USING"RECEPTOR DISTANCE (METERS):#####.##";RDIST(I2)
5440 PRINT:PRINT"DOSE RATES FOR INDIVIDUAL RADIONUCLIDES:"
5445 PRINT:PRINT"ISOTOPE";TAB(11)"(REM/HR)";TAB(25)"ISOTOPE";TAB(35)"(REM/HR)"
5450 FOR I=1 TO 10
5460 RDRWB(I2)=RDRWB(I2)+RDRATE(I)+RDRATE(I+10)
5462 RWBTIS(I2)=RWBTIS(I2)+RDRTIS(I)+RDRTIS(I+10)
5465 NEXT I
5475 GOTO 6950
5482 LPRINT:LPRINT:LPRINT:LPRINT"*****"
5483 LPRINT"***** RESULTS *****"
5484 LPRINT"*****"
5490 LPRINT:LPRINT USING"RECEPTOR DISTANCE (METERS):#####.##";RDIST(I2)
5495 LPRINT:LPRINT TAB(5)"PLUME TRAVEL TIME FROM";LPRINT USING"INITIATION OF
RELEASE:### HOURS AND ##.## MINS.";RHR(I2);RMIN(I2)
5496 LPRINT:LPRINT USING"CHI/Q VALUE: ##.##^";RCHIQ(I2)
5500 LPRINT:LPRINT:LPRINT TAB(19)"DOSE RATES FOR INDIVIDUAL RADIONUCLIDES:";LPRINT
TAB(19)"*****"
5505 LPRINT:LPRINT TAB(5)"RADIO- AIR 5cm DEPTH";TAB(44)"RADIO- A
IR 5cm DEPTH"
5507 LPRINT TAB(4)"NUCLIDE";TAB(15)"(RAD/HR)";TAB(27)"(REM/HR)";TAB(43)"NUCLIDE";TAB
(54)"(RAD/HR)";TAB(66)"(REM/HR)";LPRINT
5510 FOR I=1 TO 10
5515 LPRINT:LPRINT USING" & ##.##^ ##.##^ * & ##.##^ #
#.##^";MID$(SITOP,I*6,6);RDRATE(I);RDRTIS(I);MID$
(SITOP,(I+10)*6,6);RDRATE(I+10);RDRTIS(I+10)
5520 RDRWB(I2)=RDRWB(I2)+RDRATE(I)+RDRATE(I+10)
5522 RWBTIS(I2)=RWBTIS(I2)+RDRTIS(I)+RDRTIS(I+10)
5525 NEXT I
5530 LPRINT:LPRINT:LPRINT TAB(15)"WHOLE BODY EXTERNAL DOSE FROM THE ELEVATED PLU
ME:";LPRINT TAB(15)"*****"
5535 LPRINT:LPRINT USING" AIR (RAD/HR); ##.##^ * 5cm DEPTH (R
EM/HR); ##.##^";RDRWB(I2);RWBTIS(I2)
6950 I2=I2+1;GOTO 5075
6985 '*****
6990 ' * ELEVATED PLUME HAS TOUCHED DOWN. *
6995 '*****
7000 ON ILU GOTO 7001,7010
7001 INPUT" * HIT CARRIAGE RETURN TO CONTINUE. *",S
7002 FOR I=1 TO 17
7003 PRINT
7004 NEXT I
7005 PRINT:PRINT USING"PLUME HAS TOUCHED DOWN BETWEEN#####.## ";RDIST(I2-1);PRIN
T USING"AND#####.## METERS. ";RDIST(I2)
7007 PRINT"CHECK SUMMARY TABLE FOR REMAINING DISTANCES.":PRINT:GOTO 7036
7010 LPRINT:LPRINT:LPRINT:LPRINT TAB(19)"*****"
7015 LPRINT TAB(19)" * ELEVATED PLUME HAS TOUCHED DOWN *"
7017 LPRINT USING" BETWEEN #####.## AND #####.## METERS. ";RDIS
T(I2-1);RDIST(I2)
7030 LPRINT TAB(19)" * SEE SUMMARY OUTPUT LISTED BELOW. *"
7035 LPRINT TAB(19)"*****"
7036 FOR I5=I2 TO 6
7037 RCHIQ(I5)=(RSIGMA(I5,ICLAS)/RWIND)*2.71828^(-(0.5*RSTACK^2)/(RSIGZ(I5,ICLAS)
^2))
7038 NEXT I5
7040 '*****
7045 ' * GROUND RELEASE SCENARIO EQUATIONS. *
7046 '*****

```

```

7050 ON IFLAG GOTO 7055,7120,7125,7130,7135,7140,7145
7054 *** ISOTOPIC PATHWAY, ***
7055 RQWB=0!:RQTH=0!
7056 IF((IE=1)AND(I2>6))THEN 7073
7060 FOR I=1 TO 15
7065 RQWB=RQWB+RIQUE(I)*RDF(I)
7070 NEXT I
7071 IF(IE=1)THEN I4=I2 ELSE I4=1
7072 FOR I5=I4 TO 6
7073 IF(IG=1)THEN RWBTIS(I5)=(RQWB*RSIGMA(I5,ICLAS))/RWIND ELSE RWBTIS(I5)=((RQWB*RSIGMA(I5,ICLAS))/RWIND)*2.71828^(-(0.5*RSTACK^2)/(RSIGZ(I5,ICLAS)^2))
