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MELCOR Accident Consequence Code System (MACCS)

User's Guide

Prepared by D. I. Chanin, J. L. Sprung, L. T. Ritchie, H-N Jow

Sandia National Laboratories

Prepared for
U.S. Nuclear Regulatory Commission

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MELCOR Accident Consequence Code System (MACCS)

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ABSTRACT

This report describes the MACCS computer code. The purpose of this code is to simulate the impact of severe accidents at nuclear power plants on the surrounding environment. MACCS has been developed for the U.S. Nuclear Regulatory Commission to replace the previous CRAC2 code, and it incorporates many improvements in modeling flexibility in comparison to CRAC2.

The principal phenomena considered in MACCS are atmospheric transport, mitigative actions based on dose projection, dose accumulation by a number of pathways including food and water ingestion, early and latent health effects, and economic costs.

The MACCS code can be used for a variety of applications. These include (1) probabilistic risk assessment (PRA) of nuclear power plants and other nuclear facilities, (2) sensitivity studies to gain a better understanding of the parameters important to PRA, and (3) cost-benefit analysis.

This report is composed of three volumes. Volume I, the User's Guide, describes the input data requirements of the MACCS code and provides directions for its use as illustrated by three sample problems. Volume II, the Model Description, describes the underlying models that are implemented in the code, and Volume III, the Programmer's Reference Manual, describes the code's structure and database management.

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FOREWORD

This report provides the documentation of the MACCS computer code, which performs probabilistic calculations of potential offsite consequences of the atmospheric releases of radioactive material in reactor accidents. Sandia National Laboratories (SNL) developed the code for the U.S. Nuclear Regulatory Commission (NRC). The report consists of three volumes -- Volume I being the User's Guide; Volume II, the Model Description; and Volume III, the Programmer's Reference Manual.

With the publication of this report, the MACCS code is released for use within the NRC and for the benefit of other interested users. The MACCS code supersedes the earlier NRC consequence codes, namely, CRAC and CRAC2. The code, its formatted data files, and two pre-processor programs, namely, DOSFAC and MAXGC, which generate certain types of data for the code, are available on magnetic tape from the National Energy Software Center, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439.

The MACCS code has evolved through several draft versions. The current version (i.e., Version 1.5), simply called MACCS, has been substantially improved and subjected to rigorous quality assurance and verification processes. Idaho National Engineering Laboratory (INEL) performed line-by-line checking of the individual code modules to (a) assess the internal and interfacing consistencies and (b) verify that the FORTRAN statements correctly represent the algorithms, statistical techniques, input data requirements, and output capabilities. INEL's efforts were to ensure that the intended models were implemented into a consistent and essentially error-free computer code as specified by state-of-the-art coding standards for large scientific computer programs. Mr. Ulf Tveten, Institute of Energy Technology, Kjeller, Norway, under a subcontract from SNL, performed a comprehensive review of the chronic exposure pathway modeling in MACCS and compared it with those in the latest versions of the consequence codes that are being used, or planned to be completed in the near future, in several member countries of the Organization for Economic Cooperation and Development (OECD). INEL, Mr. Tveten, and SNL were interactively involved in the processes of quality assurance, verification, review, identification of errors and implementation of their correction, and model updating. These processes were largely completed before the MACCS code was used for consequence analysis for the second draft of NUREG-1150. INEL's quality assurance and verification report will be published as NUREG/CR-5376. Mr. Tveten's chronic exposure pathway review report will be published as NUREG/CR-5377.

An NRC effort is under way for comparing MACCS with similar codes of earlier vintage using the benchmark problems of the International Consequence Code Comparison Study. This study was sponsored by the OECD, Nuclear Energy Agency (NEA), Committee on the Safety of Nuclear Installations (CSNI), and was completed in 1983. The staff findings will be published as NUREG-1364. Further, it is also planned that MACCS will participate in the forthcoming NEA/CSNI-sponsored consequence code comparison study scheduled to be completed in 1992. Several other new generation consequence codes from the OECD member countries will also participate in the study. The NRC staff will be assisted by Brookhaven National Laboratory in performing the required analysis using MACCS for the study.

Some of the major new features of MACCS are: (a) improved approximation of the Gaussian crosswind concentration profile, (b) improved health effect models, (c) improved weather sampling, (d) treatment of multiphase release with capability for treatment of change in the wind direction at the reactor between the release phases, (e) detailed chronic exposure pathway modeling, (f) inclusion of inhalation of resuspended radionuclides as an early exposure pathway, (g) provision for more complex emergency response and long-term protective measures, and (h) code flexibility, so that virtually all model parameters can now be provided by the user via input.

The item (h) above is a very useful feature of MACCS that will facilitate the analysis of consequence uncertainties due to uncertainties in the model parameters. However, the user now has to prepare much more data, involving multiple disciplines, for input. This introduces the potential for an inexperienced user to produce distorted results because of improper or inconsistent data.

MACCS continues to use a straight line Gaussian plume dispersion and transport model like its predecessors, CRAC and CRAC2. Although this model is very convenient for probabilistic calculations of consequences using a large number of weather samples, care should be exercised in the MACCS applications to any deterministic, or real-time, situations because of such limitations of the model.

Additional improvements in MACCS will be undertaken in the near future. These include incorporation of latent cancer effect models for high-LET radiation (discussed in the BEIR IV report) and any changes that may be dictated by the recently revised assessment of latent cancer risks of radiation (discussed in the BEIR V report). Research for improvements in these areas is under way. In the longer term, additional areas for improvement will be identified by comparing MACCS with other full-scope consequence codes, such as CONDOR (United Kingdom), UFOMOD (Federal Republic of Germany), and COSYMA (Commission of the European Communities).

The MACCS code represents a significant advancement in the development of severe accident analysis methods. Comments based on use of the code would be greatly appreciated and should be forwarded to the undersigned.

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USER'S OVERVIEW

Introduction

Sandia National Laboratories has developed a new severe accident risk-assessment code, MACCS (MELCOR [We84] Accident Consequence Code System), for the U.S. Nuclear Regulatory Commission as a replacement for the CRAC2 [Ri83] code. The MACCS code models the off-site consequences of radioactive releases; that is, it considers atmospheric transport and deposition, mitigative actions, dosimetry, health effects, and economic costs. The MACCS code is available on magnetic tape from the National Energy Software Center, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois, 60439.

Our objectives in developing MACCS were (1) to develop a code structure that facilitates the performance of sensitivity and uncertainty analyses, (2) to provide flexibility for performing site-specific consequence analyses, (3) to provide a modular structure that permits incorporation of future modeling improvements, and (4) to provide a portable program that can be used on most large computer systems. The coding conforms to the FORTRAN 77 ANSI standard [AN78].

To facilitate performing uncertainty and sensitivity analyses, the value of almost every parameter used in the MACCS code may be changed by the user through input. Please refer to Volume 2 of this document [Jo89] for a description of the model parameters which cannot be modified through user input. Because of this flexibility, the user is asked to provide significantly more input data than in previous consequence models. Therefore, we have made every effort to develop an input format that is self-documenting in order to make the code easy to use.

Unless specified otherwise, all times used in the code are referenced to the time of accident initiation. This point in time is normally referred to as "scram." Throughout MACCS, SI units have been used to the greatest possible extent. Table 1 contains conversion factors between commonly used SI and English units.

Table 1
Conversion Factors for SI Units

Quantity	SI Unit	English Unit	Conversion
absorbed dose	Gray (Gy)	rad	1 Gy = 100 rad
dose equivalent	sievert (Sv)	rem	1 Sv = 100 rem
radioactivity	becquerel (Bq)	curie (Ci)	1 Bq = 2.7E-11 Ci
distance	meter (m)	mile (mi)	1 m = 6.2E-3 mi
area	sq kilometer	sq mile	1 sq km = 0.386 sq mi
area	hectare (ha)	acre	1 ha = 2.5 acres
power	Watt (W)	Btu/hour	1 W = 3.4 Btu/hour
speed	meter/sec (m/s)	miles/hour (mph)	1 m/s = 2.2 mph

This report describes the input data required by the MACCS program. The remainder of this overview section presents an overview to the structure of MACCS and a description of MACCS user input processing. Chapters 1, 2, and 3 provide descriptions of the data requirements for each of the main modules in MACCS (ATMOS, EARLY and CHRONC). A glossary of all the input variables defined in Chapters 1 to 3 is presented in Appendix A. The formats of the auxiliary input files (weather data, dose conversion factors, and site descriptive data) are described in Appendix B. A description of the procedure file that controls MACCS is supplied in Appendix C. Finally, listings of some of the input and output files for the sample problems are provided in Appendix D.

It is hoped that this document will allow a knowledgeable consequence analyst to exercise MACCS. This report is not intended to provide a description of the models used within MACCS or to describe the method of their implementation. A description of the MACCS models is available as Volume 2 of this document [Jo89]. A Programmer's Reference Manual is available as Volume 3 [Ro89].

MACCS Structure

This section is intended to provide sufficient information so that the reader may understand the general sequence of the MACCS calculations.

The internal documentation of MACCS is intended to provide a detailed picture of the code structure. The program itself begins with a set of comment cards which present the hierarchical control structure of MACCS in graphical form.

Every subroutine or function program unit in MACCS begins with a stylized block of information that states: (1) the purpose of the program unit, (2) the name(s) of the program unit which reference it, (3) a glossary of the variables it utilizes, (4) a glossary of the program units it references, (5) the name and date of its authorship, and (6) a history of its modification.

As a further aid, the program units of MACCS are arranged in the order in which they are first referenced.

A MACCS calculation consists of three phases: (1) input processing and validation, (2) phenomenological modeling, and (3) output processing.

The calculations begin with the processing of all input to the code. Extensive error checking is used so that any input errors are located and diagnosed before attempting to perform the modeling phase of the calculations. If any errors are detected, the program will try to validate as much of the subsequent input as possible in order to facilitate the debugging process but execution of the program will be terminated before attempting to perform the next phase.

The second phase of the calculations is where all the phenomenological modeling occurs. The sequence in which the phenomena are evaluated closely follows the temporal order of events in the real world which would occur in the event of a reactor accident. The phenomenological models are for the most part based on empirical data and the solutions they entail are usually analytical in nature and computationally straightforward.

The modeling phase of MACCS is subdivided into three parts: ATMOS, EARLY, and CHRONC. ATMOS treats the atmospheric transport and dispersion of material and its deposition from the air. EARLY models the effect of the accident on the surrounding area during an emergency action period which can have a duration of up to one week. CHRONC considers the impact in the period subsequent to the emergency action period and up to $t=\infty$. The following list describes the sequence of phenomenological modeling in ATMOS, EARLY, and CHRONC.

ATMOS:

- define the weather conditions
- initialize the dimensions of the plume
- calculate radioactive decay occurring before release
- determine whether there will be any plume rise
- calculate the arrival time of the plume
- calculate the amount of material remaining after wet deposition
- calculate the dispersion of the plume
- calculate radioactive decay during transport
- determine the amount of plume rise of a buoyant plume
- calculate a prospective χ/Q that ignores deposition
- calculate the amount of material remaining after dry deposition
- calculate the amount of material lost from dry and wet deposition together
- calculate average air and ground concentrations
- deplete the inventory of the plume due to deposition
- update the particle size distribution for depletion

EARLY:

- calculate the histogram approximating the Gaussian distribution
- calculate the cloudshine correction factor
- calculate the doses in the relocation zone (non-shelterees, non-evacuees)
- calculate the doses to shelterees and evacuees while they are stationary
- calculate the doses to evacuees while they are moving
- calculate the health effect risks
- produce the EARLY results requested by the user

CHRONC:

- calculate the ground concentrations on the spatial grid
- determine the efficiency of the first year growing season food pathway

calculate how long people are gone from home for relocation or evacuation
determine what actions are needed during the intermediate phase period
determine what doses are incurred during the intermediate phase period
find a set of actions to meet exposure criteria in the long-term period
determine the effectiveness and cost of decontamination/interdiction
determine if the selected actions are cost-effective
accumulate the resulting doses and costs from all pathways and actions
produce the CHRONC results requested by the user

The data needed to define the models described above are specified through three user input files with the names: ATMOS, EARLY, and CHRONC. The requirements for preparation of these files are described in Chapters 1, 2, and 3 of this document.

In some cases, the user may not need to exercise all of the code's features. For instance, if all that is needed is a calculation of air and ground concentrations as a function of distance, only the ATMOS module need be exercised and EARLY and CHRONC can be skipped. As another example, if a sensitivity study on emergency response assumptions is being performed, there may be no need to run the CHRONC module.

The skipping of modules is controlled by the specification of a control variable in the previous module's user input file. A control variable in the ATMOS User Input File (ENDAT1) can be used to signify that both EARLY and CHRONC are to be skipped. By setting a control variable on the EARLY User Input File (ENDAT2), CHRONC alone can be skipped. If any module is inactivated in this way, there is no need to prepare its corresponding user input file.

Of the three phenomenological modules in MACCS, the ATMOS module is the only one which must always be exercised. Depending on the value of user-specified parameters in the ATMOS User Input File, results can be generated for either single weather trials or multiple weather trials.

The OUTPUT module generates complementary cumulative distribution functions (CCDFs) [NR82] of the results generated by EARLY and CHRONC when the user requests that those results be produced as described in Section 2.11. This is done for both single and multiple weather trial runs. The results that can be produced are defined in Sections 2.12 to 2.19, and Sections 3.13 to 3.17. There is currently no provision for the production of any CCDF results from ATMOS such as air or ground concentrations, or contaminated area.

A CCDF is generated internally for all of the user requested consequence measures. For each of these CCDFs, the code always produces a one-line summary describing various aspects of the distribution function that is written to the List Output File.

For any subset of the results, the user can, in addition, cause the code to print out the entire CCDF table. This feature of printing out the CCDF table is under user control and is described in each of the sections where the user requests the production of the individual consequence measures.

The results from the OUTPUT module are presented individually for each emergency response strategy, and also as a weighted sum of the combined results. Consequences calculated by both EARLY and CHRONC (such as cancer cases) are summed together in the overall weighted sum. In addition, the weighting fractions associated with the individual emergency response scenarios of EARLY (up to three are allowed) are automatically combined according to the values of "fraction of the people" or "fraction of the time" specified on the EARLY User Input File (WTFRAC).

There is no provision for specifying each accident's expected rate of occurrence (accident frequency). All consequence measures calculated by MACCS are conditional on the occurrence of a particular accident. For directions on the interpretation of the consequence values presented by the OUTPUT module, please refer to Section 2.11 of this document.

MACCS can handle multiple source terms in a single run. When more than one source term is specified, the results for each are presented on the output listing in the order of their appearance on the ATMOS User Input File. The OUTPUT module will print a description of all the results for each source term before going on to the next source term. The code is currently dimensioned to handle up to 60 source terms at a time.

When the user has requested that multiple weather trials be performed according to weather category sampling (Section 1.16), the user has the capability of having the OUTPUT module present a table of relative contribution from each weather category sampling bin (Section 2.2). This enables the user to see what type of weather conditions contribute the most to the mean consequence value of each result on the output listing. These tables can only be produced if weather category sampling is being used (METCOD=2). This feature is especially useful now that the user has some control over the bins defining weather category since it can provide a means of "fine-tuning" the bin definitions. Section 2.11 provides additional information on the interpretation of the relative contribution tables.

Parameters defining both the rain intensity and rain distance bin definitions are specified on the ATMOS User Input File as described in Section 1.16. In contrast to the categorization of rain events, which is under the user's control as defined in Section 1.16, the initial condition bins for stability-class and wind-speed remain hard-wired into the code with no provision for easy modification by the user. It is hoped that a future version of MACCS will give the user complete flexibility in defining the weather category bins.

User Input Processing

The user input files for MACCS are processed by a free-field input processor, INPRE, that was developed to emulate the function of the INPPRE/CRACKR package which was originally developed for MELCOR. The replacement for the INPPRE/CRACKR package was developed for MACCS in order to facilitate the portability and ease of maintenance of the MACCS code. The INPRE package is portable without any modification to any computer system with an ANSI standard FORTRAN compiler [AN78].

The format of the input files was designed to maximize their readability. The input processor allows comments to be freely interspersed with the data which allows the input files to be essentially self-documenting.

Because of the requirements of the INPRE free-field input processor, certain restrictions on the format of the input data files are necessary. The input data files consist of a sequence of card images, with each card allowed a length of up to 100 characters. The sequence of cards is delimited by a special terminator record. A terminator record is a card with a period (.) in column one. Each card in a file is either a comment card or a data card. Comment cards are denoted by an asterisk (*) in column one. Data cards are required to begin in column one with an eleven character record identifier consisting of eight or nine alphanumeric identification characters followed by two or three numeric characters which are used for sequencing. An example of a record identifier is RIATNAM1001.

The input processor begins by sorting all the data cards in the file according to the collating sequence of their record identifiers. If more than one data card has the same record identifier, the last card encountered is used and all earlier cards with the same identifier are ignored. Cards may appear in any order. The ordering of data cards is only important for cards sharing the same record identifier.