7074 NEXT I5
7075 FOR I=16 TO 20
7080 RQTH=RQTH+RIQUE(I)*RDF(I)
7085 NEXT I
7086 FOR I5=1 TO 6
7087 IF(IG=1)THEN RORTH(I5)=(RQTH*RSIGMA(I5,ICLAS)*.25)/RWIND:GOTO 7090
7088 RORTH(I5)=RQTH*RCHIQ(I5)*.25
7090 NEXT I5
7115 GOTO 8000
7119 *** GROSS RELEASE PATHWAY, ***
7120 RQWB=RQUE:GOTO 7150
7124 *** CONTAINMENT LEAKAGE - COOLANT INVENTORY, ***
7125 RQWB=IPQWR*7.2E-09*RPERCO:GOTO 7150
7129 *** CONTAINMENT LEAKAGE - GAP INVENTORY, ***
7130 RQWB=IPQWR*.00072*RPERCO:GOTO 7150
7134 *** CONTAINMENT LEAKAGE - FUEL MELT, ***
7135 RQWB=IPQWR*.072*RPERCO:GOTO 7150
7139 *** CONTAINMENT LEAKAGE - MONITOR READING, ***
7140 RQWB=IPQWR*.00072*RSTERM:GOTO 7150
7144 *** COOLANT LEAKAGE, ***
7145 RQWB=RRATE*RACTIV*.016667
7150 RQTH=RQWB
7155 *** DECAY FUNCTION FOR AGE < 1 DAY, ***
7160 IF(AGEFL=0)THEN 7171
7162 IF(IFLAG<>6)THEN RT=RIREL ELSE RT=RPOST
7163 IF(RT>24!)THEN 7171
7165 RQWB=RQWB*(1!*(2.71828^(-.1*RT)))
7170 RQTH=RQTH*(.34*(2.71828^(RT/22!)))
7171 IF((IE=1)AND(I2>6))THEN 7180
7172 IF(IE=1)THEN I4=I2 ELSE I4=1
7173 FOR I5=I4 TO 6
7174 IF(IG=1)THEN RWBTIS(I5)=(RQWB*RSIGMA(I5,ICLAS)*33.539)/RWIND ELSE RWBTIS(I5)=((RQWB*RSIGMA(I5,ICLAS)*33.539)/RWIND)*2.71828^(-(0.5*RSTACK^2)/(RSIGZ(I5,ICLAS)^2))
7175 NEXT I5
7180 FOR I5=1 TO 6
7185 IF(IG=1)THEN RORTH(I5)=(RQTH*RSIGMA(I5,ICLAS)*RIRF*.25*1.06E+07)/RWIND:GOTO 7195
7190 RORTH(I5)=RQTH*RCHIQ(I5)*RIRF*.25*1.06E+07
7195 NEXT I5
8000 IF((IE=1)AND(I2<=6))THEN I4=I2 ELSE I4=1
8001 FOR I5=I4 TO 6
8005 RCHIQ(I5)=RSIGMA(I5,ICLAS)/RWIND
8006 IF(IE=1)THEN RCHIQ(I5)=RCHIQ(I5)*2.71828^(-(0.5*RSTACK^2)/(RSIGZ(I5,ICLAS)^2))
8010 RMIN(I5)=RDIS(I5)/RWIND
8015 IF((RMIN(I5)/3600!)<1!)THEN 8025
8020 RHR(I5)=RHR(I5)+1!:RMIN(I5)=RMIN(I5)-3600!:GOTO 8015
8025 RMIN(I5)=RMIN(I5)/60!

```

```

8030 NEXT I5
8035 ON ILU GOTO 8037,8085
8037 IF(IE=1)THEN INPUT"* HIT CARRIAGE RETURN TO CONTINUE. *",S
8040 FOR I2=1 TO 3
8045 PRINT
8050 NEXT I2
8055 PRINT"***** PLUME INFORMATION *****":PRINT
8060 PRINT:PRINT TAB(3)"DISTANCE";TAB(16)"PLUME TRAVEL TIME";TAB(39)"CHI/Q"
8062 PRINT TAB(3)"(METERS)";TAB(17)"(HOURS:MINUTES)";TAB(39)"VALUE":PRINT
8065 FOR I2=1 TO 6
8070 PRINT:PRINT USING"          .N          .N          .N.N^";RDIST(I2);
RHR(I2);RMIN(I2);RCHI(I2)
8075 NEXT I2
8080 PRINT:PRINT:PRINT:INPUT"* HIT CARRIAGE RETURN TO CONTINUE. *",S;GOTO 9760
8085 LPRINT:LPRINT:LPRINT:LPRINT TAB(29)"*****"
8090 LPRINT"***** PLUME INFORMATION *****"
8095 LPRINT TAB(29)"*****":LPRINT:LPRINT
8100 LPRINT TAB(12)"DISTANCE";TAB(31)"PLUME TRAVEL TIME";TAB(39)"CHI/Q"
8105 LPRINT TAB(7)"(METERS) (MILES)";TAB(32)"(HOURS:MINUTES)";TAB(39)"VALUE":L
PRINT
8110 FOR I2=1 TO 6
8112 RDMI=RDIST(I2)*.00062
8115 LPRINT:LPRINT USING"          .N          .N          .N : .N.N
.N.N^";RDIST(I2);RDMI;RHR(I2);RMIN(I2);RCHI(I2)
)
8120 NEXT I2
9750 GOTO 9870
9760 FOR I2=1 TO 10
9770 PRINT
9780 NEXT I2
9790 PRINT"***** SUMMARY *****"
9800 PRINT:PRINT"***** CALCULATED DOSE RATES *****"
9810 PRINT:PRINT" DISTANCE WHOLE BODY INFANT THYROID"
9812 PRINT" (METERS) (REM/HR) (REM/HR)"
9820 FOR I2=1 TO 6
9830 PRINT:PRINT USING"          .N          .N.N^ .N.N^";RDIST(I2);RWBTIS(
I2);RDRTH(I2)
9840 NEXT I2
9842 PRINT:PRINT:PRINT:INPUT"* HIT CARRIAGE RETURN TO CONTINUE. *",S
9845 FOR I2=1 TO 10
9846 PRINT
9847 NEXT I2
9851 PRINT:PRINT:PRINT:PRINT:PRINT"***** CALCULATED DOSES *****"
9852 PRINT:PRINT" DISTANCE WHOLE BODY INFANT THYROID"
9853 PRINT" (METERS) (REM) (REM)"
9854 FOR I2=1 TO 6
9855 RWBTIS(I2)=RWBTIS(I2)*RDUR;RDRTH(I2)=RDRTH(I2)*RDUR
9856 PRINT:PRINT USING"          .N          .N.N^ .N.N^";RDIST(I2);RWBTIS(
I2);RDRTH(I2)
9857 NEXT I2
9858 PRINT:PRINT:PRINT:INPUT"* HIT CARRIAGE RETURN TO CONTINUE. *",S
9860 GOTO 9935
9870 LPRINT:LPRINT:LPRINT:LPRINT TAB(34)"*****"
9880 LPRINT"***** SUMMARY *****"
9881 LPRINT TAB(34)"*****"
9885 LPRINT:LPRINT:LPRINT TAB(24)"CALCULATED DOSE RATES (REM/HR):"
9886 LPRINT TAB(24)"*****"

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9891 LPRINT:LPRINT TAB(12)"DISTANCE";TAB(34)"WHOLE BODY";TAB(59)"INFANT":LPRINT
TAB(7)"(METERS) (MILES)";TAB(34)"5cm DEPTH";TAB(58
)"THYROID":LPRINT
9892 FOR I2=1 TO 6
9893 RDM1=RDIST(I2)*.00062:LPRINT:LPRINT USING"          #####.##    ###.##
##.##^####          ##.##^####";RDIST(I2);RDM1;RWB
TIS(I2);RDRTH(I2)
9894 NEXT I2
9896 LPRINT:LPRINT:LPRINT TAB(27)"CALCULATED DOSES (REMS):"
9897 LPRINT TAB(27)"*****"
9900 LPRINT:LPRINT TAB(12)"DISTANCE";TAB(34)"WHOLE BODY";TAB(59)"INFANT":LPRINT
TAB(7)"(METERS) (MILES)";TAB(34)"5cm DEPTH";TAB(58
)"THYROID":LPRINT
9901 FOR I2=1 TO 6
9902 RWBTIS(I2)=RWBTIS(I2)*RDUR;RDRTH(I2)=RDRTH(I2)*RDUR;RDM1=RDIST(I2)*.00062
9903 LPRINT:LPRINT USING"          #####.##    ###.##          ##.##^####
##.##^####";RDIST(I2);RDM1;RWBTIS(I2);RDRTH(I2)
9904 NEXT I2
9915 LPRINT:LPRINT:LPRINT:LPRINT TAB(26)"*****"
9920 LPRINT"***** CALCULATIONS COMPLETED *****"
*****"
9925 LPRINT TAB(26)"*****"
9930 LPRINT:LPRINT:LPRINT:LPRINT:LPRINT:LPRINT:LPRINT
9935 FOR I1=1 TO 24
9940 PRINT
9945 NEXT I1
9947 PRINT"* CALCULATIONS COMPLETED. *"
9950 PRINT:PRINT"DO YOU WISH TO RUN THE PROGRAM AGAIN?"
9955 INPUT"(RESPOND YES OR NO): ",S
9960 IF((LEFT$(S,1)="Y")OR(LEFT$(S,1)="y"))THEN 9970
9965 IF((LEFT$(S,1)="N")OR(LEFT$(S,1)="n"))THEN GOTO 10055
9967 PRINT:PRINT"ENTRY NOT UNDERSTOOD - PLEASE TRY AGAIN.":PRINT:GOTO 9955
9970 PRINT:PRINT"INPUT USER NAME."
9975 INPUT"(EX: JOHN DOE): ",S
9977 IF(S<>"")THEN SNAME=S
9980 PRINT:PRINT"INPUT TODAY'S DATE."
9985 INPUT"(EX: 5/20/82 OR 5 MAY 82): ",S
9987 IF(S<>"")THEN SDATE=S
9990 PRINT:PRINT"INPUT CURRENT TIME."
9995 INPUT"(EX: 1735 OR 5:35 PM EST): ",STIME
10000 FOR I=1 TO 10
10005 PRINT
10010 NEXT I
10015 PRINT TAB(8)"*****"
10020 PRINT TAB(8)"* WAIT-IRDAW IS SEARCHING FOR *"
10025 PRINT TAB(8)"* THE NEXT PIECE OF THE CODE. *"
10030 PRINT TAB(8)"*****"
10035 FOR I=1 TO 9
10040 PRINT
10045 NEXT I
10050 CHAIN"B:IRDAWTHR.COM",20
10055 PRINT:PRINT"* PROGRAM COMPLETED. *":PRINT:PRINT"* IRDAW SIGNING OFF. *":PR
INT
11000 END

```

APPENDIX III

PROGRAM VERIFICATION DATA

IRDAM/WRAITH Comparisons

For ground level release calculations, the most important factors in determining doses received are the X/Q values and semi-infinite dose conversion factors used. IRDAM uses X/Q values calculated from σ_y and σ_z values in WRAITH (Scherpelz, Borst and Hoenes, 1980) using the equation:

$$X/Q = \frac{1}{\bar{u} \pi \sigma_y \sigma_z}$$

where $\bar{u}$ is the windspeed.

Minor differences between IRDAM and WRAITH appear in X/Q calculations because WRAITH can take into account building wake effects and other factors not included in IRDAM.

Dose conversion factors provide another source of difference between the two models. The factors used for each are shown on the first table of this appendix. Generally the factors used are within a factor of between two and three of each other, the exception being ^{83m}Kr , a low energy gamma emitter with a low gamma yield.

Any differences between IRDAM and WRAITH for ground level external dose calculations can be accounted for by differences in X/Q values and dose conversion factors, if it is also remembered that IRDAM does not calculate decay in plume transit for the ground level release case.

Table 2 is taken from NUREG-0851 (U.S. NRC 1983) and compares WRAITH results with those obtained from the nomograms in NUREG-0851. For the purpose of comparison the dose kernels have been normalized with regard to decay in transit and daughter ingrowth. Table 3 makes a similar comparison using doses calculated from IRDAM.

Other tables in this appendix show comparisons of calculations made using finite plume geometries for dose due to shine from elevated plumes. IRDAM and WRAITH results are shown for both radionuclide-specific and gross releases.

TABLE 1. Dose conversion factors

Radionuclide	Semi-infinite dose conversion factors (rem-m ³ /Ci-hr)		
	IRDAM	WRAITH	Ratio IRDAM/WRAITH
^{83m} Kr	8.62×10^{-3}	2.00×10^{-5}	4.41×10^{-2}
^{85m} Kr	1.33×10^{-2}	1.27×10^{-2}	1.06
⁸⁵ Kr	1.84×10^{-0}	1.97×10^{-0}	0.93
⁸⁷ Kr	6.75×10^{-2}	7.22×10^{-2}	0.97
⁸⁸ Kr	1.68×10^{-3}	1.68×10^{-3}	1.01
⁸⁹ Kr	1.89×10^{-3}	1.59×10^{-3}	2.96
^{131m} Xe	1.04×10^{-1}	9.30×10^{-0}	1.12
^{133m} Xe	2.89×10^{-1}	2.69×10^{-1}	1.07
¹³³ Xe	3.36×10^{-1}	2.90×10^{-1}	1.16
^{135m} Xe	3.56×10^{-2}	3.80×10^{-2}	1.09