Multiple source terms for ATMOS and multiple emergency response strategies for EARLY can be specified by the addition of "change cards" positioned at the end of the ATMOS and EARLY user input files. Each set of change cards is separated from the rest by a period (.) in Column 1. ATMOS allows up to 59 sets of source term change cards and EARLY allows up to two sets of emergency response change cards. Each change card set must specify a new text field to describe the source term or scenario and at least one previously defined input value must be redefined in each set of change cards. If the user tries to override a previously defined input variable that is not in the data blocks for source term (Section 1.11) or emergency response (Sections 2.6 and 2.7), those cards will be ignored by the program.

Every card appearing in the source term and emergency response change card sets must have been previously supplied in the base case input for that file. That is, when the change cards are being processed, there is no capability of adding new cards to the input file database. The change cards can only be used to replace previously defined data items in the

base case input. The change card processor simply replaces a previously defined data card with the new card which has the same record identifier. If a set of change cards contains data cards with record identifiers which have not been defined in the base case input, it is possible that spurious results will be generated. All of the MACCS User Input Files must end with a period in column one.

Data required by MACCS can be of four different types: logical, character, integer, or real. Logical values are represented as either .TRUE. or .FALSE. as defined in the ANSI FORTRAN 77 standard [AN78]. Character values can be any ASCII string delimited by apostrophes (''). If the string has no embedded blanks, the apostrophes are optional provided that the string is not interpreted to be a data item of another type. Integer values can be preceded with a minus sign or an optional plus sign but they cannot have a decimal point. Real values can be written either as an optionally signed number with a decimal point (FORTRAN F format) or else in exponential notation (FORTRAN E format) as defined in the ANSI standard.

The determination of the type of each item encountered is performed as follows: the code first determines if the item is of type logical, if it isn't, it checks to see if it is of type integer, if it isn't, it checks to see if it is of type real. Any item that is neither logical, integer nor real is considered to be of type character.

More than one item can be placed on a card. Multiple items on a card are delimited either by a comma or a blank. The presence of additional blanks between items has no effect on how the items are interpreted. Multiple commas between items are not allowed.

The input processor will not convert the type of the values that it encounters from real to integer or vice versa. If an integer value is required by one of the program modules, then an integer value must be supplied by the user. If a decimal point appears in what should be an integer value, an error flag will be set and execution will be terminated upon completion of the input processing phase. Likewise, the absence of a decimal point in what should be a real value will be interpreted as an input error and cause the error flag to be set.

In addition to checking that each data item encountered is of the correct type, the input processor determines the validity of the numeric input parameters (both integer and real) by checking whether they fall within the specified range. The allowable range of each datum is listed in this report. Character string values have a length between specified limits; these limits are also listed here. If a value is encountered that falls outside the required range, the error flag will be set and a diagnostic message issued to the output file. This message will list the minimum and maximum allowable values for the item in order to facilitate the debugging process.

If any input errors are detected, the code will usually attempt to process as much as possible of the subsequent input. In some instances though, the occurrence of an input error will cause an immediate termination of the program's execution.

A data element consists of either a single value (scalar) or a set of values which are all of the same type (array). Within a user input file for a particular program module, the data that it requires has been broken up into groups of functionally related quantities. These data groups are described in separate sections of the following chapters.

The record identifier used for scalar values is always of the same form. The first two characters are a mnemonic for the data group to which it belongs. For example, the mnemonic for the Run Identification Data is RI. The next six characters of the record identifier are the name of the FORTRAN variable within the program that is used to store the value. The record identifier is always 001. Only the first item found on the card for a scalar quantity will be processed. Anything to the right of the data item is ignored by the input processor. This allows the use of descriptive comments alongside of the data item. This feature should only be used for scalar values.

Arrays are found in the input files in two different forms. The first method is similar to the approach used for scalars. A starting record identifier is constructed the same as above: a two letter mnemonic, followed by the six letter variable name, followed by 001. More than one value can appear on the data card separated by blanks or a comma. You may place as many values on the card as will fit into the 100 columns. Successive cards with ascending sequence numbers are processed until all the required data items have been supplied. The record identifiers of the succeeding cards differ from the starting record identifier only in their last three digits.

The second method used for arrays is more structured. Several arrays of the same length whose values are related appear as columns across the page. The arrays can be of different type but they all share the same record identifier. The name of a program variable is not used to construct the record identifier since more than one variable receives its value from this "data block." Instead of reading array values from left to right in rows, the arrays are read from top to bottom in columns.

All of the input parameters used by the program modules will be described in this report. Unless specified otherwise, all of these parameters are required to be supplied. Each input parameter is described in a stylized block of text which presents the following information: (1) the FORTRAN variable name used in the code, (2) the type of the data item (integer, real, logical or character), (3) an indication of whether only a single value is required (Scalar), or multiple values are required (array), (4) minimum and maximum allowable values (or lengths), (5) a statement describing the variable, and (6) an example of the variable's usage.

The next section of this document describes the Sample Problems which are being supplied with the MACCS release tape.

Sample Problems

Three sample problems are provided to illustrate the use of MACCS. These will be referred to as Problems A, B, and C. Due to the length of the output listings it is impractical to include them all in this document's printed text but they are listed on microfiche and enclosed in the rear jacket of this report. On the magnetic tape used for distributing MACCS, all of the input and output files for the Sample Problems are available in machine-readable form.

Throughout the body of this document, data cards similar to those supplied in the Sample Problem input files are used to illustrate the appearance of the data in those files. The parameter values found on these data cards are for the most part identical to the values used in the MACCS calculations for the second draft of NUREG-1150 [NR89]. It is the responsibility of each MACCS user to ensure the appropriateness of all data in the MACCS input files which they prepare.

Problem A shows how MACCS can be used for probabilistic risk assessment (PRA) studies to address a variety of needs including regulatory studies and conventional parametric variation sensitivity studies. It illustrates how MACCS can automatically loop on source terms and emergency response assumptions in a single run of the code. The weather category bin sampling method is used in this problem to estimate the distribution of consequences which could result from an accident if the time of the accident's occurrence is unknown. Automatic looping is illustrated as follows: the ATMOS User Input File for Problem A causes results to be calculated for two hypothetical source terms, and the EARLY User Input File specifies two different emergency response scenarios (95 percent evacuation and 5 percent non-evacuation as was done for the first draft of NUREG-1150 [NR87]). An additional sheltering case is presented for the purpose of illustration. There is no provision for looping on the CHRONC module and only a single set of assumptions is ever used to determine the modeling in the long-term chronic exposure phase of the calculations.

The list output produced by Sample Problem A is presented its entirety in Appendix D.3. Since all of the input processed by MACCS is echoed to the list output file, this file illustrates both input and output of the code.

Problem B illustrates how MACCS can be used to examine one of the weather sequences which was selected in the weather sampling used for Problem A. This type of examination is usually done when some type of unusual result is noticed on the output listing and the user wishes to determine if the calculations are being properly performed. The output listing of Problem A shows that the peak value of economic cost from the

first source term was \$2.71E11 and it was obtained from the calculation of weather trial number 2. By going back to the first part of the listing, we can see that this trial began at day=157 and hour=10 on the Surry weather data file.

For Problem B, the ATMOS User Input File of Problem A has been modified to run only the first source term and to calculate results for only the single weather sequence which led to the peak economic cost as described above. We have turned on the diagnostic print options in all three of the User Input Files by changing the values of the following input parameters from zero to one: IDEBUG in ATMOS, IPRINT in EARLY, and KSWDSC in CHRONC. A large amount of printed output will result.

Just by themselves, the numbers printed on the debug output listing may be hard to interpret, but they could be helpful if it is necessary to examine intermediate steps in the calculations.

In Problem C, the code is set up to run the source term of Problem B with constant meteorology; D-stability, 5 m/s wind speed, no rain. A uniform population distribution of 50 people/square-km is used for the calculations and therefore there is no need for a Site Data File. Since wind direction is not defined for constant meteorology, the value of IPLUME is changed from 2 to 1. In this run, the diagnostic print statements of Problem B have been turned off and only the standard presentation of results from the OUTPUT module appears on the output listing.

Once MACCS is installed on a computer system, the user can verify that all is well by running the sample problems and comparing the resulting output files to those on the distribution magnetic tape which were generated on a VAX/VMS system. Since MACCS is intended to be portable to any computer, the numeric output values by and large should be identical or very close to identical. The only significant deviation might lie in the probabilities of non-zero and peak value consequences since the precision of arithmetic and the handling of underflow will vary on different computer systems.

If the user is working with a VAX/VMS system, the MACCS command file included on the installation tape may be used to execute the three sample problems as follows after the input files have been loaded and the program compiled and linked. The sample problems can be executed by typing the following three command lines.

```
A- @MACCS IN1A IN2A IN3A METSUR SURSIT TEMPA
B- @MACCS IN1B IN2B IN3B METSUR SURSIT TEMPB
C- @MACCS IN1C IN2C IN3C "" "" TEMPC
```

The output from these sample problems will be found in the three files: TEMPA.OUT, TEMPB.OUT, and TEMPC.OUT. Sample Problem C does not require a meteorological data file (METSUR) or a Site Data File (SURSIT), since it uses constant weather conditions and a uniform population density.

References

- AN78 "American National Standard Programming Language FORTRAN," ANSI X3.9-1978, available from American National Standards Institute, 1430 Broadway, New York, NY 10018, copyrighted.
- Jo89 Jow, H.N., et al., MELCOR Accident Consequence Code System (MACCS) Volume 2: Model Description, NUREG/CR-4691, SAND86-1562, Sandia National Laboratories, Albuquerque, NM, 1990.
- NR82 U.S. Nuclear Regulatory Commission, PRA Procedures Guide, NUREG/CR-2300, Vol. 2, 1982, available from National Technical Information Service, Springfield, Virginia, 22161.
- NR87 U.S. Nuclear Regulatory Commission, Reactor Risk Reference Document, USNRC Draft Report NUREG-1150, February 1987.
- NR89 U.S. Nuclear Regulatory Commission, Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants, Second Draft NUREG-1150, June 1989.
- Ri83 Ritchie, L. T., Calculations of Reactor Accident Consequences Version 2 CRAC2: Computer Code, User's Guide, NUREG/CR-2326, SAND81-1994, Sandia National Laboratories, Albuquerque, NM, 1983.
- Ro89 Rollstin, J.A., et al., MELCOR Accident Consequence Code System (MACCS) Volume 3: Programmer's Reference Manual, NUREG/CR-4691, SAND86-1562, Sandia National Laboratories, Albuquerque, NM, 1990.
- We84 Weigand, G. G., Thermal-Hydraulic Process Modeling in Risk Analysis: An Assessment of the Relevant Systems, Structures, and Phenomena, NUREG/CR-3986, SAND84-1219, Sandia National Laboratories, Albuquerque, NM, 1984.

1.0 ATMOS USER INPUT FILE

1.1 Introduction to ATMOS

The ATMOS program calculates the dispersion and deposition of material released to the atmosphere as a function of downwind distance. It utilizes a Gaussian plume model with Pasquill-Gifford dispersion parameters [NR82]. The phenomena that ATMOS treats are (1) building wake effects, (2) buoyant plume rise, (3) plume dispersion during transport, (4) wet and dry deposition, and (5) radioactive decay.

At the midpoint of each spatial interval along the transport path, air and ground concentrations for all the radionuclides are calculated as well as miscellaneous information about plume size, height, and transport timing. This data is stored in common blocks which are used later by the EARLY and CHRONC modules of MACCS.

Transport and deposition in ATMOS are treated with a one-dimensional model. Concentration values are calculated only for the plume centerline. There is no calculation in ATMOS of off-centerline concentrations. The adjustment for off-axis location is handled in the the EARLY and CHRONC modules.

Several different options for specifying weather conditions are available to the user. These include two weather sampling options: (1) category bin sampling and (2) strictly random sampling; as well as three different methods of specifying a single weather trial: (1) constant weather conditions, (2) fixed start time in the weather file, and (3) user supplied 120 hour weather sequence.

It is up to the user to specify the various parameters needed for these calculations. There are no default values. All of this information is supplied through the user input file to ATMOS and all of the input parameters are described in this chapter.

1.2 Run Identification (RI) Data

In order to identify the computer run that is being performed, the user is required to supply a text field that will be printed on all of the list output produced for this run by MACCS. All of the MACCS programs obtain the current date and time from the computer operating system so it is not necessary to include information of that type. In addition to this text field, a text field describing the source term is supplied separately in the Release Description Data Block which defines the source term.

Variable Name - ATNAM1

Variable Type - Character, Scalar

Allowed Range - 1 <= length <= 80

Purpose - Identifies this MACCS calculation. This identification information will be printed at the top of all pages of the OUTPUT listing.

Example Usage:

```
*
* GENERAL DESCRIPTIVE TITLE DESCRIBING THE ATMOSPHERIC ASSUMPTION FOR
* THESE RUNS
*
RIATNAM1001 'IN1A.INP, SURRY, SAMPLE PROBLEM A, ATMOS INPUT'
```

Note to user: The asterisk in column one denotes a comment.

1.3 Geometry (GE) Data

A polar grid coordinate system is used by MACCS to represent the region surrounding the reactor. The reactor itself is always located at the centerpoint of the coordinate system ($r = 0$). The data in this section defines the grid spacing between spatial elements in the radial direction. All of the consequence calculations performed by MACCS are stored on the basis of the radial spacing defined here. For example, air and ground concentrations are calculated to be representative of the entire length of the spatial element (not just its centerpoint).

Variable Name - NUMRAD
Variable Type - Integer, Scalar
Allowed Range - $2 \leq \text{value} \leq 35$
Purpose - Number of radial spatial intervals defined in the model. This quantity defines the polar coordinate spatial grid which will be used by all three of the program modules: ATMOS, EARLY, and CHRONC. If a Site Data File is being used, the value supplied here must match exactly the value supplied on that file as variable NSPDTS.

Example Usage:

```
*
* NUMBER OF RADIAL SPATIAL ELEMENTS
*
GENUMRAD001 26
```

Variable Name - SPAEND
Variable Type - Real, Array
Allowed Range - $0.001 \leq \text{value} \leq 9999$. (kilometers)
Purpose - Distance in kilometers to the endpoints of the spatial intervals. If a Site Data File is being used, the values supplied here must be within 10 percent of the corresponding parameter values supplied on that file for the array SPDSTS.

Note: The spacing between adjacent spatial intervals should be at least 0.1 kilometers.

Example Usage:

```
*
* SPATIAL ENDPOINT DISTANCES IN KILOMETERS
*
GESPAEND001    0.16    0.52    1.21    1.61    2.13
GESPAEND002    3.22    4.02    4.83    5.63    8.05
GESPAEND003    11.27   16.09   20.92   25.75   32.19
GESPAEND004    40.23   48.28   64.37   80.47  112.65
GESPAEND005   160.93  241.14  321.87  563.27  804.67
GESPAEND006  1609.34
```

Note to user: Elements in the array must be separated by blanks or a comma. The number of items per card is left to the user's discretion. The sequence numbers of the record identifiers must be in ascending order.

1.4 Nuclide (IS) Data

This section defines the physical characteristics of the nuclides that are to be modeled. These nuclides are divided into groups that share similar physical and chemical characteristics. Information on radioactive decay (half-life and decay schemes) is also provided here.

Variable Name - NUMISO
Variable Type - Integer, Scalar
Allowed Range - 1 <= value <= 150
Purpose - Number of nuclides defined in the model. Several other input parameters use this value to determine the number of values which are required to be supplied. The Dose Conversion Data File must have dose conversion data for each of the nuclides defined here.

Example Usage:

```
*
* NUMBER OF NUCLIDES
*
ISNUMISO001 60
```

Variable Name - MAXGRP
Variable Type - Integer, Scalar
Allowed Range - 1 <= value <= 10
Purpose - Number of chemical element groups defined in the model. Each nuclide will be assigned to a chemical element group, e.g., noble gases. The wet and dry deposition characteristics of a nuclide, as well as its release fraction, depend on the number of the element group (IGROUP) to which it is assigned.

Example Usage:

*
* NUMBER OF ELEMENT GROUPS
*
ISMAXGRP001 9

Variable Name - WETDEP
Variable Type - Logical, Array
Allowed Value - .TRUE. or .FALSE.
Purpose - Logical flag for each of the element groups that indicates whether they are subject to wet deposition. The user must supply MAXGRP number of values in column one of the data block.

Variable Name - DRYDEP
Variable Type - Logical, Array
Allowed Value - .TRUE. or .FALSE.
Purpose - Logical flag for each of the nuclide groups that indicates whether they are subject to dry deposition. The user must supply MAXGRP number of values in column two of the data block.

Example Usage of WETDEP, and DRYDEP:

*
* WET AND DRY DEPOSITION FLAGS FOR EACH NUCLIDE GROUP
*
* WETDEP DRYDEP
*
ISDEPFLA001 .FALSE. .FALSE.
ISDEPFLA002 .TRUE. .TRUE.
ISDEPFLA003 .TRUE. .TRUE.
ISDEPFLA004 .TRUE. .TRUE.
ISDEPFLA005 .TRUE. .TRUE.
ISDEPFLA006 .TRUE. .TRUE.
ISDEPFLA007 .TRUE. .TRUE.
ISDEPFLA008 .TRUE. .TRUE.
ISDEPFLA009 .TRUE. .TRUE.

Note to user: The remaining four variables in this section are supplied in a block of data consisting of four arrays, each containing NUMISO values. These four arrays appear as four columns of data.

Variable Name - NUCNAM
Variable Type - Character, Array
Allowed Range - 3 <= length <= 8
Purpose - Name of the nuclide, e.g., CO-58. The user must supply NUMISO values for this variable in column one of the data block.

Variable Name - PARENT
 Variable Type - Character, Array
 Allowed Range - 3 <= length <= 8
 Purpose - The name of the parent nuclide whose decay results in the production of this nuclide as a daughter product. For each nuclide, either supply the name of its parent or enter NONE in column two of the data block. A nuclide can be the parent of only one daughter. The user must supply NUMISO values for this variable in column two of the data block.

Variable Name - IGROUP
 Variable Type - INTEGER, Array
 Allowed Range - 1 <= value <= MAXGRP
 Purpose - This is the chemical element group to which the nuclide is assigned. The nuclides should be grouped according to their physical-chemical properties. Both the deposition behavior and the release fraction of an nuclide depend on the element group to which it is assigned. All members of an element group have the same deposition characteristics and release fraction. The user must supply NUMISO values for this variable in column three of the data block.

Variable Name - HAFLIF
 Variable Type - REAL, Array
 Allowed Range - 1.E-35 <= value <= 1.E35 (seconds)
 Purpose - This is the half-life of the nuclide in seconds. Because of the solution of the decay equation, if a nuclide has a parent, then the half-lives of parent and daughter must not be the same. The user must supply NUMISO values for this variable in column four of the data block.

Example Usage of NUCNAM, PARENT, IGROUP, HAFLIF:

* NUCLIDE GROUP DATA FOR 9 NUCLIDE GROUPS

	NUCNAM	PARENT	IGROUP	HAFLIF
ISOTPGRP001	CO-58	NONE	6	6.160E+06
ISOTPGRP002	CO-60	NONE	6	1.660E+08
ISOTPGRP003	KR-85	NONE	1	3.386E+08
ISOTPGRP004	KR-85M	NONE	1	1.613E+04
ISOTPGRP005	KR-87	NONE	1	4.560E+03
ISOTPGRP006	KR-88	NONE	1	1.008E+04
ISOTPGRP007	RB-86	NONE	3	1.611E+06
ISOTPGRP008	SR-89	NONE	5	4.493E+06
ISOTPGRP009	SR-90	NONE	5	8.865E+08
ISOTPGRP010	SR-91	NONE	5	3.413E+04
ISOTPGRP011	Y-90	SR-90	7	2.307E+05
ISOTPGRP012	Y-91	SR-91	7	5.080E+06
ISOTPGRP013	ZR-95	NONE	7	5.659E+06

ISOTPGRP014	ZR-97	NONE	7	6.048E+04	
ISOTPGRP015	NB-95	ZR-95	7	3.033E+06	
ISOTPGRP016	MO-99	NONE	6	2.377E+05	
ISOTPGRP017	TC-99M	MO-99	6	2.167E+04	
ISOTPGRP018	RU-103	NONE	6	3.421E+06	
ISOTPGRP019	RU-105	NONE	6	1.598E+04	
ISOTPGRP020	RU-106	NONE	6	3.188E+07	
ISOTPGRP021	RH-105	RU-105	6	1.278E+05	
ISOTPGRP022	SB-127	NONE	4	3.283E+05	
ISOTPGRP023	SB-129	NONE	4	1.562E+04	
ISOTPGRP024	TE-127	SB-127	4	3.366E+04	
ISOTPGRP025	TE-127M	NONE	4	9.418E+06	
ISOTPGRP026	TE-129	SB-129	4	4.200E+03	
ISOTPGRP027	TE-129M	NONE	4	2.886E+06	
ISOTPGRP028	TE-131M	NONE	4	1.080E+05	
ISOTPGRP029	TE-132	NONE	4	2.808E+05	
ISOTPGRP030	I-131	TE-131M	2	6.947E+05	
ISOTPGRP031	I-132	TE-132	2	8.226E+03	
ISOTPGRP032	I-133	NONE	2	7.488E+04	
ISOTPGRP033	I-134	NONE	2	3.156E+03	
ISOTPGRP034	I-135	NONE	2	2.371E+04	
ISOTPGRP035	XE-133	I-133	1	4.571E+05	
ISOTPGRP036	XE-135	I-135	1	3.301E+04	
ISOTPGRP037	CS-134	NONE	3	6.501E+07	
ISOTPGRP038	CS-136	NONE	3	1.123E+06	
ISOTPGRP039	CS-137	NONE	3	9.495E+08	
ISOTPGRP040	BA-140	NONE	9	1.105E+06	
ISOTPGRP041	LA-140	BA-140	7	1.448E+05	
ISOTPGRP042	CE-141	LA-141	8	2.811E+06	PARENT ADDED
ISOTPGRP043	CE-143	NONE	8	1.188E+05	
ISOTPGRP044	CE-144	NONE	8	2.457E+07	
ISOTPGRP045	PR-143	CE-143	7	1.173E+06	
ISOTPGRP046	ND-147	NONE	7	9.495E+05	
ISOTPGRP047	NP-239	NONE	8	2.030E+05	
ISOTPGRP048	PU-238	CM-242	8	2.809E+09	
ISOTPGRP049	PU-239	NP-239	8	7.700E+11	
ISOTPGRP050	PU-240	CM-244	8	2.133E+11	
ISOTPGRP051	PU-241	NONE	8	4.608E+08	
ISOTPGRP052	AM-241	PU-241	7	1.366E+10	
ISOTPGRP053	CM-242	NONE	7	1.408E+07	
ISOTPGRP054	CM-244	NONE	7	5.712E+08	
ISOTPGRP055	SR-92	NONE	5	9.756E+03	NEW
ISOTPGRP056	Y-92	SR-92	7	1.274E+04	NEW
ISOTPGRP057	Y-93	NONE	7	3.636E+04	NEW
ISOTPGRP058	BA-139	NONE	9	4.986E+03	NEW
ISOTPGRP059	LA-141	NONE	7	1.418E+04	NEW
ISOTPGRP060	LA-142	NONE	7	5.724E+03	NEW

1.5 Wet Deposition (WD) Data

The washout model predicts how much material is deposited on the ground by rainfall. Washout is a function of both rain duration and rain

intensity. The fraction remaining after wet deposition is: $\text{EXP}(-\text{CWASH1} * \text{rain duration} * \text{rain intensity} ** \text{CWASH2})$, where rain duration is in seconds and rain intensity is in millimeters per hour [Br81].

Variable Name - CWASH1
Variable Type - Real, Scalar
Allowed Range - 0. <= value <= 1.
Purpose - The linear term of the washout function.

Example Usage:

```
*  
* WASHOUT COEFFICIENT NUMBER ONE, LINEAR FACTOR  
*  
WDCWASH1001 9.5E-5 (HELTON AFTER JONES, 1986)
```

Variable Name - CWASH2
Variable Type - Real, Scalar
Allowed Range - 0. <= value <= 1.
Purpose - The exponential term of the washout function.

Example Usage:

```
*  
* WASHOUT COEFFICIENT NUMBER TWO, EXPONENTIAL FACTOR  
*  
WDCWASH2001 0.8 (HELTON AFTER JONES, 1986)
```

1.6 Dry Deposition (DD) Data

Dry deposition is modeled using the source depletion method [NR82]. The concentration of material at any single point on the ground is the product of the integrated ground-level air concentration times the deposition velocity. The material in each element group can be distributed among several particle size groups, with each element group having a different distribution of material among the particle size groups. The particle size distribution of each element group is specified in the Release Description Data. All of the plume segments will have the same distribution of particle sizes at the time of their release, but this distribution will change with time as the plumes travel downwind.

Variable Name - NPSGRP
Variable Type - Integer, Scalar
Allowed Range - 1 <= value <= 10
Purpose - The number of particle size groups that will be used for the dry deposition model. A deposition velocity must be specified for each representative particle size group.

Example Usage:

```
*
```

* NUMBER OF PARTICLE SIZE GROUPS

*

DDNPSGRP001 3

Variable Name - VDEPOS

Variable Type - Real, Array

Allowed Range - 0. <= value <= 10. (meters / second)

Purpose - The representative dry deposition velocities of the particle size groups. The user must supply NPSGRP values for this variable on one or more cards.

Example Usage:

*

* DEPOSITION VELOCITY OF EACH PARTICLE SIZE GROUP (M/S)

*

DDVDEPOS001 0.001 0.01 0.02

1.7 Dispersion Parameter (DP) Data

The Gaussian plume model of atmospheric dispersion uses spatially dependent dispersion parameters, sigma-y and sigma-z. Sigma-y and sigma-z are functions of the form:

sigma-y = CYSIGA (X) ** CYSIGB, and

sigma-z = CZSIGA (X) ** CZSIGB,

where sigma-y, sigma-z, and X (the downwind distance from the source), are all in meters.

Variable Name - CYSIGA

Variable Type - Real, Array

Allowed Range - 1.E-35 <= value <= 10.

Purpose - The linear term of the expression for sigma-y. The user must supply six values of CYSIGA, one for each of the six Pasquill-Gifford stability classes (classes A through F).

Example Usage:

*

* LINEAR TERM OF THE EXPRESSION FOR SIGMA-Y, 6 STABILITY CLASSES

*

* STABILITY CLASS: A B C D E F

*

DPCYSIGA001 0.3658 0.2751 0.2089 0.1474 0.1046 0.0722

Variable Name - CYSIGB

Variable Type - Real, Array

Allowed Range - 1.E-35 <= value <= 10.

Purpose - The exponential term of the expression for sigma-y. The user must supply six values of CYSIGB, one for each of the six Pasquill-Gifford stability classes (classes A through F).

Example Usage:

```
*
* EXPONENTIAL TERM OF THE EXPRESSION FOR SIGMA-Y, 6 STABILITY CLASSES
*
* STABILITY CLASS: A      B      C      D      E      F
*
DPCYSIGB001    0.9031    0.9031    0.9031    0.9031    0.9031    0.9031
```

Variable Name - CZSIGA
Variable Type - Real, Array
Allowed Range - 1.E-35 <= value <= 10.
Purpose - The linear term of the expression for sigma-z. The user must supply six values of CZSIGA, one for each of the six Pasquill-Gifford stability classes (classes A through F).

Example Usage:

```
*
* LINEAR TERM OF THE EXPRESSION FOR SIGMA-Z, 6 STABILITY CLASSES
*
* STABILITY CLASS: A      B      C      D      E      F
*
DPCZSIGA001    2.5E-4    1.9E-3      0.2      0.3      0.4      0.2
```

Variable Name - CZSIGB
Variable Type - Real, Array
Allowed Range - 1.E-35 <= value <= 10.
Purpose - The exponential term of the expression for sigma-z. The user must supply six values of CZSIGB, one for each of the six Pasquill-Gifford stability classes (classes A through F).

Example Usage:

```
*
* EXPONENTIAL TERM OF THE EXPRESSION FOR SIGMA-Z, 6 STABILITY CLASSES
*
* STABILITY CLASS; A      B      C      D      E      F
*
DPCZSIGB001    2.125    1.6021    0.8543    0.6532    0.6021    0.6020
```

Variable Name - YSCALE
Variable Type - Real, Scalar
Allowed Range - 0.01 <= value <= 100.0
Purpose - A linear scaling factor which is applied to the formula used for calculating sigma-y. It is just a convenient method for adjusting all the linear factors (CYSIGA) by a constant multiplicative factor.

Example Usage:

```
*
* LINEAR SCALING FACTOR FOR SIGMA-Y FUNCTION, NORMALLY 1
*
DPYSCALE001    1.

Variable Name - ZSCALE
Variable Type - Real, Scalar
Allowed Range - 0.01 <= value <= 100.0
Purpose       - A linear scaling factor which is applied to the formula
                  used for calculating sigma-z. It is normally used to
                  adjust the vertical dispersion parameters to take account
                  of surface roughness.
```

Example Usage:

```
*
* LINEAR SCALING FACTOR FOR SIGMA-Z FUNCTION,
* NORMALLY USED FOR SURFACE ROUGHNESS LENGTH CORRECTION.
* (Z1 / Z0) ** 0.2, FROM CRAC2 WE HAVE (10 CM / 3 CM) ** 0.2 = 1.27
*
DPZSCALE001    1.27
```

1.8 Plume Meander (PM) Data

In order to account for the effect of plume meander during transport of the plume, an expansion factor, EXPFAC, is calculated which serves to widen the plumes in the cross-wind direction. It acts as a linear factor on sigma-y during the calculation of χ/Q , but it does not affect the rate of growth of sigma-y. A two part function is used. The expansion factors used for different plume segments are independent of each other. If the release duration of the plume segment is less than or equal to BRKPNT, then the following formula will be used,

$$\text{EXPFAC} = (\text{plume-segment-release-duration} / \text{TIMBAS}) ** \text{XPFAC1}.$$

If the plume segment duration exceeds BRKPNT, then a different factor is used for the exponent of the function,

$$\text{EXPFAC} = (\text{plume-segment-release-duration} / \text{TIMBAS}) ** \text{XPFAC2}.$$

In both expressions, the duration of the plume segment is limited to 10 hours. A warning is printed on the output listing if the user specifies a release duration exceeding 10 hours.

```
Variable Name - TIMBAS
Variable Type - Real, Scalar
Allowed Range - 60. <= value <= 36000. (seconds)

Purpose       - The time base associated with the parameterization of the
                  plume meander adjustment factor (seconds).
```

Example Usage:

*
* TIME BASE FOR EXPANSION FACTOR (SECONDS)
*
PMTIMBAS001 600. (TEN MINUTES)

Variable Name - BRKPNT
Variable Type - Real, Scalar
Allowed Range - 60. <= value <= 36000. (seconds)
Purpose - The time break point in the formula used for calculating the plume meander expansion factor (seconds). If the release duration is less than or equal to this value, the first formula is used. If the release duration exceeds this value, the second formula is used.

Example Usage:

*
* BREAK POINT FOR FORMULA CHANGE (SECONDS)
*
PMBRPNT001 3600.

Variable Name - XPFAC1
Variable Type - Real, Scalar
Allowed Range - 0.01 <= value <= 1. (unitless)
Purpose - The exponential factor used in calculating the plume meander expansion factor for releases having release durations that are less than or equal to BRKPNT.

Example Usage:

*
* EXPONENTIAL EXPANSION FACTOR NUMBER 1
*
PMXPFAC1001 0.2

Variable Name - XPFAC2
Variable Type - Real, Scalar
Allowed Range - 0.01 <= value <= 1. (unitless)
Purpose - The exponential factor used in calculating the plume meander expansion factor for releases having release durations that are greater than BRKPNT.

Example Usage:

*
* EXPONENTIAL EXPANSION FACTOR NUMBER 2
*
PMXPFAC2001 0.25

1.9 Plume Rise (PR) Data

A plume rise model based on the recommendations of Gary Briggs is incorporated into MACCS. There are three basic components of the MACCS plume rise model: (1) entrainment of buoyant plumes in a building wake, (2) plume rise under unstable and neutral conditions (classes A to D), and (3) plume rise under stable conditions (classes E to F). These component models are described in the MACCS Model Description [Jo89]. The individual numeric coefficients utilized by these models are hard-wired into the code with no provision for their convenient modification by the user.

While it is not possible for the user to vary the individual coefficients utilized by the three components of the plume rise model, it is possible to modify their end results by the specification of linear scaling factors that are described in this section.

Variable Name - SCLCRW
Variable Type - Real, Scalar
Allowed Range - $0.01 \leq \text{value} \leq 100$.
Purpose - Linear scaling factor on the critical wind speed used in determining if buoyant plumes will be trapped in the turbulent wake of the reactor building complex. Parameter values less than 1. make plume rise less likely to occur because plume liftoff occurs only if the ambient wind speed at the time of release is less than the calculated critical wind speed.

If there is a need to ignore the effect of building wake entrainment, this can be achieved by setting SCLCRW to its maximum allowable value.

Example Usage:

```
*  
* SCALING FACTOR FOR THE CRITICAL WIND SPEED FOR ENTRAINMENT OF A BUOYANT  
* PLUME  
* (USED BY FUNCTION CAUGHT)  
*  
PRSCLCRW001 1.
```

Variable Name - SCLADP
Variable Type - Real, Scalar
Allowed Range - $0.01 \leq \text{value} \leq 100.0$ (unitless)
Purpose - Linear scaling factor on the plume rise formula used for determining the amount of plume rise that will occur when unstable or neutral atmospheric conditions occur (classes A through D).

Example Usage:

*
* SCALING FACTOR FOR THE A-D STABILITY PLUME RISE FORMULA
* (USED BY FUNCTION PLMRIS)
*

PRSCCLADP001 1.