¹³⁵ Xe	2.06×10^{-2}	2.06×10^{-2}	0.99
¹³⁷ Xe	1.62×10^{-2}	1.43×10^{-2}	2.40
¹³⁸ Xe	1.01×10^{-3}	1.01×10^{-3}	1.23
¹³⁴ Cs	9.66×10^{-2}	1.41×10^{-3}	0.68
¹³⁷ Cs	3.70×10^{-2}	5.35×10^{-2}	0.72

TABLE 2. Comparison of total body dose kernels calculated by WRAITH and by Nomograms for the straight-line Gaussian plume model

Nuclide	Release height h (m)	Downwind distance R (m)	Stability class S	Total body dose kernels*		
				WRAITH $K_W(h,R,S)$	Nomograms** $K_N(h,R,S)$	Agreement ratio K_N/K_W
^{85}Kr	100	400	B	2.34×10^{-8}	3.96×10^{-8}	1.69
	100	800	G	2.10×10^{-8}	9.72×10^{-8}	4.63
	100	1609	E	1.81×10^{-8}	2.88×10^{-8}	1.53
^{87}Kr	100	400	G	6.13×10^{-6}	57.6×10^{-5}	9.40
	100	800	C	6.64×10^{-6}	9.54×10^{-6}	1.44
	100	1609	A	3.10×10^{-7}	7.20×10^{-7}	2.32
^{88}Kr	100	400	F	1.66×10^{-5}	10.8×10^{-5}	6.51
	100	800	A	6.67×10^{-6}	10.1×10^{-6}	1.51
	100	1609	B	7.08×10^{-6}	7.92×10^{-6}	1.12
^{89}Kr	100	400	A	0.72×10^{-5}	3.35×10^{-5}	4.65
	100	800	E	0.42×10^{-5}	1.37×10^{-5}	3.26
	100	1609	G	0.34×10^{-5}	1.19×10^{-5}	3.50
^{133}Xe	100	400	B	3.99×10^{-7}	6.84×10^{-7}	1.71
	100	800	F	3.08×10^{-7}	8.28×10^{-7}	2.69
	100	1609	D	2.82×10^{-7}	3.67×10^{-7}	1.30

TABLE 2. (contd)

Nuclide	Release height h (m)	Downwind distance R (m)	Stability class S	Total body dose kernels*		
				WRAITH $K_W(h,R,S)$	Nomograms** $K_N(h,R,S)$	Agreement ratio K_N/K_W
^{135}Xe	100	400	D	2.39×10^{-6}	7.20×10^{-6}	3.01
	100	800	A	0.82×10^{-6}	1.87×10^{-6}	2.28
	100	1609	E	2.14×10^{-6}	3.17×10^{-6}	1.48
^{137}Xe	100	400	E	1.31×10^{-6}	7.20×10^{-6}	5.50
	100	800	A	4.72×10^{-7}	11.6×10^{-7}	2.46
	100	1609	G	1.29×10^{-6}	4.68×10^{-6}	3.63
^{138}Xe	100	400	B	0.98×10^{-5}	1.80×10^{-5}	1.84
	100	800	E	8.24×10^{-6}	23.4×10^{-6}	2.84
	100	1609	D	7.34×10^{-6}	10.8×10^{-6}	1.47

*Kernal units are (mrem/hr) (m/sec)/($\mu\text{Ci/sec}$).

** $K(h,R,S) = 3.6 \times 10^{-3} B(h,R,S)$, where $B(h,R,S)$ is determined from the total body dose nomograms.

TABLE 3. Comparison of total body dose kernels calculated by WRAITH and by IRDAM for the straight-line Gaussian plume model

Nuclide	Release height h (m)	Downwind distance R (m)	Stability class S	Total body dose kernels*		
				WRAITH $K_W(h,R,S)$	IRDAM $K_I(h,R,S)$	Agreement ratio K_I/K_W
^{85}Kr	100	400	B	2.34×10^{-8}	3.1×10^{-8}	1.3
	100	800	G	2.10×10^{-8}	2.3×10^{-8}	1.1
	100	1609	E	1.81×10^{-8}	2.2×10^{-8}	1.2
^{87}Kr	100	400	G	6.13×10^{-6}	1.8×10^{-5}	2.9
	100	800	C	6.64×10^{-6}	1.3×10^{-5}	1.9
	100	1609	A	3.10×10^{-7}	7.6×10^{-7}	2.5
^{88}Kr	100	400	F	1.66×10^{-5}	1.7×10^{-5}	1.0
	100	800	A	6.67×10^{-6}	1.0×10^{-5}	1.5
	100	1609	B	7.08×10^{-6}	8.0×10^{-6}	1.1
^{89}Kr	100	400	A	0.72×10^{-5}	5.9×10^{-5}	8.1
	100	800	E	0.42×10^{-5}	1.3×10^{-6}	0.3
	100	1609	G	0.34×10^{-5}	1.3×10^{-7}	0.04
^{133}Xe	100	400	B	3.99×10^{-7}	5.6×10^{-7}	1.4
	100	800	F	3.08×10^{-7}	2.8×10^{-7}	0.9
	100	1609	D	2.82×10^{-7}	2.5×10^{-7}	0.9

TABLE 3. (contd)

Nuclide	Release height h (m)	Downwind distance R (m)	Stability class S	Total body dose kernels*		
				WRAITH $K_W(h,R,S)$	IROAM $K_I(h,R,S)$	Agreement ratio K_I/K_W
^{135}Xe	100	400	D	2.39×10^{-6}	1.0×10^{-6}	0.4
	100	800	A	0.82×10^{-6}	1.1×10^{-6}	1.3
	100	1609	E	2.14×10^{-6}	1.2×10^{-6}	0.6
^{137}Xe	100	400	E	1.31×10^{-6}	1.5×10^{-6}	1.2
	100	800	A	4.72×10^{-7}	8.8×10^{-6}	1.9
	100	1609	G	1.29×10^{-6}	1.44×10^{-7}	0.1
^{138}Xe	100	400	B	0.98×10^{-5}	2.3×10^{-5}	2.3
	100	800	E	8.24×10^{-6}	1.1×10^{-5}	1.3
	100	1609	D	7.34×10^{-6}	1.0×10^{-5}	1.4

*Kernal units are (mrem/hr) (m/sec)/($\mu\text{Ci/sec}$).

TABLE 4. Elevated release calculation comparisons
between IRDAM and WRAITH

Isotopic release

Height: 25 m
Stability: F
Distance: 500 m

Windspeed: 2 m/s
Duration: 4 hr
Release rate: 1 Ci/s
each nuclide

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
^{83m}Kr	3.94×10^{-6}	1.04×10^{-4}	0.039
^{85m}Kr	8.16×10^{-3}	1.61×10^{-2}	0.51
^{85}Kr	1.16×10^{-4}	2.30×10^{-4}	0.50
^{87}Kr	4.76×10^{-2}	6.57×10^{-2}	0.72
^{88}Kr	5.20×10^{-2}	1.64×10^{-1}	0.32
^{89}Kr	2.52×10^{-2}	6.15×10^{-2}	0.41
^{131m}Xe	3.41×10^{-4}	1.35×10^{-3}	0.25
^{133m}Xe	3.14×10^{-3}	3.49×10^{-3}	0.90
^{133}Xe	3.68×10^{-3}	5.30×10^{-3}	0.69
^{135m}Xe	1.96×10^{-2}	3.81×10^{-2}	0.51
^{135}Xe	9.60×10^{-3}	2.52×10^{-2}	0.38
^{137}Xe	4.24×10^{-3}	7.71×10^{-3}	0.55
^{138}Xe	4.24×10^{-2}	7.95×10^{-2}	0.53
^{134}Cs	7.16×10^{-2}	1.56×10^{-1}	0.46
^{137}Cs	3.00×10^{-2}	5.95×10^{-2}	0.78
^{131}I	2.14×10^{-2}	3.86×10^{-2}	0.55
^{132}I	8.80×10^{-2}	2.20×10^{-1}	0.40
^{133}I	3.43×10^{-2}	6.18×10^{-2}	0.56
^{134}I	7.00×10^{-2}	2.40×10^{-1}	0.29
^{135}I	5.84×10^{-2}	1.43×10^{-1}	0.41

TABLE 5. Elevated release calculation comparisons
between IRDAM and WRAITH

Isotopic release

Height: 50 m
Stability: D
Distance: 500 m

Windspeed: 2 m/s
Duration: 4 hr
Release rate: 1 Ci/s
each nuclide

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
^{83m}Kr	1.42×10^{-6}	2.25×10^{-5}	6.31×10^{-2}
^{85m}Kr	5.28×10^{-3}	7.82×10^{-3}	0.68
^{85}Kr	7.44×10^{-5}	1.07×10^{-4}	0.70
^{87}Kr	3.03×10^{-2}	3.06×10^{-2}	0.99
^{88}Kr	3.26×10^{-2}	7.67×10^{-2}	0.43
^{89}Kr	1.62×10^{-2}	2.86×10^{-2}	0.57
^{131m}Xe	2.12×10^{-4}	4.44×10^{-4}	0.48
^{133m}Xe	1.95×10^{-3}	1.46×10^{-3}	1.34
^{133}Xe	2.26×10^{-3}	2.23×10^{-3}	1.01
^{135m}Xe	1.26×10^{-2}	1.77×10^{-2}	0.71
^{135}Xe	4.64×10^{-3}	1.20×10^{-2}	0.39
^{137}Xe	2.72×10^{-3}	3.58×10^{-3}	0.76
^{138}Xe	2.73×10^{-2}	3.72×10^{-2}	0.73
^{134}Cs	4.60×10^{-2}	7.23×10^{-2}	0.64
^{137}Cs	1.92×10^{-2}	2.76×10^{-2}	0.70
^{131}I	1.37×10^{-2}	1.84×10^{-2}	0.74
^{132}I	5.68×10^{-2}	1.02×10^{-1}	0.56
^{133}I	2.21×10^{-2}	2.87×10^{-2}	0.77
^{134}I	4.48×10^{-2}	1.10×10^{-1}	0.41
^{135}I	3.75×10^{-2}	6.59×10^{-2}	0.57

TABLE 6. Elevated release calculation comparisons
between IRDAM and WRAITH

Isotopic release

Height: 50 m
Stability: F
Distance: 500 m

Windspeed: 2 m/s
Duration: 4 hr
Release rate: 1 Ci/s
each nuclide

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
^{83m}Kr	1.53×10^{-6}	6.50×10^{-6}	0.23
^{85m}Kr	5.72×10^{-3}	8.06×10^{-3}	0.71
^{85}Kr	9.64×10^{-5}	1.08×10^{-4}	0.89
^{87}Kr	4.96×10^{-2}	3.08×10^{-2}	1.61
^{88}Kr	5.20×10^{-2}	7.72×10^{-2}	0.67
^{89}Kr	2.52×10^{-2}	2.88×10^{-2}	0.87
^{131m}Xe	2.12×10^{-4}	3.60×10^{-4}	0.59
^{133m}Xe	2.06×10^{-3}	1.39×10^{-3}	1.48
^{133}Xe	2.03×10^{-3}	2.28×10^{-3}	0.89
^{135m}Xe	1.64×10^{-2}	1.78×10^{-2}	0.92
^{135}Xe	5.56×10^{-3}	1.22×10^{-2}	0.46
^{137}Xe	3.41×10^{-3}	3.61×10^{-3}	0.94
^{138}Xe	3.99×10^{-2}	3.74×10^{-2}	1.07
^{134}Cs	6.44×10^{-2}	7.28×10^{-2}	0.88
^{137}Cs	2.59×10^{-2}	2.79×10^{-2}	0.93
^{131}I	1.68×10^{-2}	1.87×10^{-2}	0.90
^{132}I	8.24×10^{-2}	1.02×10^{-1}	0.81
^{133}I	3.15×10^{-2}	2.89×10^{-2}	1.09
^{134}I	6.76×10^{-2}	1.11×10^{-1}	0.61
^{135}I	5.68×10^{-2}	6.62×10^{-2}	0.81

TABLE 7. Elevated release calculation comparisons
between IRDAM and WRAITH

Isotopic release

Height: 50 m

Windspeed: 2 m/s

Stability: F

Duration: 4 hr

Distance: 1000 m

Release rate: 1 Ci/s
each nuclide

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
^{83m}Kr	1.36×10^{-6}	8.63×10^{-6}	0.16
^{85m}Kr	5.04×10^{-3}	7.30×10^{-3}	0.69
^{85}Kr	7.80×10^{-5}	9.95×10^{-5}	0.78
^{87}Kr	3.40×10^{-2}	2.74×10^{-2}	1.24
^{88}Kr	3.68×10^{-2}	7.01×10^{-2}	0.53
^{89}Kr	7.44×10^{-3}	1.07×10^{-2}	0.69
^{131m}Xe	1.96×10^{-4}	3.42×10^{-4}	0.57
^{133m}Xe	1.85×10^{-3}	1.29×10^{-3}	1.43
^{133}Xe	1.98×10^{-3}	2.05×10^{-3}	0.96
^{135m}Xe	1.10×10^{-2}	1.42×10^{-2}	0.78
^{135}Xe	4.68×10^{-3}	1.13×10^{-2}	0.41
^{137}Xe	1.33×10^{-3}	1.57×10^{-3}	0.85
^{138}Xe	2.77×10^{-2}	2.82×10^{-2}	0.98
^{134}Cs	5.00×10^{-2}	6.71×10^{-2}	0.74
^{137}Cs	2.06×10^{-2}	2.54×10^{-2}	0.81
^{131}I	1.41×10^{-2}	1.72×10^{-2}	0.82
^{132}I	6.12×10^{-2}	9.24×10^{-2}	0.66
^{133}I	2.42×10^{-2}	2.66×10^{-2}	0.91