Variable Name - SCLEFP
Variable Type - Real, Scalar
Allowed Range - 0.01 <= value <= 100.0 (unitless)
Purpose - Linear scaling factor on the plume rise formula used for determining the amount of plume rise that will occur when stable atmospheric conditions occur (classes E and F).

Example Usage:

*
* SCALING FACTOR FOR THE E-F STABILITY PLUME RISE FORMULA
* (USED BY FUNCTION PLMRIS)
*

PRSCLEFP001 1.

1.10 Wake Effects (WE) Data

The initial size of the plume is determined by the width and height of the reactor building wake. Sigma-y is initialized to width/4.3, and sigma-z is initialized to height/2.15. The height of the building wake is also used to determine if the plume is entrained in the turbulent region surrounding the building. Consequently, in addition to determining the initial plume size, the wake-height is utilized in the determination of whether or not buoyant plume rise will occur.

Variable Name - BUILDW
Variable Type - Real, Scalar
Allowed Range - 1.0 <= value <= 1000.0 (meters)
Purpose - Defines the width of the reactor building wake.

Example Usage:

*
* BUILDING WIDTH (METERS)
*

WEBUILDW001 40.

Variable Name - BUILDH
Variable Type - Real, Scalar
Allowed Range - 1.0 <= value <= 1000.0 (meters)
Purpose - Defines the height of the reactor building wake.

Example Usage:

*

* BUILDING HEIGHT (METERS)

*

WEBUILDH001 50.

1.11 Release Description (RD) Data

ATMOS can handle multiple plume segments in order to treat a release which has a composition that varies with time. The plume segments that comprise a release can be separated by a time gap, or can directly follow the preceding segment, but they are not allowed to overlap. The plume segments can be released at different heights, have different heat contents, and have different durations, but they will all share the same particle size distribution.

MACCS incorporates the capability for calculating the consequences from up to 60 different source terms in a single run of the code. This is accomplished by appending "change cards" to the ATMOS User Input File. The first source term is defined in the main body of the ATMOS User Input File. Up to 59 additional source terms can be defined through change card sets positioned at the end of the file.

The delimiter used to separate the change card sets is a period (.) in column one. The end of the file is also signified by a period in column one. All of the MACCS User Input Files must end with a period in column one. The sample ATMOS user input file listed in Appendix D.1 is an example illustrating the use of change cards for a Probabilistic Risk Assessment (PRA) application of the code.

The purpose of the change card processing in ATMOS is solely to allow modification of the previously specified Release Description Data. If data items from another data block appear in the change cards, they will be ignored. Each set of change cards must include a new value of ATNAM2, a text field describing the source term. Also, each set of change cards must specify a change in at least one of the numeric input variables described in this data block.

Variable Name - ATNAM2

Variable Type - Character, Scalar

Allowed Range - 1 <= length <= 80

Purpose - Identifies the name of the source term being studied. This name will be printed on all pages of the OUTPUT listing. A unique name must be specified for each source term.

Example Usage:

*

* SPECIFIC DESCRIPTIVE TEXT DESCRIBING THIS PARTICULAR SOURCE TERM

*

RDATNAM2001 'HYPOTHETICAL SOURCE TERM NUMBER 1'

Variable Name - OALARM
Variable Type - Real, Scalar
Allowed Range - 0. <= value <= 604800. seconds (one week)
Purpose - Defines the time at which notification is given to off-site emergency response officials to initiate protective measures for the surrounding population. This time is a function of the accident sequence. It is measured from accident initiation (scram time) and is given in units of seconds.

Example Usage:

```
*  
* TIME AFTER ACCIDENT INITIATION AT WHICH THE OFFSITE ALARM IS RUNG  
* EVACUATION WILL BEGIN EDELAY SECONDS AFTERWARDS, SEE THE EARLY INPUT  
* FILE  
*  
RDOALARM001 17280.
```

Variable Name - NUMREL
Variable Type - Integer, Scalar
Allowed Range - 1 <= value <= 4
Purpose - Defines the number of plumes that will be released.

Note: If the multiple source term feature is being used, it is not possible to provide a larger value for NUMREL in the change cards than the value which was defined previously. That is, the values of NUMREL specified on change cards cannot be larger than the value of NUMREL specified in the base case data.

Example Usage:

```
*  
* NUMBER OF PLUME SEGMENTS THAT ARE RELEASED  
*  
RDNUMREL001 2
```

Variable Name - MAXRIS
Variable Type - Integer, Scalar
Allowed Range - 1 <= value <= NUMREL
Purpose - Specifies which plume segment is to be considered risk dominant. The selection of the risk dominant plume is usually based on its potential for causing early fatalities. Release of the risk dominant plume always begins at the selected meteorological start time of the weather sequence.

Example Usage:

```
*  
* SELECTION OF RISK DOMINANT PLUME SEGMENT  
*
```

RDMAXRIS001 1

Variable Name - REFTIM
Variable Type - Real, Array
Allowed Range - 0. <= value <= 1.
Purpose - Specifies the representative time point of each plume segment (0.=leading edge, 0.5=midpoint, 1.=trailing edge). The characteristics of a plume are uniform along its length. This parameter allows the user to locate the contents of the plume in a "bucket" of material situated at some point within the plume's length. The radioactive decay, dry deposition, and dispersion calculations are all performed as if the entire contents of the plume segment are located at this point. The user must supply NUMREL values of REFTIM, one for each plume segment.

The choice of this parameter will have no impact on the wet deposition calculations since those are performed as if the entire contents of the plume are uniformly distributed along its length.

Example Usage:

```
*  
* REPRESENTATIVE TIME POINT FOR DISPERSION AND RADIOACTIVE DECAY  
*  
RDREFTIM001 0. 0.5 (CORRESPONDING TO HEAD AND MIDPOINT WEATHER)
```

Variable Name - PLHEAT
Variable Type - Real, Array
Allowed Range - 0.0 <= value <= 1.E10 (Watts)
Purpose - Specifies the rate of release of sensible heat in each plume segment. This quantity should be calculated as the amount of sensible heat in the plume segment divided by the duration of the plume segment. The value specified here is used to determine the amount of bouyant plume rise which will occur. The user must supply NUMREL values of PLHEAT, one for each plume segment.

Example Usage:

```
*  
* HEAT CONTENT OF THE RELEASE SEGMENTS (WATTS)  
* A VALUE SPECIFIED FOR EACH OF THE RELEASE SEGMENTS  
*  
RDPLHEAT001 6.37E+06 3.43E+06
```

Variable Name - PLHITE
Variable Type - Real, Array
Allowed Range - 0.0 <= value <= 1000.0 (meters)

Purpose - Specifies the height above ground level at which each plume segment is released. The user must supply NUMREL values of PLHITE, one for each plume segment.

Example Usage:

```
*
* HEIGHT OF THE PLUME SEGMENTS AT RELEASE (METERS)
* A VALUE SPECIFIED FOR EACH OF THE RELEASE SEGMENTS
*
RDPLHITE001 30. 30.
```

Variable Name - PLUDUR
Variable Type - Real, Array
Allowed Range - 60.0 <= value <= 86400.0 (seconds) ONE DAY
Purpose - Specifies the duration in seconds of each plume segment. The user must supply NUMREL values of PLUDUR, one for each plume segment.

Example Usage:

```
*
* DURATION OF THE PLUME SEGMENTS (SECONDS)
* A VALUE SPECIFIED FOR EACH OF THE RELEASE SEGMENTS
*
RDPLUDUR001 9000. 12588.
```

Variable Name - PDELAY
Variable Type - Real, Array
Allowed Range - 0. <= value <= 345600.0 (seconds) (4 DAYS)
Purpose - Specifies the start time of each plume segment in seconds from the time of accident initiation, e.g., reactor scram. The user must supply NUMREL values for PDELAY, one for each plume segment.

Example Usage:

```
*
* TIME OF RELEASE FOR EACH PLUME (SECS FROM SCRAM)
* A VALUE SPECIFIED FOR EACH OF THE RELEASE SEGMENTS
*
RDPDELAY001 17280. 26280.
```

Variable Name - PSDIST
Variable Type - Real, Array
Allowed Range - 0. <= value <= 1.
Purpose - Defines the fraction of the released material allocated to each of the particle size (deposition velocity) bins. All of the plume segments must use the same distribution of material among these bins. The user must specify one data card for each of the chemical element groups. The number of chemical element groups was defined as variable

MAXGRP in Section 1.4. On each of these cards, the user must supply an allocation fraction to be associated with each of the particle size groups. The number of particle size groups was defined as the input variable NPSGRP in Section 1.6.

Example Usage:

```

*
* PARTICLE SIZE DISTRIBUTION OF EACH ELEMENT GROUP
*
*          0.001    0.01    0.02  DEPOSITION VELOCITY OF EACH GROUP (M/S)
*
RDPDIST001 0.1      0.8      0.1
RDPDIST002 0.1      0.8      0.1
RDPDIST003 0.1      0.8      0.1
RDPDIST004 0.1      0.8      0.1
RDPDIST005 0.1      0.8      0.1
RDPDIST006 0.1      0.8      0.1
RDPDIST007 0.1      0.8      0.1
RDPDIST008 0.1      0.8      0.1
RDPDIST009 0.1      0.8      0.1

```

Variable Name - CORINV

Variable Type - Real, Array

Allowed Range - 0. <= value <= 1.E35 (becquerels)

Purpose - Defines the inventory of each nuclide present in the reactor at the time of accident initiation (scram). The inventory is given in units of becquerels (disintegrations/second). All of the nuclides which have been previously defined on the list of nuclides (NUCNAM array in Section 1.4) must be listed here. The nuclide names and their respective inventories may appear in any order.

Example Usage:

```

* 3578 MWTB BWR CORE INVENTORY, 80 O/O CAPACITY, 3/3 SHUTDOWN INVENTORY
*      SUPPLIED BY D.E. BENNETT, 6/17/86

```

```

*
*          NUCNAM          CORINV (BECQUERELS)
*
RDCORINV001  CO-58          2.024E+16
RDCORINV002  CO-60          2.423E+16
RDCORINV003  KR-85          3.317E+16
RDCORINV004  KR-85M         1.206E+18
RDCORINV005  KR-87          2.193E+18
RDCORINV006  KR-88          2.960E+18
RDCORINV007  RB-86          1.856E+15
RDCORINV008  SR-89          3.673E+18
RDCORINV009  SR-90          2.599E+17
RDCORINV010  SR-91          4.771E+18

```

RDCORINV011	SR-92	4.984E+18
RDCORINV012	Y-90	2.783E+17
RDCORINV013	Y-91	4.482E+18
RDCORINV014	Y-92	5.004E+18
RDCORINV015	Y-93	5.690E+18
RDCORINV016	ZR-95	5.899E+18
RDCORINV017	ZR-97	6.073E+18
RDCORINV018	NB-95	5.581E+18
RDCORINV019	MO-99	6.436E+18
RDCORINV020	TC-99M	5.554E+18
RDCORINV021	RU-103	4.877E+18
RDCORINV022	RU-105	3.254E+18
RDCORINV023	RU-106	1.327E+18
RDCORINV024	RH-105	2.429E+18
RDCORINV025	SB-127	3.077E+17
RDCORINV026	SB-129	1.068E+18
RDCORINV027	TE-127	2.979E+17
RDCORINV028	TE-127M	4.010E+16
RDCORINV029	TE-129	1.002E+18
RDCORINV030	TE-129M	2.634E+17
RDCORINV031	TE-131M	5.058E+17
RDCORINV032	TE-132	4.944E+18
RDCORINV033	I-131	3.417E+18
RDCORINV034	I-132	5.020E+18
RDCORINV035	I-133	7.172E+18
RDCORINV036	I-134	7.850E+18
RDCORINV037	I-135	6.751E+18
RDCORINV038	XE-133	7.182E+18
RDCORINV039	XE-135	1.707E+18
RDCORINV040	CS-134	5.596E+17
RDCORINV041	CS-136	1.501E+17
RDCORINV042	CS-137	3.350E+17
RDCORINV043	BA-139	6.612E+18
RDCORINV044	BA-140	6.522E+18
RDCORINV045	LA-140	6.655E+18
RDCORINV046	LA-141	6.145E+18
RDCORINV047	LA-142	5.912E+18
RDCORINV048	CE-141	5.922E+18
RDCORINV049	CE-143	5.765E+18
RDCORINV050	CE-144	3.841E+18
RDCORINV051	PR-143	5.643E+18
RDCORINV052	ND-147	2.522E+18
RDCORINV053	NP-239	7.516E+19
RDCORINV054	PU-238	5.226E+15
RDCORINV055	PU-239	1.325E+15
RDCORINV056	PU-240	1.659E+15
RDCORINV057	PU-241	2.856E+17
RDCORINV058	AM-241	2.903E+14
RDCORINV059	CM-242	7.667E+16
RDCORINV060	CM-244	4.137E+15

Variable Name - CORSCA
 Variable Type - Real, Scalar
 Allowed Range - $1.E-35 \leq \text{value} \leq 1.E35$
 Purpose - This is a linear scaling factor that can be used to adjust the inventory of all the nuclides defined in the model. It is preferable to obtain new sets of inventory values when studying reactors of varying power levels but this is not always possible.

When plant specific inventories are not available, a representative inventory may be obtained by linear scaling of the inventory of a similar reactor having a different thermal power level. The scale factor used can be chosen to be the ratio of the two reactor's thermal power levels.

The parameter CORSCA may also be used to convert the reactor inventory from one set of units to another during the input processing phase in order to avoid the tedium of manually converting a set of data from one set of units to another. For example, to convert from curies to becquerels, use a value of $3.7E10$ for CORSCA.

Example Usage:

```

*
* SCALING FACTOR TO ADJUST THE CORE INVENTORY
*
RDCORSCA001  0.715  *  SURRY
  
```

Variable Name - RELFRC
 Variable Type - Real, Array
 Allowed Range - $0. \leq \text{value} \leq 1.$
 Purpose - Defines the release fractions for each of the plume segments. One card is supplied for each plume and it contains as many values as there are element groups. All components of an element group are released from the reactor in the same fraction.

Release fractions are applied to the core inventory at the time of scram to calculate the amount of radioactivity for each nuclide allocated to each plume segment. During the delay period before the plume's release, radioactive decay and buildup of daughter products is calculated by adjustments to the release inventory of each individual plume segment. This means that any buildup of daughter products is released in the same fraction as its parent.

For example, consider the case of radioiodine which decays to radioxenon during holdup inside the containment after accident initiation (scram). Let us assume that

the Noble gases (xenon) have a release fraction of one and the iodine group has a release fraction of one-half. The interpretation of these release fractions is as follows. After adjusting for radioactive decay up to the time of release, all of the xenon in the reactor at the time of scram will be released (release-fraction=1). Because of the assumption that daughters are released according to the same fraction as their parents, the daughter product buildup of xenon which resulted from the decay of radioiodine will be subject to a release fraction of one-half (the release fraction of the iodine).

This approach for treatment of the in-plant processes prior to release is consistent with the methodology of the Source Term Code Package (STCP) and MELCOR. It may not be appropriate for other source term generation programs.

Example Usage:

```
*
* RELEASE FRACTIONS FOR NUCLIDE GROUPS IN RELEASE
*
* GENERIC SOURCE TERM A
*
*           XE/KR      I      CS      TE      SR      RU      LA      CE      BA
*
* RDRELFRC001  7.0E-01 4.7E-01 4.7E-01 3.4E-01 3.E-01 5.E-03 3.E-02 4.5E-02 2.7E-01
* RDRELFRC002  2.9E-01 1.0E-02 9.0E-03 5.3E-03 2.E-03 4.E-04 1.E-04 9.6E-04 2.3E-03
```

1.12 Output-Control (OC) Data

The user has the option of looking at tables of dispersion data for all of the trials that are performed. This information includes air and ground concentrations, sigma-y and sigma-z values, and arrival and departure times for each plume segment at each spatial interval. This data is written to the standard output file (TAPE6).

Variable Name - ENDAT1
Variable Type - Logical, Scalar
Allowed Value - .TRUE. or .FALSE.
Purpose - Control flag which allows the user to execute only the ATMOS module. A value of .TRUE. tells the code that EARLY and CHRONC will not be run. When this is done, the User Input Files for EARLY and CHRONC and a Site Data File need not be supplied. If the user wishes to skip execution of only the CHRONC module, that can be accomplished through the input variable ENDAT2 on the EARLY User Input File.

Example Usage:

```
*  
* FLAG TO INDICATE THAT THIS IS THE LAST PROGRAM IN THE SERIES TO BE RUN  
*  
OCENDAT1001 .FALSE. (SET THIS VALUE TO .TRUE. TO SKIP EARLY AND CHRONC)
```

Variable Name - IDEBUG
Variable Type - Integer, Scalar
Allowed Range - $0 \leq \text{value} \leq 8$
Purpose - Specifies the quantity of debug output to be printed. For normal runs, IDEBUG should be set to zero (i.e., no debug output is printed. If IDEBUG is set to one or two, a print of the atmospheric transport results described below will be generated for each weather trial and each plume segment. If IDEBUG is set to a value of three or more the hourly meteorological data which was used for each weather trial will also be printed.