^{134}I	4.76×10^{-2}	9.69×10^{-2}	0.49
^{135}I	4.20×10^{-2}	6.06×10^{-2}	0.69

TABLE 8. Elevated release calculation comparisons
between IRDAM and WRAITH

Isotopic release

Height: 50 m
Stability: F
Distance: 2000 m

Windspeed: 2 m/s
Duration: 4 hr
Release rate: 1 Ci/s
each nuclide

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
^{83m}Kr	1.27×10^{-6}	1.68×10^{-5}	0.076
^{85m}Kr	5.24×10^{-3}	6.03×10^{-3}	0.87
^{85}Kr	7.40×10^{-5}	8.56×10^{-5}	0.86
^{87}Kr	2.57×10^{-2}	2.20×10^{-2}	1.17
^{88}Kr	2.97×10^{-2}	5.87×10^{-2}	0.51
^{89}Kr	1.02×10^{-3}	1.49×10^{-3}	0.69
^{131m}Xe	2.24×10^{-4}	3.45×10^{-4}	0.65
^{133m}Xe	2.04×10^{-3}	1.16×10^{-3}	1.76
^{133}Xe	2.46×10^{-3}	1.71×10^{-3}	1.44
^{135m}Xe	7.12×10^{-3}	9.26×10^{-3}	0.77
^{135}Xe	4.60×10^{-3}	9.73×10^{-3}	0.47
^{137}Xe	2.86×10^{-4}	2.98×10^{-4}	0.96
^{138}Xe	2.03×10^{-2}	1.62×10^{-2}	1.25
^{134}Cs	4.52×10^{-2}	5.78×10^{-2}	0.78
^{137}Cs	1.90×10^{-2}	2.17×10^{-2}	0.88
^{131}I	1.38×10^{-2}	1.47×10^{-2}	0.93
^{132}I	5.16×10^{-2}	7.64×10^{-2}	0.68
^{133}I	2.14×10^{-2}	2.28×10^{-2}	0.94
^{134}I	3.67×10^{-2}	7.49×10^{-2}	0.49
^{135}I	3.55×10^{-2}	5.17×10^{-2}	0.69

TABLE 9. Elevated release calculation comparisons
between IRDAM and WRAITH

Isotopic release

Height: 75 m
Stability: D
Distance: 500 m

Windspeed: 2 m/s
Duration: 4 hr
Release rate: 1 Ci/s
each nuclide

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
^{83m}Kr	5.60×10^{-7}	1.74×10^{-6}	0.32
^{85m}Kr	3.42×10^{-3}	4.69×10^{-3}	0.73
^{85}Kr	5.68×10^{-5}	6.29×10^{-5}	0.90
^{87}Kr	2.73×10^{-2}	1.82×10^{-2}	1.50
^{88}Kr	2.82×10^{-2}	4.56×10^{-2}	0.62
^{89}Kr	1.40×10^{-2}	1.69×10^{-2}	0.83
^{131m}Xe	1.26×10^{-4}	1.71×10^{-4}	0.74
^{133m}Xe	1.21×10^{-3}	7.80×10^{-4}	1.55
^{133}Xe	7.16×10^{-4}	1.14×10^{-3}	0.63
^{135m}Xe	9.60×10^{-3}	1.04×10^{-2}	0.92
^{135}Xe	3.23×10^{-3}	7.21×10^{-3}	0.45
^{137}Xe	2.02×10^{-3}	2.10×10^{-3}	0.96
^{138}Xe	2.27×10^{-2}	2.20×10^{-2}	1.03
^{134}Cs	3.70×10^{-2}	4.23×10^{-2}	0.87
^{137}Cs	1.50×10^{-2}	1.62×10^{-2}	0.93
^{131}I	9.76×10^{-3}	1.10×10^{-2}	0.89
^{132}I	4.68×10^{-2}	5.95×10^{-2}	0.79
^{133}I	1.80×10^{-2}	1.68×10^{-2}	1.07
^{134}I	3.79×10^{-2}	6.46×10^{-2}	0.59
^{135}I	3.18×10^{-2}	3.86×10^{-2}	0.82

TABLE 10. Elevated release calculation comparisons
between IRDAM and WRAITH

Isotopic release

Height: 75 m

Windspeed: 2 m/s

Stability: D

Duration: 4 hr

Distance: 1000 m

Release rate: 1 Ci/s
each nuclide

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
^{83m}Kr	6.68×10^{-7}	1.01×10^{-5}	0.061
^{85m}Kr	4.40×10^{-3}	4.21×10^{-3}	1.05
^{85}Kr	6.20×10^{-5}	5.89×10^{-5}	1.05
^{87}Kr	2.38×10^{-2}	1.65×10^{-2}	1.44
^{88}Kr	2.61×10^{-2}	4.23×10^{-2}	0.62
^{89}Kr	5.36×10^{-3}	6.41×10^{-3}	0.84
^{131m}Xe	1.82×10^{-4}	2.10×10^{-4}	0.87
^{133m}Xe	1.66×10^{-3}	7.75×10^{-4}	2.14
^{133}Xe	9.20×10^{-4}	1.06×10^{-3}	0.87
^{135m}Xe	8.72×10^{-3}	8.39×10^{-3}	1.04
^{135}Xe	3.84×10^{-3}	6.69×10^{-3}	0.57
^{137}Xe	1.08×10^{-3}	9.28×10^{-4}	1.16
^{138}Xe	2.06×10^{-2}	1.69×10^{-2}	1.22
^{134}Cs	3.82×10^{-2}	3.97×10^{-2}	0.96
^{137}Cs	1.60×10^{-2}	1.50×10^{-2}	1.07
^{131}I	1.14×10^{-2}	1.02×10^{-2}	1.12
^{132}I	4.56×10^{-2}	5.48×10^{-2}	0.83
^{133}I	1.82×10^{-2}	1.57×10^{-2}	1.16
^{134}I	3.48×10^{-2}	5.76×10^{-2}	0.60
^{135}I	3.06×10^{-2}	3.62×10^{-2}	0.85

TABLE 11. Elevated release calculation comparisons
between IROAM and WRAITH

Height: 75 m	Isotopic release	Windspeed: 2 m/s
Stability: F		Duration: 4 hr
Distance: 500 m		Release rate: 1 Ci/s each nuclide

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
^{83m}Kr	6.28×10^{-7}	5.35×10^{-7}	1.17
^{85m}Kr	3.47×10^{-3}	4.84×10^{-3}	0.72
^{85}Kr	6.76×10^{-5}	6.43×10^{-5}	1.05
^{87}Kr	3.89×10^{-2}	1.85×10^{-2}	2.10
^{88}Kr	3.94×10^{-2}	4.65×10^{-2}	0.85
^{89}Kr	1.92×10^{-2}	1.73×10^{-2}	1.11
^{131m}Xe	1.28×10^{-4}	1.67×10^{-4}	0.77
^{133m}Xe	1.26×10^{-3}	7.91×10^{-4}	1.59
^{133}Xe	8.92×10^{-4}	1.16×10^{-3}	0.77
^{135m}Xe	1.15×10^{-2}	1.06×10^{-2}	1.08
^{135}Xe	3.49×10^{-3}	7.41×10^{-3}	0.47
^{137}Xe	2.34×10^{-3}	2.15×10^{-3}	1.09
^{138}Xe	2.94×10^{-2}	2.25×10^{-2}	1.31
^{134}Cs	4.64×10^{-2}	4.32×10^{-2}	1.07
^{137}Cs	1.84×10^{-2}	1.66×10^{-2}	1.11
^{131}I	1.09×10^{-2}	1.13×10^{-2}	0.96
^{132}I	6.04×10^{-2}	6.08×10^{-2}	0.99
^{133}I	2.30×10^{-2}	1.72×10^{-2}	1.34
^{134}I	5.04×10^{-2}	6.59×10^{-2}	0.76
^{135}I	4.24×10^{-2}	3.94×10^{-2}	1.08

TABLE 12. Elevated release calculation comparisons
between IRDAM and WRAITH

Isotopic release

Height: 75 m
Stability: F
Distance: 1000 m

Windspeed: 2 m/s
Duration: 4 hr
Release rate: 1 Ci/s
each nuclide

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
^{83m}Kr	5.84×10^{-7}	6.86×10^{-7}	0.85
^{85m}Kr	3.46×10^{-3}	4.50×10^{-3}	0.77
^{85}Kr	6.28×10^{-5}	6.08×10^{-5}	1.03
^{87}Kr	3.18×10^{-2}	1.69×10^{-2}	1.88
^{88}Kr	3.32×10^{-2}	4.34×10^{-2}	0.76
^{89}Kr	6.68×10^{-3}	6.58×10^{-3}	1.02
^{131m}Xe	1.29×10^{-4}	1.57×10^{-4}	0.82
^{133m}Xe	1.25×10^{-3}	7.46×10^{-4}	1.68
^{133}Xe	8.04×10^{-4}	1.08×10^{-3}	0.74
^{135m}Xe	8.80×10^{-3}	8.65×10^{-3}	1.02
^{135}Xe	3.40×10^{-3}	7.02×10^{-3}	0.48
^{137}Xe	1.04×10^{-3}	9.57×10^{-4}	1.09
^{138}Xe	2.40×10^{-2}	1.74×10^{-2}	1.38
^{134}Cs	4.20×10^{-2}	4.09×10^{-2}	1.03
^{137}Cs	1.68×10^{-2}	1.55×10^{-2}	1.08
^{131}I	1.05×10^{-2}	1.07×10^{-2}	0.98
^{132}I	5.28×10^{-2}	5.64×10^{-2}	0.94
^{133}I	2.06×10^{-2}	1.62×10^{-2}	1.27
^{134}I	4.20×10^{-2}	5.91×10^{-2}	0.71
^{135}I	3.70×10^{-2}	3.71×10^{-2}	1.00

TABLE 13. Elevated release calculation comparisons
between IRDAM and WRAITH

Isotopic release	
Height: 75 m	Windspeed: 2 m/s
Stability: F	Duration: 4 hr
Distance: 2000 m	Release rate: 1 Ci/s each nuclide

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
^{83m}Kr	5.40×10^{-7}	1.61×10^{-6}	0.34
^{85m}Kr	3.41×10^{-3}	3.81×10^{-3}	0.90
^{85}Kr	5.68×10^{-5}	5.34×10^{-5}	1.06
^{87}Kr	2.36×10^{-2}	1.39×10^{-2}	1.70
^{88}Kr	2.61×10^{-2}	3.71×10^{-2}	0.70
^{89}Kr	9.00×10^{-4}	9.39×10^{-4}	0.96
^{131m}Xe	1.31×10^{-4}	1.41×10^{-4}	0.93
^{133m}Xe	1.24×10^{-3}	6.57×10^{-4}	1.89
^{133}Xe	7.28×10^{-4}	9.25×10^{-4}	0.79
^{135m}Xe	5.44×10^{-3}	5.77×10^{-3}	0.94
^{135}Xe	3.24×10^{-3}	6.17×10^{-3}	0.53
^{137}Xe	2.12×10^{-4}	1.86×10^{-4}	1.14
^{138}Xe	1.71×10^{-2}	1.02×10^{-2}	1.68
^{134}Cs	3.67×10^{-2}	3.60×10^{-2}	1.02
^{137}Cs	1.49×10^{-2}	1.35×10^{-2}	1.10
^{131}I	9.88×10^{-3}	9.34×10^{-3}	1.06
^{132}I	4.32×10^{-2}	4.76×10^{-2}	0.91
^{133}I	1.77×10^{-2}	1.42×10^{-2}	1.25
^{134}I	3.15×10^{-2}	4.66×10^{-2}	0.68
^{135}I	3.06×10^{-2}	3.23×10^{-2}	0.95

TABLE 14. Elevated release calculation comparisons
between IRDAM and WRAITH

Isotopic release

Height: 75 m
Stability: F
Distance: 3000 m

Windspeed: 2 m/s
Duration: 4 hr
Release rate: 1 Ci/s
each nuclide

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
^{83m}Kr	5.72×10^{-7}	3.47×10^{-6}	0.16
^{85m}Kr	3.66×10^{-3}	3.26×10^{-3}	1.12
^{85}Kr	5.76×10^{-5}	4.76×10^{-5}	1.21
^{87}Kr	2.04×10^{-2}	1.15×10^{-2}	1.77
^{88}Kr	2.38×10^{-2}	3.22×10^{-2}	0.74
^{89}Kr	1.39×10^{-4}	1.36×10^{-4}	1.02
^{131m}Xe	1.49×10^{-4}	1.38×10^{-4}	1.08
^{133m}Xe	1.39×10^{-3}	5.95×10^{-4}	2.34
^{133}Xe	7.80×10^{-4}	8.11×10^{-4}	0.96
^{135m}Xe	3.80×10^{-3}	4.01×10^{-3}	0.95
^{135}Xe	3.40×10^{-3}	5.48×10^{-3}	0.62
^{137}Xe	4.88×10^{-5}	3.68×10^{-5}	1.33
^{138}Xe	1.39×10^{-2}	6.09×10^{-3}	2.28
^{134}Cs	3.63×10^{-2}	3.21×10^{-2}	1.13
^{137}Cs	1.50×10^{-2}	1.20×10^{-2}	1.25
^{131}I	1.04×10^{-2}	8.27×10^{-3}	1.26
^{132}I	4.04×10^{-2}	4.07×10^{-2}	0.99
^{133}I	1.73×10^{-2}	1.26×10^{-2}	1.37
^{134}I	2.71×10^{-2}	3.73×10^{-2}	0.73
^{135}I	2.89×10^{-2}	2.85×10^{-2}	1.01

TABLE 15. Elevated release calculation comparisons
between IRDAM and WRAITH

Gross release	
Height: 50 m	Windspeed: 2 m/s
Stability: F	Duration: 4 hr
I/NG: 0.02	Release rate: 1 Ci/s
Decay: 0 hr	Plume touchdown: 2000-3000 m
	*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
500 m	2.13×10^{-2}	2.41×10^{-2}	0.88
1000 m	1.37×10^{-2}	2.24×10^{-2}	0.61
2000 m	1.00×10^{-2}	1.94×10^{-2}	0.52
3000 m	8.93×10^{-2}	1.66×10^{-2}	5.38
8000 m	2.34×10^{-2}	7.82×10^{-3}	3.00
20000 m	6.84×10^{-3}	2.50×10^{-3}	2.74

	Thyroid Dose (rem)		
	IRDAM (infant)	WRAITH (Adult)	IRDAM/WRAITH**
500 m	3.18×10^{-8}	8.88×10^{-9}	3.58
1000 m	2.44×10^{-2}	6.74×10^{-3}	3.62
2000 m	5.10×10^{-1}	1.41×10^{-1}	3.62
3000 m	8.18×10^{-1}	2.25×10^{-1}	3.64
8000 m	5.70×10^{-1}	1.54×10^{-1}	3.70
20000 m	2.30×10^{-1}	6.81×10^{-2}	3.38