The debug output for atmospheric transport prints the results described below.

NUCNAM - name of the nuclide for which results are being presented,
DISTANCE - distance to the center of the spatial interval (meters),
GL AIRCON - centerline ground level integrated air concentration from this plume segment averaged over the spatial interval's length (becquerel-seconds / cubic-meter),
GRNCON - centerline ground concentration after passage of this plume averaged over the spatial interval's length (becquerels / square-meter),
GL X/Q - centerline ground level chi over Q (χ/Q), ratio of air concentration, chi, to source strength Q, in SI units, averaged over the interval's length,
WETREM - fraction of material remaining in the plume segment after wet deposition over the spatial interval's length,
DRYREM - fraction of material remaining in the plume segment after dry deposition over the spatial interval's length,
REMINV - adjusted source strength of the plume upon entering each spatial interval after adjustment for losses in the previous intervals due to radioactive decay and wet and dry deposition (becquerels),
PLSIGY - horizontal dispersion parameter sigma-y averaged over the spatial interval's length (meters),

- PLSIGZ - vertical dispersion parameter sigma-z averaged over the spatial interval's length (meters),
- WEATHER - indices to the first and last hours of the weather sequence used for determining atmospheric conditions during transport across each spatial interval,
- HTFCTR - ratio of the centerline ground level air concentration (z=0) to the plume centerline air concentration (z=H),
- AVGHIT - average height (H) of the plume as it traversed the spatial interval (meters),
- TIMCEN - time after accident initiation at which the leading edge of the plume arrived at the center of the spatial interval (seconds),
- TIMOVH - duration for which the plume was overhead at the centerpoint of the spatial interval (seconds).

Example Usage:

*

OCIDEBUG001 1 (REQUEST A TRACE OF ATMOSPHERIC DISPERSION)

Variable Name - NUCOUT

Variable Type - Character, Scalar

Allowed Range - 3 <= length <= 8

Purpose - Specifies which nuclide will appear on the dispersion listing if one is produced. The dispersion listing is only produced if IDEBUG is greater than zero. The specified nuclide name must appear on the previously defined list of nuclides, NUCNAM, defined in Section 1.4.

This item is only required if IDEBUG is greater than zero.

Example Usage:

*

* NAME OF THE NUCLIDE TO BE LISTED ON THE DISPERSION LISTINGS

*

OCNUCOUT001 CS-137

1.13 Meteorological Sampling (M1) Specification

There are five options available to the user for specifying the weather data that will be used by ATMOS. The code can either be used to run a single weather sequence or multiple weather sequences.

If a single weather sequence is desired, there are three ways to specify the weather. The user can either (1) specify data for 120 hours of

weather on the ATMOS User Input File, (2) specify a starting day and hour in the weather data file for the weather sequence, or (3) specify constant weather conditions. For the specified starting day and hour option, the program will obtain 120 hours of weather data from the weather file beginning at the specified date and time. A file of hourly weather data covering a period of one year (8,760 hours) is required if the fixed start time or either of the weather sampling options are to be used. The format of this file is described in Appendix C.1.

The two methods of weather sampling are: (1) a modified version of the weather bin sampling method used by CRAC2 [Ri84], and (2) a stratified purely random sampling approach.

The weather bin sampling method sorts weather sequences into categories and assigns a probability to each category according to their initial conditions (wind speed and stability class) and the occurrence of rain (intensity and distance). Because the rain bins depend on rain intensity as well as the downwind distance at which rain occurs, the user is required to supply parameters defining the rain weather bins as part of the ATMOS User Input File. The definitions of the other weather bins, those defined by initial stability class and wind speed, are hard-wired in the code. The definitions of those initial condition weather bins are not the same as used in CRAC2. In addition to changing the breakpoints used to categorize wind speed, the wind speed slowdown bins of CRAC2 have been removed. A description of the MACCS weather sampling algorithm can be found in the MACCS Model Description [Jo89].

The stratified random sampling method allows the user to sample weather from each day of the year after division of each day into one, two, three or four equal time periods. Each weather sequence selected is considered to have the same probability of occurrence, that is,

$$P = \frac{1}{\text{total-selected-samples}}$$

Because of the flexibility that ATMOS affords in the specification of the geometric grid, it is necessary to guard against the possibility of running out of weather data. It is possible that 120 hours of weather may not suffice to carry all the plume segments out to the last spatial interval. Also, the user may wish to cause the occurrence of rain in the outermost spatial intervals in order to prevent radioactive material from escaping consideration. For these reasons, the user must specify a set of boundary weather conditions.

Depending on the option selected by the user, different data items will be required by ATMOS.

Variable Name - METCOD
 Variable Type - Integer, Scalar
 Allowed Range - 1 <= value <= 5

Purpose - Meteorological sampling option code:
1 - fixed start time in the weather file (day,hour),
2 - weather bin sampling,
3 - 120 hours of weather supplied by the user,
4 - constant weather conditions (use boundary weather),
5 - stratified random sampling from each day of the year.

Example Usage:

```
*  
* METEOROLOGICAL SAMPLING OPTION CODE:  
*  
M1METCOD001 2
```

1.14 Boundary Weather (M2) Data

Boundary Weather Data are required for all possible values of METCOD. This data block specifies the weather conditions that will be used if 120 hours of recorded weather data do not transport the last plume through the limiting spatial interval for measured weather, LIMSPA. The boundary weather data are also used for predicting the behavior of the plume at all spatial intervals beyond LIMSPA.

For the case of constant weather, METCOD=4, the boundary weather data in this section determines the constant weather conditions that will be used. The boundary weather is used throughout the atmospheric calculations and the value of LIMSPA is ignored by the program in this case.

Variable Name - LIMSPA
Variable Type - Integer, Scalar
Allowed Range - $0 \leq \text{value} \leq \text{NUMRAD}$
Purpose - This is the limiting spatial interval for use of recorded weather data. All spatial intervals beyond this spatial interval will use the boundary weather conditions specified below.

If a value of zero is specified, then the boundary weather conditions will be used right from the start. If METCOD=4, the value of LIMSPA is ignored.

Example Usage:

```
*  
* LAST SPATIAL INTERVAL FOR MEASURED WEATHER  
*  
M2LIMSPA001 25
```

Variable Name - BNDMXH
Variable Type - Real, Scalar
Allowed Range - $1.E2 \leq \text{value} \leq 1.E4$ (meters)
Purpose - This is the mixing layer height that will be used for the boundary weather conditions.

Example Usage:

```
*  
* BOUNDARY WEATHER MIXING LAYER HEIGHT  
*  
M2BNDMXH001 1000. (METERS)
```

Variable Name - IBDSTB
Variable Type - Integer, Scalar
Allowed Range - 1 <= value <= 6
Purpose - This is the stability class that will be used for the boundary weather conditions. The integers 1 through 6 represent Pasquill-Gifford stability classes A through F, respectively.

Example Usage:

```
*  
* BOUNDARY WEATHER STABILITY CLASS INDEX  
*  
M2IBDSTB001 1 (A-STABILITY)
```

Variable Name - BNDRAN
Variable Type - Real, Scalar
Allowed Range - 0. <= value <= 99. (millimeters / hour)
Purpose - This is the rain rate that will be used for the boundary weather conditions.

Example Usage:

```
*  
* BOUNDARY WEATHER RAIN RATE  
*  
M2BNDRAN001 0. (0 MM / HOUR - NO RAIN)
```

Variable Name - BNDWND
Variable Type - Real, Scalar
Allowed Range - 0.5 <= value <= 30. (meters / second)
Purpose - This is the wind speed that will be used for the boundary weather conditions.

Example Usage:

```
*  
* BOUNDARY WEATHER WIND SPEED  
*  
M2BNDWND001 0.5 (M / S)
```

1.15 Fixed Start Time (M3) Data

The data in this section must be supplied for all values of METCOD except METCOD=2 (meteorological bin sampling), and METCOD=5 (stratified random

sampling). The data is needed for all of these option choices because the food pathway calculations of the CHRONC module depend on the accident's day of occurrence.

If the user has chosen METCOD=1, the values of ISTRDY and ISTRHR specify the starting day and hour in the weather file of the single weather trial that will be performed.

Variable Name - ISTRDY
Variable Type - Integer, Scalar
Allowed Range - 1 <= value <= 365
Purpose - This is the day in the year on which the weather sequence is to begin.

Example Usage:

```
*  
* START DAY OF THE WEATHER SEQUENCE  
*  
M3ISTRDY001    152
```

Variable Name - ISTRHR
Variable Type - Integer, Scalar
Allowed Range - 1 <= value <= 24
Purpose - This is the hour of day on which the weather sequence is to begin.

Example Usage:

```
*  
* START HOUR OF THE WEATHER SEQUENCE  
*  
M3ISTRHR001    17
```

1.16 Meteorological Bin Sampling (M4) Data

The data in this section must be supplied if the user chooses METCOD=2. This sampling method requires that the meteorological data be sorted into a set of weather bins. The bins are defined to represent rain conditions in different distance intervals downwind from the accident site together with sixteen bins for initial conditions (stability class and wind speed).

Definition of the rain intensities and distance intervals that define the rain bins is the responsibility of the user. The user must specify either two or three rain intensities which are used as breakpoints in the categorization of rain rate (NRINTN). A rain intensity of zero is not allowed. For example, if the user specifies two rain intensity breakpoints of 1 mm/hr and 4 mm/hr, the following three rain intensity bins, where x is the rain intensity, will result:

1. $0 \text{ mm/hr} < x \leq 1 \text{ mm/hr}$,
2. $1 \text{ mm/hr} < x \leq 4 \text{ mm/hr}$,
3. $4 \text{ mm/hr} < x$.

The concept of rain distance intervals used in MACCS is similar to that used by CRAC2 [Ri84] but MACCS requires that the user specify the rain distances to be used in the weather categorization. Let us suppose that the user specifies 2, 4, 8, and 16 km as four distance intervals (NRNINT). Then these values define the following four rain distance intervals:

1. $0 \text{ km} \leq \text{distance of first rain occurrence} \leq 2 \text{ km}$,
2. $2 \text{ km} < \text{distance of first rain occurrence} \leq 4 \text{ km}$,
3. $4 \text{ km} < \text{distance of first rain occurrence} \leq 8 \text{ km}$,
4. $8 \text{ km} < \text{distance of first rain occurrence} \leq 16 \text{ km}$.

The total number of weather bins, N, is determined by the expression $N = \text{NRNINT} * (\text{NRINTN} + 1) + 16$, where NRNINT is the number of distance intervals and NRINTN is the number of rain intensity breakpoints. Thus, the total number of defined bins can range from twenty-eight to forty depending on the values supplied by the user.

The sixteen initial condition weather bins are hard-wired into the code as follows:

METBIN	STABILITY	WIND-SPEED (u)
1	A/B	$0 \text{ m/s} < u \leq 3 \text{ m/s}$
2	A/B	$3 \text{ m/s} < u$
3	C/D	$0 \text{ m/s} < u \leq 1 \text{ m/s}$
4	C/D	$1 \text{ m/s} < u \leq 2 \text{ m/s}$
5	C/D	$2 \text{ m/s} < u \leq 3 \text{ m/s}$
6	C/D	$3 \text{ m/s} < u \leq 5 \text{ m/s}$
7	C/D	$5 \text{ m/s} < u \leq 7 \text{ m/s}$
8	C/D	$7 \text{ m/s} < u$
9	E	$0 \text{ m/s} < u \leq 1 \text{ m/s}$
10	E	$1 \text{ m/s} < u \leq 2 \text{ m/s}$
11	E	$2 \text{ m/s} < u \leq 3 \text{ m/s}$
12	E	$3 \text{ m/s} < u$
13	F	$0 \text{ m/s} < u \leq 1 \text{ m/s}$
14	F	$1 \text{ m/s} < u \leq 2 \text{ m/s}$
15	F	$2 \text{ m/s} < u \leq 3 \text{ m/s}$
16	F	$3 \text{ m/s} < u$

Note that the definition of the initial condition weather categories are not the same as those used by CRAC2. Also, MACCS does not consider wind speed slowdowns in the weather categorization.

The user controls how many weather sequences are chosen from each weather bin by the choice of a value for NSMPLS, defined later in this section. This can be done in two different ways: either (1) request that the same number of weather sequences are to be chosen from each bin and specify the number of sequences, NSMPLS, to be selected ($1 \leq \text{NSMPLS} \leq 10$), or else (2) specify a non-uniform sampling from the categories ($\text{NSMPLS}=0$) as defined below.

Variable Name - NRNINT
 Variable Type - Integer, Scalar
 Allowed Range - $4 \leq \text{value} \leq 6$
 Purpose - Defines the number of rain distance intervals used in the weather categorization.

Example Usage:

```
*
* NUMBER OF RAIN DISTANCE INTERVALS FOR BINNING
*
M4NRNINT001 5
```

Variable Name - RNDSTS
 Variable Type - Real, Array
 Allowed Range - $0.001 \leq \text{value} \leq 99.9$ (kilometers)
 Purpose - Defines the rain distance interval endpoints to be used for the weather categorization. These distance values must lie within 10 percent of the spatial interval endpoint distances (variable SPAEND in Section 1.3), i.e., $0.9 \times \text{SPAEND}(i) \leq \text{RNDSTS}(j) \leq 1.1 \times \text{SPAEND}(i)$, for each j and some value of i . The user must supply NRNINT unique values in ascending order.

Example Usage:

```
*
* ENDPOINTS OF THE RAIN DISTANCE INTERVALS (KILOMETERS)
*
* NOTE: THESE MUST BE CHOSEN TO MATCH THE SPATIAL ENDPOINT DISTANCES
*       SPECIFIED FOR THE ARRAY SPAEND (10 PERCENT ERROR IS ALLOWED).
*
M4RNDSTS001 3.22 5.63 11.27 20.92 32.19 KM
```

Variable Name - NRINTN
 Variable Type - Integer, Scalar
 Allowed Range - $2 \leq \text{value} \leq 3$
 Purpose - Defines the number of rain intensity breakpoints to be used for the weather categorization.

Example Usage:

```
*  
* NUMBER OF RAIN INTENSITY BREAKPOINTS  
*  
M4NRINTN001 3
```

Variable Name - RNRATE
Variable Type - Integer, Array
Allowed Range - 0.001 <= value <= 100.0 (mm/hour)
Purpose - Defines the rain intensity breakpoints. The user must supply NRINTN different values in ascending order.

Example Usage:

```
*  
* RAIN INTENSITY BREAKPOINTS FOR WEATHER BINNING (MILLIMETERS PER HOUR)  
*  
M4RNRATE001 2. 4. 6.
```

Variable Name - NSMPLS
Variable Type - Integer, Scalar
Allowed Range - 0 <= value <= 10
Purpose - Defines the number of weather sequences to be chosen from each of the individual weather category bins. If the user supplies a value of zero, the following data cards allow the user to specify how many samples are to be chosen from each of the individual weather category bins.

Example Usage:

```
*  
* NUMBER OF SAMPLES PER BIN  
*  
M4NSMPLS001 4 (THIS NUMBER SHOULD SET TO 4 FOR RISK ASSESSMENT)
```

Variable Name - IRSEED
Variable Type - Integer, Scalar
Allowed Range - 0 <= value <= 255
Purpose - Defines the initial seed of the random number generator. Changes to this value will cause different weather sequences to be selected.

The random number generator of MACCS is included in the FORTRAN source code and therefore runs made on different types of computers should select identical sets of weather sequences.

Example Usage:

```
*
* INITIAL SEED FOR RANDOM NUMBER GENERATOR
*
M4IRSEED001  79
```

Note: the following cards in this section are only needed if NSMPLS=0.

Variable Name - NSBINS
Variable Type - Integer, Scalar
Allowed Range - 1 <= value <= N, total number of weather bins
Purpose - Defines the number of weather bins from which weather sequences are to be chosen. Sampling a subset of all the weather bins allows the effects of weather type to be examined.

Example Usage:

```
*
* NUMBER OF BINS TO BE SAMPLED (WHEN NSMPLS = 0)
*
M4NSBINS001  6
```

Variable Name - INDXBN
Variable Type - Integer, Array
Allowed Range - 1 <= value <= N, total number of weather bins
Purpose - Defines the list of weather bins from which weather sequences are to be selected. The user must supply NSBINS values in column one of the data block.

In order to find the index number to a rain bin, please refer to the page of the output listing with the title
- "METEOROLOGICAL BIN SUMMARY."

Variable Name - INWGHT
Variable Type - Integer, Array
Allowed Range - 1 <= value <= 8760
Purpose - Defines the number of weather sequences which the user would like to be selected from the specified weather bin. If the requested number of sequences cannot be found, the code will select all of the sequences in the specified bin. The user must supply NSBINS values in column two of the data block.

Example Usage:

```
*
*          BIN NUMBER      SAMPLE SIZE
*          INDXBN          INWGHT
M4SMPLDF001  3              8
M4SMPLDF002  4             16
M4SMPLDF003  5             12
```

M4SMPLDF004	6	4
M4SMPLDF005	7	4
M4SMPLDF006	8	4

1.17 User Supplied Weather Sequence (M5) Data

The data in this section must be supplied if the user chooses METCOD=3. There must be one data card for each hour of weather in the sequence. The five arrays in this section are supplied in a block of data as columns.