**Wraith calculates adult thyroid dose.

TABLE 16. Elevated release calculation comparisons
between IRDAM and WRAITH

Gross release

Height: 50 m

Stability: F

I/NG: 0.02

Decay: 24 hr

Windspeed: 2 m/s

Duration: 4 hr

Release rate: 1 Ci/s

Plume touchdown: 2000-3000 m

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
500 m	2.73×10^{-3}	3.16×10^{-3}	0.86
1000 m	2.50×10^{-3}	2.87×10^{-3}	0.87
2000 m	2.91×10^{-3}	2.41×10^{-3}	1.21
3000 m	8.12×10^{-3}	2.03×10^{-3}	4.0
8000 m	2.13×10^{-3}	9.90×10^{-4}	2.15
20000 m	6.22×10^{-4}	4.30×10^{-4}	1.45

	Thyroid Dose (rem)		
	IRDAM (infant)	WRAITH (Adult)	IRDAM/WRAITH**
500 m	9.38×10^{-8}	2.67×10^{-8}	3.52
1000 m	7.14×10^{-2}	2.03×10^{-2}	3.52
2000 m	1.50×10	4.25×10^{-1}	3.52
3000 m	2.40×10	6.83×10^{-1}	3.52
8000 m	1.68×10	4.71×10^{-1}	3.56
20000 m	6.76×10^{-1}	2.14×10^{-1}	3.16

**Wraith calculates adult thyroid dose.

TABLE 17. Elevated release calculation comparisons
between IRDAM and WRAITH

Gross release

Height: 50 m

Stability: F

I/NG: 0.2

Decay: 0 hr

Windspeed: 2 m/s

Duration: 4 hr

Release rate: 1 Ci/s

Plume touchdown: 2000-3000 m

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
500 m	2.62×10^{-2}	3.11×10^{-2}	0.84
1000 m	1.75×10^{-2}	2.86×10^{-2}	0.61
2000 m	1.35×10^{-2}	2.43×10^{-2}	0.56
3000 m	8.93×10^{-2}	2.05×10^{-2}	4.36
8000 m	2.34×10^{-2}	9.24×10^{-3}	2.53
20000 m	6.84×10^{-3}	2.92×10^{-3}	2.34

	Thyroid Dose (rem)		
	IRDAM (infant)	WRAITH (Adult)	IRDAM/WRAITH**
500 m	2.72×10^{-7}	7.55×10^{-8}	3.60
1000 m	2.06×10^{-1}	5.73×10^{-2}	3.60
2000 m	4.34×10	1.20×10	3.62
3000 m	6.96×10	1.92×10	3.62
8000 m	4.84×10	1.31×10	3.70
20000 m	1.96×10	5.80×10^{-1}	3.38

**Wraith calculates adult thyroid dose.

TABLE 18. Elevated release calculation comparisons
between IRDAM and WRAITH

Gross release

Height: 50 m

Stability: F

I/NG: 0.2

Decay: 24 hr

Windspeed: 2 m/s

Duration: 4 hr

Release rate: 1 Ci/s

Plume touchdown: 2000-3000 m

*Finite plume calculation

	5 cm Depth Dose (rem)		
	IRDAM	WRAITH*	IRDAM/WRAITH
500 m	6.31×10^{-3}	6.83×10^{-3}	0.92
1000 m	5.26×10^{-3}	6.25×10^{-3}	0.84
2000 m	5.32×10^{-3}	5.31×10^{-3}	1.00
3000 m	8.12×10^{-3}	4.52×10^{-3}	1.80
8000 m	2.13×10^{-3}	2.27×10^{-3}	0.94
20000 m	6.22×10^{-4}	9.96×10^{-4}	0.62

	Thyroid Dose (rem)		
	IRDAM (infant)	WRAITH (Adult)	IRDAM/WRAITH**
500 m	7.98×10^{-7}	2.27×10^{-7}	3.52
1000 m	6.08×10^{-1}	1.72×10^{-1}	3.54
2000 m	1.27×10^{-1}	3.62×10	3.52
3000 m	2.04×10^{-1}	5.80×10	3.52
8000 m	1.42×10^{-1}	4.01×10	3.56
20000 m	5.76×10	1.82×10	3.16

**Wraith calculates adult thyroid dose.

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16. ABSTRACT (200 words or less) The Interactive Rapid Dose Assessment Model (IRDAM) is a tool to assist respondents to radiological emergencies. It is intended to provide the user with a capability that is easily portable and user friendly so that it may be used at any location (HQ, Base Team, or Site Team) while the staff is not fully augmented to scope the extent of the problem. IRDAM is the micro computer based system containing a dose projection routine. The hardware and software package is an initial effort to demonstrate the feasibility of a deployable system that is sufficiently flexible to deal with a variety of radiological emergencies. This volume provides the technical bases for the dose projection routine used in this initial IRDAM.					
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