Variable Name - HRMXHT
 Variable Type - Real, Array
 Allowed Range - $1.E2 \leq \text{length} \leq 1.E4$ (meters)
 Purpose - These are the mixing layer heights that will be used for the single trial. They are given in units of meters. The user must supply 120 values of ISTAB in column one of the data block.

Note: The atmospheric dispersion model currently being used cannot accommodate a mixing layer height that varies with time during a weather sequence. The single value of mixing height which will be used in the atmospheric model is the largest value in the following set of values: the 120 values supplied here, and the boundary weather mixing layer height, BNDMXH.

Variable Name - IHRSTB
 Variable Type - Integer, Array
 Allowed Range - $1 \leq \text{value} \leq 6$
 Purpose - Defines the stability classes that will be used for the single trial. The integers 1 through 6 represent the Pasquill-Gifford stability classes A through F. The user must supply 120 values of ISTAB in column two of the data block corresponding to each of the 120 hours in the weather sequence.

Variable Name - HRRAIN
 Variable Type - Real, Array
 Allowed Range - $0.0 \leq \text{value} \leq 99.0$ (mm/hr)
 Purpose - Defines the rain rates that will be used for the single trial. They are given in units of millimeters per hour. The user must supply 120 values of RNMM in column three of the data block.

Variable Name - HRWNDV
 Variable Type - Real, Array
 Allowed Range - $0.5 \leq \text{value} \leq 30.0$ (m/s)
 Purpose - Defines the wind speeds that will be used for the single trial. They are given in units of meters per second. The user must supply 120 values of WINDSP in column four of the data block.

Variable Name - IHRDIR
 Variable Type - Integer, Array
 Allowed Range - 1 <= value <= 16
 Purpose - Defines the wind directions that will be used for the single trial. They are given as integers corresponding to the wind directions North through North-Northwest. The user must supply 120 values of IHRDIR in column five of the data block.

Example Usage:

```
*
* 120 HOURS OF WEATHER EXPLICITLY SPECIFIED BY THE USER
* (THIS DATA IS ONLY PROCESSED IF METCOD IS SET TO 3)
*
*           HRMXHT   IHRSTB   HRRRAIN   HRWNDV   IHRDIR
M5METDAT001   1000.     4.       0.       3.4     2
M5METDAT002   1000.     3.       0.       4.6     4
M5METDAT003   1000.     4.       0.       3.8     3
...
and likewise for a total of 120 data cards
...
M5METDAT120   1000.     2.       0.       5.4     8
```

References

- Br81 Brenk, H.D., and K.J. Vogt, "The Calculation of Wet Deposition from Radioactive Plumes," Nuclear Safety, Vol. 22, No. 3 (1981).
- Jo89 Jow, H.N., et al., MELCOR Accident Consequence Code System (MACCS) Volume 2: Model Description, NUREG/CR-4691, SAND86-1562, Sandia National Laboratories, Albuquerque, NM, 1990.
- NR82 U.S. Nuclear Regulatory Commission, PRA Procedures Guide, NUREG/CR-2300, Vol. 2, 1982, available for purchase from National Technical Information Service, Springfield, Virginia, 22161.
- Ri84 Ritchie, L.T., CRAC2 Model Description, NUREG/CR-2326, SAND81-1994, Sandia National Laboratories, Albuquerque, NM, 1983.

2.0 EARLY USER INPUT FILE

2.1 Introduction to EARLY

The EARLY module models the time period immediately following a reactor accident. This period is commonly referred to as the emergency phase. It may extend up to one week after the arrival of the first plume at any downwind spatial interval. The subsequent intermediate and long-term periods are treated by CHRONC. The user may specify scenarios that make use of evacuation, sheltering, and dose-dependent relocation. Results can be calculated for combinations of scenarios weighted either by time fractions (frequencies of occurrence) or population fractions (fraction of the population engaging in the specified behavior).

The EARLY module has the capability for combining results from up to three different emergency response scenarios. This is accomplished by appending "change cards" to the EARLY User Input File. The first emergency response scenario is defined in the main body of the EARLY User Input File. Up to two additional emergency response scenarios can be defined through change card sets positioned at the end of the file.

The delimiter used to separate the change card sets is a period (.) in column one. The end of the file is also signified by a period in column one. All of the MACCS User Input Files must end with a period in column one. The sample EARLY User Input File listed in Appendix D.2 is an example illustrating the use of change cards for a PRA application of the code.

The purpose of the change card processing in EARLY is solely to allow modification of the previously specified emergency response scenario data. Any cards appearing in the change card sets must have been previously defined in either the Evacuation Zone Data (Section 2.6) or the Shelter and Relocation Data (Section 2.7). If data items from another data block appear in the change cards, they will be ignored. Each set of change cards must include a new value of EANAM2, a text field describing the emergency response scenario. Also, each set of change cards must produce a change in at least one of the numeric input variables described in the Evacuation Zone Data or in the Shelter and Relocation Data.

EARLY calculates the doses and health effects that result from exposure during the emergency response period for up to three different emergency response scenarios and these are written in binary form to units 31 to 33. The results calculated by CHRONC are written to unit 34. All of these files have the same format.

For results which are calculated by both EARLY and CHRONC, such as population dose and cancer cases, the OUTPUT module automatically adds the value of the consequence calculated by CHRONC to the value of the same consequence measure produced by EARLY in order to generate the "overall combined" results. If more than one EARLY emergency response scenario is being run, these results are combined according to the weighting fractions supplied by the user on the EARLY User Input File,

and the weighted sum is then combined with the CHRONC result to produce the overall result.

Whenever results are combined by the code, the listing produced by the OUTPUT module will present the overall combination of results as well as each of the individual components from which it is constructed.

It is up to the user to specify the various parameters needed for these calculations. There are no default values. In addition to specifying the characteristics of the model, the user has complete control over the output produced by EARLY and must explicitly specify which results are to be produced. All of this information is supplied through the User Input File for EARLY and all of the input parameters are described in this chapter.

The User Input File for EARLY consists of ten data blocks used to define the simulation and an additional eight data blocks used to specify the output desired by the user. These eighteen data blocks are described below.

2.2 Miscellaneous (MI) Data

The user must supply information to identify the run, define the histogram approximating the crosswind Gaussian distribution, and also supply information describing the handling of the wind-rose. It is possible to specify a single wind-rose that will override the wind-roses that were calculated in ATMOS for each of the weather category sampling bins. The user must also specify how to treat changes in wind direction. There are three options to choose from and these are described below.

Variable Name - EANAM1
Variable Type - Character, Scalar
Allowed Range - 1 <= length <= 80
Purpose - Identifies a name describing the EARLY calculations. This is printed on all pages of the OUTPUT listing. A name describing the particular emergency response assumption will be requested in addition to this name.

Example Usage:

```
*
* GENERAL DESCRIPTIVE INFORMATION FOR THE "EARLY" INPUT FILE
*
MIEANAM1001 'IN2A.INP, SURRY, SAMPLE PROBLEM A, EARLY INPUT'
```

Variable Name - ENDAT2
Variable Type - Logical, Scalar
Allowed Value - .TRUE. or .FALSE.
Purpose - Control flag which allows the user to execute only the ATMOS and EARLY modules while skipping execution of the CHRONC module. If CHRONC is to be skipped, there is no

need for the user to specify a CHRONC User Input File. A value of .TRUE. causes MACCS to skip the CHRONC module. A value of .FALSE. causes the CHRONC module to be executed.

Example Usage:

```
*
* FLAG TO INDICATE THAT THIS IS THE LAST PROGRAM IN THE SERIES TO BE RUN
*
MIENDAT2001 .FALSE.      (SET THIS VALUE TO .TRUE. TO SKIP CHRONC)
```

Variable Name - IPLUME
Variable Type - Integer, Scalar
Allowed Range - 1 <= value <= 3
Purpose - Dispersion model option code:

- 1 - Straight line dispersion model:
All plume segments travel in the same direction. Each set of modeling results is rotated around the sixteen compass directions (population sectors) to yield sixteen sets of results for each weather trial.
- 2 - Wind-shift plume dispersion model with rotation:
Each plume segment in the release travels in the direction that the wind is blowing at the time that its representative time point (REFTIM in Section 1.11) leaves the reactor. Each set of modeling results is rotated around the sixteen compass directions (population sectors) to yield sixteen sets of results for each weather trial.
- 3 - Wind-shift dispersion model without rotation:
Each plume segment in the release travels in the direction that the wind is blowing at the time that its representative time point (REFTIM in Section 1.11) leaves the reactor. No rotation of the wind shift pattern is performed. Each weather trial yields one set of results.

Example Usage:

```
*
* DISPERSION MODEL OPTION CODE: 1- STRAIGHT LINE,
*                                2- WIND-SHIFT WITH ROTATION,
*                                3- WIND-SHIFT WITHOUT ROTATION.
*
MIIPLUME001 2
```

Variable Name - NUMFIN
Variable Type - Integer, Scalar
Allowed Range - 3, 5, or 7
Purpose - Number of fine grid subdivisions used by the model. A step function is used to approximate the Gaussian

distribution of the plume in the crosswind direction. Each of the 22.5 degree sectors is subdivided into NUMFIN fine grid elements, with doses and risks being uniform in each of the fine grid elements.

Example Usage:

```
*  
* NUMBER OF FINE GRID SUBDIVISIONS USED BY THE MODEL  
*  
MINUMFIN001  7      (3, 5 OR 7 ALLOWED)
```

Variable Name - IPRINT
Variable Type - Integer, Scalar
Allowed Range - 0 <= value <= 10
Purpose - Specifies the quantity of debug output that is desired. The higher the value, the more output will be printed. Debug output is written to FORTRAN unit 6 (TAPE6). Normal runs should specify a value of zero. The choice of any other value should only be made by people familiar with the code for examination in detail of single weather sequences.

For various values of IPRINT, the code will print out intermediate results on the list output file. These are described below.

IPRINT ≥1: skin dose conversion factors, centerline doses for all organs (if IPLUME=1), Gaussian histogram and cloudshine correction factors, return code values (RETCOD).

IPRINT ≥2: final groundshine dose rate for each organ, each plume segment.

IPRINT ≥4: total acute dose for organs 2 and 3, early fatality, early injury, and cancer risk values for each spatial element.

IPRINT ≥8: acute dose to organs 2 and 3 after completion of subroutine RELZON, acute dose to organs 2 and 3 after completion of subroutine ESTAT.

Example Usage:

```
*  
* LEVEL OF DEBUG OUTPUT REQUIRED, NORMAL RUNS SHOULD SPECIFY ZERO  
*  
MIIPRINT001  0
```

Variable Name - RISCAT
Variable Type - Logical, Scalar
Allowed Value - .TRUE. or .FALSE.
Purpose - If the option of weather category bin sampling was chosen by the user in the ATMOS User Input File (METCOD=2), the display of results produced by the OUTPUT module can show

the relative contribution of each of the weather category bins to the mean consequence value.

Example Usage:

```
*
* FLAG INDICATING IF RISK CONTRIBUTION IS TO BE BROKEN DOWN BY WEATHER
* CATEGORY BIN ON THE OUTPUT LISTING
*
MIRISCAT001 .FALSE.
```

Variable Name - OVERRID
Variable Type - Logical, Scalar
Allowed Value - .TRUE. or .FALSE.
Purpose - Specifies whether the wind-rose probabilities are to be supplied by the user. If the weather sampling option was chosen in ATMOS (METCOD=2), wind-roses for each weather sampling bin have been passed down from ATMOS. Those wind-roses will be used if OVERRID = .FALSE. If no wind-rose is available to EARLY, a uniform wind-rose will be used, that is, P = 0.0625 in each direction.

Example Usage:

```
*
* FLAG INDICATING IF WIND-ROSES FROM ATMOS ARE TO BE OVERRIDDEN
*
MIOVERRID001 .FALSE. (USE THE WIND ROSE CALCULATED FOR EACH WEATHER BIN)
```

Note to user: The following data is only required if (OVERRID=.TRUE.).

Variable Name - WINROS
Variable Type - Real, Array
Allowed Range - 0. <= value <= 1.
Purpose - These are the probabilities of the wind blowing from the site into each of the sixteen compass sectors (rotating clockwise from N to NNW).

The sum of these values must be between 0.95 and 1.05.
The user must supply 16 values in rows on one or more data cards.

Example Usage:

```
*
* SITING STUDY WINDROSE FOR THE PEACH BOTTOM SITE
*
MIWINROS001 8.521E-02 6.360E-02 4.605E-02 5.189E-02 6.869E-02 9.493E-02
MIWINROS002 1.145E-01 1.090E-01 6.019E-02 4.326E-02 3.148E-02 3.238E-02
MIWINROS003 3.383E-02 4.625E-02 5.446E-02 6.424E-02
```

2.3 Population Distribution (PD) Data

The user must supply information to define the polar coordinate population distribution surrounding the site. This information can be supplied

from the Site Data File or a uniform population distribution can be specified by the user. The format of the Site Data File is described in Appendix B.3.

Note: Whatever values are supplied here will be used by both the EARLY and the CHRONC modules in defining the characteristics of the region surrounding the site. There is no possibility of having EARLY and CHRONC use different population distributions.

Variable Name - POPFLG
Variable Type - Character, Scalar
Allowed Range - 4 <= length <= 7
Purpose - Specifies whether the population is to be defined by the Site Data File or if it is to be uniform. The value specified must be FILE or UNIFORM. If a value of UNIFORM is supplied, the program will not attempt to read the Site Data File.

Example Usage:

```
*  
* POPULATION DISTRIBUTION FLAG, SPECIFY 'UNIFORM' OR 'FILE'  
*  
PDPOPFLG001 UNIFORM
```

Variable Name - IBEGIN
Variable Type - Integer, Scalar
Allowed Range - 1 <= value <= NUMRAD
Purpose - Specifies the spatial interval at which the population begins. Inside of this region there are no people. This allows the modeling of an exclusion zone. This value is only required if POPFLG=UNIFORM.

Example Usage:

```
*  
* FIRST SPATIAL INTERVAL IS AN EXCLUSION ZONE  
*  
PDIBEGIN001 2
```

Variable Name - POPDEN
Variable Type - Real, Scalar
Allowed Range - 0.0 <= value <= 1.E6 (people / square-kilometer)
Purpose - Specifies the uniform population density of the region. This value is only required if POPFLG=UNIFORM.

Example Usage:

```
*  
* ASSUME 100 PEOPLE PER SQ. KILOMETER  
*  
PDPOPDEN001 100.
```

2.4 Organ Definition (OD) Data

The MACCS code will only calculate doses for the organs defined in this section. The shelter and relocation model (variable CRIORG), and the health effects models (prompt fatalities, early injuries, and latent cancers) must only reference organs which are on the list of organs. The same is true of the dose related output options (results of type 3, 5, and 6). MACCS will check to ensure that appropriate dosimetry data are available on the Dose Conversion Factors Data File for all of these organs.

MACCS can calculate two kinds of doses: lifetime dose and effective acute dose.

Lifetime dose is utilized for determining the need for mitigative actions and for calculating the cancer induction and population dose results. It represents the 0 to 50 year dose commitment to an ICRP reference man [IC79].

Effective acute doses are used for calculating the acute health effects in the EARLY module. The acute health effects are "early fatalities" and "early injuries." A full description of the meaning of effective acute dose can be found in Section 2.8, Early Fatality Data.

The list of organs for which dosimetry data are available is presented below.

	EFFECTIVE		
	ACUTE	LIFETIME	
'SKIN'	YES	NO	
'LUNGS'	YES	YES	
'RED MARR'	YES	YES	(red bone marrow)
'SMALL IN'	YES	YES	(small intestine)
'LOWER LI'	YES	YES	(lower large intestine)
'STOMACH'	YES	YES	
'THYROID'	NO	YES	
'THYROIDH'	YES	YES	(pseudo-thyroid for calculating health effects)
'EDEWBODY'	NO	YES	(effective whole body dose equivalent)
'BONE SUR'	NO	YES	(bone surface)
'BREAST'	NO	YES	
'OVARIES'	NO	YES	
'TESTES'	NO	YES	

If the Dose Conversion Factors Data File supplied with MACCS is to be used for the calculations, the organ names must be spelled exactly as above. If some other dose factor file is used, its organ names must be identical to those input to EARLY in the ORGNAM list defined below.

Apostrophes are mandatory if the organ name has any embedded blanks. Any reference to an organ that cannot be found on the organ list (ORGNAM) will cause the error flag to be set and execution will be inhibited.

Variable Name - NUMORG
 Variable Type - Integer, Scalar
 Allowed Range - 1 <= value <= 10
 Purpose - The number of organs for which doses will be calculated.
 For each of these organs, dose factors must be found on
 the Dose Conversion Factors File.

Example Usage:

```
*
* NUMBER OF ORGANS DEFINED FOR HEALTH EFFECTS
*
ODNUMORG001    9
```

Variable Name - ORGNAM
 Variable Type - Character, Array
 Allowed Range - 2 <= length <= 10
 Purpose - The names of the NORGAN organs defined in the model. For
 each of these organs, dose conversion factors must be found on the Dose Conversion Factors File. The skin
 organ receives special handling. If skin doses are to be
 calculated, SKIN must be the first organ name on the
 list. If skin doses are not required, an organ called
 NULL must occupy the first position. Do not use NULL
 anywhere but in the first position on the list.

Note: The CHRONC module normally only calculates doses to the cancer
 target organs defined in Section 2.10. If the user would like to
 calculate the long-term dose to an organ which is not defined to
 be a cancer target organ, such as the effective whole body dose
 equivalent (EDEWBODY), that organ name must appear as the second
 organ on the list of organs being defined here.

If the user specifies the long-term critical organ, CRTOCR,
 defined in Section 3.4, to be an organ which is not a cancer
 target organ, a fatal error will result unless that organ appears
 as the number two organ on the list of organs below.

Example Usage:

```
*
* NAMES OF THE ORGANS DEFINED FOR HEALTH EFFECTS
*
ODORGNAM001 'SKIN', 'EDEWBODY', 'LUNGS', 'RED MARR', 'LOWER LI',
ODORGNAM002 'STOMACH', 'THYROIDH', 'BONE SUR', 'BREAST'
*
or if skin doses are not required,
*
ODORGNAM001 'NULL', 'EDEWBODY', 'LUNGS', 'RED MARR', 'LOWER LI',
ODORGNAM002 'STOMACH', 'THYROIDH', 'BONE SUR', 'BREAST'
```

2.5 Shielding and Exposure (SE) Data

This section defines the shielding factors for exposure to cloudshine, groundshine, inhalation and deposition to skin for three types of activities (normal activity, evacuation, and sheltering). A breathing rate is also specified for each type of activity. In addition, the resuspension parameters to be used for the emergency phase time period (EARLY), the resuspension coefficient and resuspension half-life are also defined.

Some of the parameter values defined in this section are used in both the EARLY and the CHRONC modules; these are: (1) the normal activity groundshine and (2) inhalation protection factors as well as the (3) normal activity breathing rate. The CHRONC module does not calculate the effects resulting from direct exposure to the radioactive cloud, therefore it makes no use of the (1) cloudshine and (2) deposition to skin shielding factors. The long-term resuspension parameters are defined on the basis of data supplied in the CHRONC User Input File and the emergency phase resuspension parameters defined here are not used in the CHRONC module.

Variable Name - CSFACT
Variable Type - Real, Array
Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)
Purpose - Cloudshine shielding factor for the three types of activity.

Example Usage:

```
*
* THREE VALUES OF EACH PROTECTION FACTOR ARE SUPPLIED,
* ONE FOR EACH TYPE OF ACTIVITY. THE FACTORS ARE LISTED
* IN THE FOLLOWING ORDER: EVACUATION, NORMAL ACTIVITY, SHELTERING
*
* CLOUD SHIELDING FACTOR
*
SECSFACT001 1. 0.75 0.6
```

Variable Name - PROTIN
Variable Type - Real, Array
Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)
Purpose - Inhalation protection factor for the three types of activity.

Example Usage:

```
*
* PROTECTION FACTOR FOR INHALATION
*
SEPROTIN001 1. 0.41 .33
```

Variable Name - BRRATE
Variable Type - Real, Array
Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (cubic meters per second)
Purpose - Breathing rates for the three types of activity.

Example Usage:

```
*  
* BREATHING RATE (CUBIC METERS PER SECOND)  
*  
SEBRRATE001  0.000266  0.000266  0.000266
```

Variable Name - SKPFAC
Variable Type - Real, Array
Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)
Purpose - Skin protection factors for the three types of activity.

Example Usage:

```
*  
* SKIN PROTECTION FACTOR  
*  
SESKPFAC001  1.0  0.41  0.33
```

Variable Name - GSHFAC
Variable Type - Real, Array
Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)
Purpose - Groundshine shielding factors for the three types of activity.

Example Usage:

```
*  
* GROUND SHIELDING FACTOR  
*  
SEGSHFAC001  0.5  0.33  0.2
```

Variable Name - RESCON
Variable Type - Real, Scalar
Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (per meter)
Purpose - Emergency phase resuspension concentration coefficient initial value. The weathering half-life associated with RESCON is defined below as RESHAF. The resuspension model used is as follows:

$\text{air-conc.} = \text{ground-conc.} * \text{RESCON} * \text{EXP} (-t * 0.693 / \text{RESHAF})$, where

air-conc. - the instantaneous air concentration resulting from resuspension of material deposited by a single plume segment at t seconds following the departure of that plume segment (becquerels / cubic-meter),

ground-conc. = final ground concentration following the passage of the
plume segment (becquerels / square-meter),

RESCON = initial value of the resuspension coefficient (per meter),

t = time after passage of the plume (seconds),

RESHAF = resuspension coefficient half-life (seconds).

Example Usage:

```
*  
* RESUSPENSION INHALATION MODEL CONCENTRATION COEFFICIENT (/METER)  
*  
SERESCON001  1.E-4      (RESUSPENSION IS TURNED ON)
```

Variable Name - RESHAF
Variable Type - Real, Scalar
Allowed Range - 1.0 <= value <= 1.E10 (seconds)
Purpose - Emergency phase resuspension concentration coefficient
weathering half-life.

Example Usage:

```
*  
* RESUSPENSION CONCENTRATION COEFFICIENT HALF-LIFE (SEC)  
*  
SERESHAF001  1.825E5    (2.11 DAYS)
```

2.6 Evacuation Zone (EZ) Data

In the current implementation, MACCS is limited to an evacuation model where the only movement allowed is radially outward.

All individuals between the first and last evacuating intervals [INIEVA and LASEVA(3)] are assumed to evacuate. Evacuating individuals travel radially outward at a constant speed and are subject to radiation exposure until they leave the LASMOV spatial interval whereupon they are assumed to avoid all further exposure.

Within the evacuation zone, up to three regions with different evacuation delay times may be defined. The three times associated with these regions are specified in EDELAY. Outer boundaries of the three evacuation rings are specified in LASEVA. Some of these values may be zero, indicating that the region is null.

Variable Name - EANAM2
Variable Type - Character, Scalar
Allowed Range - 1 <= length <= 80
Purpose - Identifies the name of the emergency response scenario being studied. This name will be printed on all pages of the OUTPUT listing. A unique name must be specified for each emergency response.

Example Usage:

```
*
* SPECIFIC DESCRIPTION OF THE EMERGENCY RESPONSE STRATEGY BEING USED
*
EZEANAM2001 'EVACUATION WITHIN 10 MILES, RELOCATION MODELS ELSEWHERE'
```

Variable Name - WTNAME
Variable Type - Character, Scalar
Allowed Range - 4 <= length <= 6
Purpose - Specifies whether the weighting fraction defined below is to be applied to either the consequence magnitude (fraction of the people) or its associated probability (fraction of the time).

Example Usage:

```
*
* THE TYPE OF WEIGHTING TO BE APPLIED TO THE EMERGENCY RESPONSE SCENARIOS
* YOU MUST SPECIFY A VALUE OF 'TIME' OR 'PEOPLE'
*
EZWTNAME001 'PEOPLE'
```

Variable Name - WTFRAC
Variable Type - Real, Scalar
Allowed Range - 0.0 <= value <= 1.0
Purpose - Weighting fraction to be applied to the results from this emergency response scenario. This value is used by the OUTPUT module in combining results for the "overall weighted sum." The weighting can be done for either "fraction of the people" or "fraction of the time" as determined by the input variable WTNAME.

Example Usage:

```
*
* WEIGHTING FRACTION APPLICABLE TO THIS SCENARIO
*
EZWTFRAC001 0.95 (95% OF THE PEOPLE WITHIN 10 MILES EVACUATE)
```

Variable Name - LASMOV
Variable Type - Integer, Scalar
Allowed Range - 0 <= value <= (NUMRAD - 1)
Purpose - The outermost spatial interval of the evacuation movement zone. This is the distance after which evacuees are assumed to disappear from the early health effects model and receive no further dose.

If the user specifies a value of zero, there will be no evacuation and no further data in this section are required.

Example Usage:

```
*
* LAST RING IN THE MOVEMENT ZONE
*
EZLASMOV001 15      (EVACUEES DISAPPEAR AFTER TRAVELLING TO 20 MILES)
```

Note to user: The following items in this section are only required if LASMOV is greater than zero.

Variable Name - INIEVA
Variable Type - Integer, Scalar
Allowed Range - $1 \leq \text{value} \leq \text{LASMOV}$
Purpose - This value is only required if LASMOV is greater than zero. It specifies the innermost spatial interval of the evacuation zone. A value greater than one means that there will be an inner shelter zone. The inner shelter zone comprises the INIEVA-1 spatial intervals closest to the reactor.

Example Usage:

```
*
* FIRST SPATIAL INTERVAL IN THE EVACUATION ZONE
*
EZINIEVA001 1      (NO INNER SHELTER ZONE)
```

Variable Name - LASEVA
Variable Type - Integer, Array
Allowed Range - $0 \leq \text{value} \leq \text{LASMOV}$
Purpose - The outer spatial intervals marking off the three evacuation delay zones from nearest to farthest. These allow a phased evacuation. The user must supply three values. A value of zero for any of the rings causes that zone to be null. The non-zero values must not be less than INIEVA and they must be in ascending order.

Example Usage:

```
*
* OUTER BOUNDS OF THE 3 EVACUATION ZONES (0 MEANS THE ZONE IS NOT
* DEFINED)
*
EZLASEVA001 0 0 12 (EVACUATION FROM A SINGLE ZONE OUT TO 10 MILES)
```

Variable Name - EDELAY
Variable Type - Real, Array
Allowed Range - $0. \leq \text{value} \leq 86400.0$ (seconds) (one day)
Purpose - Defines the time necessary for evacuees to get moving. Before evacuating, evacuees can receive doses from the plume segments while continuing normal activity. The

user must supply evacuation delay times for each of the three evacuation rings even if some of them are null. Evacuees remain in place until EDELAY seconds have elapsed from the off-site alarm time, OALARM, (see Section 1.11) and then they begin their evacuation.

Note: The reference point for evacuation (alarm time) is different from the reference time for relocation actions (time after first plume arrival).

Example Usage:

```
*
* EVACUATION DELAY TIMES FOR THE 3 EVAC ZONES
*
EZEDELAY001 0. 0. 7200. (SURRY)
```

Variable Name - ESPEED
Variable Type - Real, Scalar
Allowed Range - $0.1 \leq \text{value} \leq 1.E6$ (meters / second)
Purpose - The speed at which all evacuees travel radially outward.

Example Usage:

```
*
* RADIAL EVACUATION SPEED (METERS / SECOND)
*
EZESPEED001 1.8 (SURRY)
```

2.7 Shelter and Relocation (SR) Data

The user can specify the existence of two shelter zones; one inside of the evacuation zone, the other outside of it. Both of these zones are optional. The inner shelter zone is defined if a value greater than one was specified for INIEVA. The outer shelter zone is defined if LASHE2 is assigned a non-zero value. Even though these zones are optional, the code requires that all of the parameters described in this section be supplied.

Variable Name - TTOSH1
Variable Type - Real, Scalar
Allowed Range - $0.0 \leq \text{value} \leq 86400.0$ (seconds) (one day)
Purpose - Defines the time to take shelter in the inner shelter zone. People here take shelter TTOSH1 seconds after the offsite alarm time, OALARM, (see Section 1.11). Normal activity shielding factors are used up to the time at which individuals take shelter. Upon taking shelter, the shelter shielding factors are used.

Note: The reference point for sheltering (alarm) is different from reference time for relocation actions (first plume arrival).

Example Usage:

*
* TIME TO TAKE SHELTER IN THE INNER SHELTER ZONE (SECONDS FROM OALARM)
*
SRTTOSH1001 0. (THIS ZONE IS NULL BECAUSE INIEVA=1)

Variable Name - SHELTL
Variable Type - Real, Scalar
Allowed Range - 0.0 <= value <= 86400.0 (seconds) (one day)
Purpose - Defines the shelter duration in the inner shelter zone. Sheltering shielding factors are used during this time period. After this period has elapsed, people are removed from the shelters without incurring any additional dose, i.e., any transit time over contaminated ground necessary to leave the region should be included in SHELTL.

Example Usage:

*
* SHELTER TIME IN THE INNER SHELTER ZONE (SECONDS)
*
SRSHELTL001 0. (THIS ZONE IS NULL BECAUSE INIEVA=1)

Variable Name - LASHE2
Variable Type - Integer, Scalar
Allowed Range - 0 <= value <= NUMRAD
Purpose - Defines the outermost ring of the outer shelter zone. The relocation zone begins at the next interval. If there is an evacuation (LASMOV > 0), and a non-zero value is specified for LASHE2, then LASHE2 must be greater than the outermost evacuating interval.

Example Usage:

*
* LAST RING OF THE OUTER SHELTER ZONE
*
SRLASHE2001 0 (THIS ZONE IS NULL)

Variable Name - TTOSH2
Variable Type - Real, Scalar
Allowed Range - 0.0 <= value <= 86400.0 (seconds) (one day)
Purpose - Defines the time to take shelter in the outer shelter zone. People here take shelter TTOSH2 seconds after the offsite alarm time, OALARM, (see Section 1.11). Normal activity shielding factors are used up to the time at which individuals take shelter. Upon taking shelter, the shelter shielding factors are used.

Example Usage:

```
*  
* TIME TO TAKE SHELTER IN THE OUTER SHELTER ZONE (SECONDS FROM OALARM)  
*  
SRTTOSH2001      0.  (THIS ZONE IS NULL)
```

Variable Name - SHEL2
Variable Type - Real, Scalar
Allowed Range - 0.0 <= value <= 86400.0 (seconds)
Purpose - Defines the shelter duration in the outer shelter zone. Sheltering shielding factors are used during this time period. After this period has elapsed, people are removed from the shelters without incurring any additional dose, i.e., any transit time over contaminated ground necessary to leave the region should be included in SHEL2.

Example Usage:

```
*  
* SHELTER TIME IN THE OUTER SHELTER ZONE (SECONDS)  
*  
SRSHEL2001      0.  (THIS ZONE IS NULL)
```

Variable Name - ENDEMP
Variable Type - Real, Scalar
Allowed Range - 86400.0 <= value <= 604800.0 (seconds after plume arrival)

Purpose - Defines the duration of the emergency phase period. EARLY only calculates doses that would be received during the emergency phase time period. Doses at each spatial interval are cut off at ENDEMP seconds after the arrival of the first plume segment to reach the interval. This cutoff applies to all individuals, no matter where they are located. Any subsequent doses will be calculated by CHRONC.

ENDEMP is also the duration for which evacuees and shelterees are kept away from their homes if there was any contamination in the coarse grid element in which they reside.

Example Usage:

```
*  
* DURATION OF THE EMERGENCY PHASE (SECONDS FROM PLUME ARRIVAL)  
*  
SRENDEMP001 604800.  (ONE WEEK)
```

Variable Name - CRIORG
Variable Type - Character, Scalar
Allowed Range - 2 <= length <= 10

Purpose - Defines the critical organ for relocation decisions during the emergency phase period considered by EARLY. In order to determine whether people can remain in the relocation zone, the total committed dose to the critical organ of an individual who remained in place for the entire emergency phase is calculated. The critical organ must be found on the list of organs, ORGNAM, defined in Section 2.4.

Example Usage:

```
*  
* CRITICAL ORGAN FOR RELOCATION  
*  
SRCRIORG001 'EDEWBODY'
```

Variable Name - TIMHOT

Variable Type - Real, Scalar

Allowed Range - 0.0 <= value <= ENDEMP (seconds after plume arrival)

Purpose - Defines the hot spot relocation action time. Hot spot relocation can only occur for individuals residing outside of the emergency response zone. That is, doses to people awaiting evacuation or protected in shelters will not be affected by the hot spot relocation model.

If the total dose commitment to any individual in a coarse grid element in the relocation region would exceed DOSHOT sieverts to the critical organ, CRIORG, for someone remaining there for the entire emergency phase (ENDEMP), people in that element are relocated at TIMHOT seconds after the arrival of the first plume at that distance.

For the purpose of evaluating the need for hot spot and normal relocation, the total dose commitment is the dose which would be received by an individual who remained in place for the entire emergency phase period while engaging in "normal" activity. The pathways used for calculating the total dose commitment are: cloudshine, groundshine, direct inhalation, and resuspension inhalation.

Any individuals relocated due to hot spots are removed from the problem for the duration of the emergency phase and receive no additional dose during the emergency phase.

Example Usage:

```
*  
* HOT SPOT RELOCATION TIME (SECONDS FROM PLUME ARRIVAL)  
*
```

SRTIMHOT001 43200. (ONE-HALF DAY)

Variable Name - TIMNRM
Variable Type - Real, Scalar
Allowed Range - TIMHOT <= value <= ENDEMP (seconds after plume arrival)
Purpose - Defines the normal relocation action time. Normal relocation can only occur for individuals residing outside of the emergency response zone. That is, doses to people awaiting evacuation or protected in shelters will not be affected by the normal relocation model.

If the total dose commitment to any individual in a coarse grid element in the relocation region would exceed DOSNRM sieverts to the critical organ, CRIORG, for someone remaining there for the entire emergency phase (ENDEMP), people in that element are relocated at TIMNRM seconds after the arrival of the first plume at that distance. Any individuals subject to normal relocation are removed from contaminated areas for the duration of the emergency phase and receive no additional dose during the emergency phase.

For the purpose of evaluating the need for hot spot and normal relocation, the total dose commitment is the dose which would be received by an individual who remained in place for the entire emergency phase period while engaging in "normal" activity. The pathways used for calculating the total dose commitment are: cloudshine, groundshine, direct inhalation, and resuspension inhalation.

Example Usage:

*
* NORMAL RELOCATION TIME (SECONDS FROM PLUME ARRIVAL)
*
SRTIMNRM001 86400. (ONE DAY)

Variable Name - DOSHOT
Variable Type - Real, Scalar
Allowed Range - 0.0 <= value <= 100.0 (sieverts)
Purpose - Defines the hot spot relocation dose threshold. If the total dose commitment to individuals outside of the evacuation and sheltering zones who remained stationary for the entire emergency phase period would exceed DOSHOT, those people would be relocated (removed) at the hot-spot relocation time (TIMHOT).

Example Usage:

```
*
* HOT SPOT RELOCATION DOSE THRESHOLD (SIEVERTS)
*
SRDOSHOTO01  0.5  (50 REM DOSE TO WHOLE BODY IN 1 WEEK TRIGGERS
*              RELOCATION)
```

Variable Name - DOSNRM
Variable Type - Real, Scalar
Allowed Range - 0. <= value <= DOSHOT (sieverts)
Purpose - Defines the normal relocation dose threshold. If the total dose commitment to individuals outside of the evacuation and sheltering zones who remained stationary for the entire emergency phase period would exceed DOSNRM, those people would be relocated (removed) at the normal relocation time TIMNRM.

Example Usage:

```
*
* NORMAL RELOCATION DOSE THRESHOLD (SIEVERTS)
*
SRDOSNRM001  0.25  (25 REM DOSE COMMITMENT IN 1 WEEK TRIGGERS REMOVAL)
```

2.8 Early Fatality (EF) Data

The individual risk of prompt fatality is modeled in MACCS using a two parameter Weibull function here called a hazard function [Ev85]. The hazard function is used to sum the cumulative risk from a number of potential types of damage as follows:

$$\text{RISK} = 1 - e^{-\Sigma H}, \text{ where}$$

$$H = \ln 2 \left(\frac{\text{DOSE}}{\text{EFFACA}} \right)^{\text{EFFACB}}$$

DOSE = effective acute dose to the target organ (described below),

EFFACA = the alpha (LD50) parameter in the hazard function (ibid., pg. II-8),

EFFACB = the beta or exponential parameter in the hazard function which defines the steepness of the dose-response function.

A dose threshold is incorporated into the early fatality model in the following manner. If the dose to any of the target organs is below the user specified threshold (see EFFTHR below), then the hazard (H) from that organ is set to zero.

When radioactive material is inhaled and retained in the respiratory system, an individual may continue to receive a radiation dose for long periods of time after the material was inhaled. Depending on particle size and chemical form, clearance mechanisms may remove the material from the body or transport it away from the respiratory system to other organs of the body. For this reason, it does not make sense to refer to radiation dose without specifying the time period of interest. The concept of lifetime dose commitment is widely used [IC79]. As applied in MACCS, it refers to the dose received over the fifty year period following inhalation by a standard reference man who is 30 years old. This lifetime dose is used to determine the need for mitigative actions and for calculating cancers and population dose.

Implementation of the Harvard Report [Ev85] early health effects models requires a calculational method which takes account of dose protraction. MACCS treats protraction by using for all early health effects a series of LD₅₀ or D₅₀ values that apply to a sequential set of time periods of fixed length.

For the calculation of early fatalities and injuries in MACCS, a new measure of dose was defined in order to reduce the computational demands of the calculations. Throughout this document it will be referred to as "effective acute" dose.

The effective acute dose, D_e, is that dose which if delivered entirely in one day would induce the same health effects as the actual dose that was delivered over many days. Thus,

$$H = \ln 2 \left(\frac{D_e}{\alpha_1} \right)^\beta = \ln 2 \left(\sum_t \frac{D_t}{\alpha_t} \right)^\beta$$

Where D_e = CF_e and D_t = CF_t in which C is the amount of material inhaled from the plume, F_e is the effective acute dose conversion factor, and F_t is the dose conversion factor for the actual dose D_t delivered in time period t. Substitution now yields

$$F_e = \sum_t \frac{\alpha_1}{\alpha_t} F_t$$

Effective acute dose conversion factors are only supplied for the organs used for calculating the early health effects. The other organs on the dose conversion file have been given effective acute dose conversion factors of -1, which prevents their inadvertent use since any resulting doses would be negative. The dose reduction factors, i.e.,

$$\frac{\alpha_1}{\alpha_t}$$

currently being used for effective acute doses are as follows:

EFFECTIVE ACUTE DOSE REDUCTION FACTORS (unitless)

	TIME PERIOD AFTER EXPOSURE (DAYS)					
	<u>0-1</u>	<u>1-7</u>	<u>7-14</u>	<u>14-30</u>	<u>30-200</u>	<u>200-365</u>
RED MARR	1.	.5	.5	.25		
LUNGS	1.	.0625	.0625	.027	.027	.0109
THYROID	1.	.2	.2	.2		
STOMACH	1.	.37				
LOWER LI	1.	.43				
SMALL IN	1.	.43				

The generation of dose conversion factors is currently done by a pre-processor program which reads a database supplied by Oak Ridge National Laboratory. This pre-processor aggregates the data into a condensed format containing only the numbers needed by MACCS.

For bone marrow death (with supportive treatment), the Harvard Report shows LD50 values of 4.5 Gy for the 0 to 1 day time period, 9 Gy for the 1 to 14 day time period, and 18 Gy for the 14 to 30 day time period. Instead of calculating three different red marrow doses and applying the three different values of LD50 to calculate risk, we calculate a single red marrow dose using the effective acute dose conversion factor.

So, according to the above table, effective acute red marrow dose is 100 percent of the first day's dose, 50 percent of the next 13 day's dose, and 25 percent of the next 16 day's dose. This acute dose is then used in the risk equation with the LD50 for the 0 to 1 day time period in order to obtain the hazard of bone marrow syndrome.

The dose protraction effect described here is only applied to the internal exposure resulting from inhalation. Dose from the direct exposure pathways in EARLY (groundshine and cloudshine) are summed together with no reduction factor being applied even if the exposure lasted more than one day. The current implementation of the early health effects models does not distinguish between cloudshine, groundshine, and the 0 to 1 day inhalation dose. They are equally effective in causing damage.

The error introduced by attributing all the direct exposure dose to the first day is small and is in the direction of overestimating risk. In most cases, emergency plans should ensure that no individuals are permitted to remain on contaminated ground for much longer than a day if dose levels were high enough to pose a risk of early health effects.

Resuspension inhalation is another area where the importance of the pathway is overestimated somewhat. The inhalation dose from resuspended material is treated identically to the inhalation dose from direct inhalation of the plume. That is, it is treated as though all the resuspended material was inhaled at the beginning of the exposure period (time=zero).

Information in this section is only used to control the calculation of individual risk. Results to be processed by OUTPUT, e.g., total cases of early fatality, average individual risk of early fatality, and centerline risk vs. distance of early fatality, are described in later sections of this document. In order for the code to produce early fatality results, the early fatality model must be defined in this section.

Variable Name - NUMEFA
Variable Type - Integer, Scalar
Allowed Range - $0 \leq \text{value} \leq 5$
Purpose - The number of early fatality effects to be included in the total risk of early fatality. A value of zero means that the early fatality model will not be used.

Example Usage:

```
*  
* NUMBER OF EARLY FATALITY EFFECTS  
*  
EFNUMEFA001  3
```

Note to user: The remaining parameters in this section are only required if NUMEFA is greater than zero.

Variable Name - ORGNAM
Variable Type - Character, Array
Allowed Range - $2 \leq \text{length} \leq 10$
Purpose - The name of the target organ for each early fatality effect. The target organ must be one of the organs listed in the organ definition data. The user must supply NUMEFA values in column one of the data block.

Variable Name - EFFACA
Variable Type - Real, Array
Allowed Range - $1.0 \leq \text{value} \leq 100.0$
Purpose - The alpha factor (LD50) in the hazard function for the target organ. The user must supply NUMEFA values in column two of the data block.

Variable Name - EFFACB
Variable Type - Real, Array
Allowed Range - $1.0 \leq \text{value} \leq 100.0$
Purpose - The beta factor (shape parameter) in the hazard function for the target organ. The user must supply NUMEFA values in column three of the data block.

Variable Name - EFFTHR
Variable Type - Real, Array
Allowed Range - $0.0 \leq \text{value} \leq 100.0$
Purpose - The threshold dose associated with this target organ. If the acute dose to this organ falls below threshold, it will not contribute to the risk of fatality. The user

must supply NUMEFA values in column four of the data block.

Example Usage of EFFACA and EFFACB:

```
*
*          ORGNAM          EFFACA  EFFACB  EFFTHR
*
EFATAGRPO01 'RED MARR'      3.8      5.0      1.5
EFATAGRPO02 'LUNGS'        10.0      7.0      5.0
EFATAGRPO03 'LOWER LI'     15.0     10.0      8.0
```

2.9 Early Injury (EI) Data

The individual risk of each type of early injury is modeled in MACCS using an approach analagous to that used for early fatality risk [Ev85]. The early injury risk model differs from the early fatality model in that instead of summing the damage from more than one organ, only a single organ is used. The early injury risk function is as follows:

$RISK = 1 - e^{-H}$, where

$$H = \ln 2 \left(\frac{DOSE}{EIFACA} \right)^{EIFACB}$$

DOSE = effective acute dose (described in Section 2.8) to the target organ,

EIFACA = the alpha (D_{50}) parameter in the hazard function (ibid., pg. II-8),

EIFACB = the beta or exponential parameter in the hazard function which defines the steepness of the dose-response function.

A dose threshold is incorporated into the early fatality model in the following manner. If the dose to any of the target organs is below the user specified threshold (see EITHRE below), then the risk of this type of early injury is set to zero.

In addition to the values described above, the user must specify the fraction of the population that is susceptible to the injury, EISUSC. Information in this section is only used to control the calculation of individual risk. Results to be processed by OUTPUT, e.g., total cases of a given injury, average individual risk of a given injury, and centerline risk vs. distance of a given injury, are described in later sections of this document. In order for the code to produce early injury results, the injuries must be defined in this section.

Variable Name - NUMEIN

Variable Type - Integer, Scalar

Allowed Range - $0 \leq \text{value} \leq 10$

Purpose - The number of different types of early injuries that will be calculated. A value of zero means that no early injuries will be calculated.

Example Usage:

```
*  
* NUMBER OF EARLY INJURY EFFECTS  
*  
EINUMINO01 7
```

Note to user: The remaining parameters in this section are only required if NUMEIN is greater than zero. The six arrays are arranged as rows of data in a single data block.

Variable Name - EINAME
Variable Type - Character, Array
Allowed Range - 1 <= length <= 16
Purpose - The name of each type of early injury. The user may specify any name. Apostrophes are mandatory if there are any embedded blanks. The user must supply NUMEIN values in column one of the data block.

Variable Name - ORGNAM
Variable Type - Character, Array
Allowed Range - 2 <= length <= 10
Purpose - The name of the target organ for each type of early injury. The target organ must be one of the organs listed in the organ definition data. The user must supply NUMEIN values in column two of the data block.

Variable Name - EISUSC
Variable Type - Real, Array
Allowed Range - 0.0 <= value <= 1.0
Purpose - The fraction of the population that is susceptible to the early injury. The user must supply NUMEIN values in column three of the data block.

Variable Name - EITHRE
Variable Type - Real, array
Allowed Range - 0.0 <= value <= 1000.0
Purpose - The threshold dose below which the risk of the injury is zero. The user must supply NUMEIN values in column four of the data block.

Variable Name - EIFACA
Variable Type - Real, Array
Allowed Range - 1.0 <= value <= 1000.0
Purpose - The alpha factor (D50) in the hazard function for the injury. The user must supply NUMEIN values in column five of the data block.

Variable Name - EIFACB
 Variable Type - Real, Array
 Allowed Range - $1.0 \leq \text{length} \leq 100.0$
 Purpose - The beta (shape) factor in the hazard function for the injury. The user must supply NUMEIN values in column six of the data block.

Example Usage of EINAME, EISUSC, EITHRE, EIFACA and EFFACB:

```

*
*
*           EINAME           ORGNAM   EISUSC EITHRE EIFACA EIFACB
*
EINJUGRP001 'PRODRMAL VOMIT' 'STOMACH'   1.    .5     2.    3.
EINJUGRP002 'DIARRHEA'      'STOMACH'   1.    1.     3.   2.5
EINJUGRP003 'PNEUMONITIS'   'LUNGS'    1.    5.    10.    7.
EINJUGRP004 'SKIN ERYTHEMA'  'SKIN'    1.    3.     6.    5.
EINJUGRP005 'TRANSEPIDERMAL' 'SKIN'    1.   10.    20.    5.
EINJUGRP006 'THYROIDITIS'   'THYROIDH' 1.   40.   240.    2.
EINJUGRP007 'HYPOTHYROIDISM' 'THYROIDH' 1.    2.    60.   1.3

```

2.10 Latent Cancer (LC) Data

This section defines the cancer induction models which are used by both the EARLY and the CHRONC modules.

Cancer risk is modeled differently in the EARLY and CHRONC modules. In the EARLY module, which treats the period immediately following the accident, individual doses can be quite high near the reactor. This calls for the use of two cancer risk models in EARLY: the first for low and medium dose levels (linear-quadratic), and the second for high dose levels where an upper-bound limit to the cancer dose-response function is utilized.

During the long-term phase modeled by CHRONC, it is assumed that exposure of the population will be limited to low levels by mitigative actions and therefore the quadratic term of the linear-quadratic cancer risk equation is ignored. Cancer risk is calculated by CHRONC using only the linear term of the linear-quadratic dose response function which is used by EARLY.

In the period modeled by EARLY, a linear-quadratic dose-response relationship is used if the dose to the target organ is less than a user-specified limit, ACTHRE, (ibid., p. I-23).

The dose response function used in this case is of the form:

$$\text{risk} = \text{DOSE} * \text{CFRISK} * (\text{DOSEFA} + \text{DOSE} * \text{DOSEFB}) * \text{ACSUSC}, \quad (1)$$

where DOSE is the 0 to 50 year lifetime dose commitment to the target organ, and CFRISK, DOSEFA, DOSEFB, and ACSUSC are input parameters described below.

If dose to the target organ is greater than the dose limit ACTHRE, the upper bound linear dose response relationship is used:

$$\text{risk} = \text{DOSE} * \text{CFRISK} * (\text{DOSEFA} + \text{ACTHRE} * \text{DOSEFB}) * \text{ACSUSC}. \quad (2)$$

In the long-term phase modeled by CHRONC, cancer risk from all pathways (groundshine, resuspension inhalation, and ingestion) are modeled with the linear dose response function given below:

$$\text{risk} = \text{DOSE} * \text{CFRISK} * \text{DOSEFA} * \text{ACSUSC}, \quad (3)$$

where the meaning of DOSE and CFRISK depend on whether individual risk (groundshine and resuspension) or collective risk (ingestion and decontamination worker's doses) is being calculated.

These three cancer fatality equations are easily depicted as follows:

The long-term phase model does not calculate an individual's level of dose resulting from ingestion of contaminated food and water or performing decontamination work in the contaminated area. The dose from these pathways is attributed to society as a whole. This necessitates the use of a linear dose response function for calculating the resulting cancers from those societal pathways.

Risk of latent cancer injury is calculated separately for each cancer syndrome. The risk factors for cancer injury are calculated using the same equations as are used to calculate cancer fatalities except that CIRISK is used instead of CFRISK. The user must specify the fraction of the population that is susceptible to each type of cancer in ACSUSC.

Information in this section is only used to control the calculation of individual risk. Results to be processed by OUTPUT, e.g., total cases of a given cancer, average individual risk of a given cancer, and centerline risk of a given cancer versus distance, are described in later sections of this document. In order for the code to produce cancer results, the cancers must be defined in this section.

Variable Name - NUMACA
 Variable Type - Integer, Scalar
 Allowed Range - 0 <= value <= 10

Purpose - The number of different types of latent cancer effects that will be calculated. A value of zero means that latent cancer effects will not be calculated.

Example Usage:

```
*  
* NUMBER OF CANCER EFFECTS  
*  
LCNUMACA001 7
```

Note: The remaining parameters in this section are only required if NUMACA is greater than zero.

Variable Name - ACTHRE
Variable Type - Real, Scalar
Allowed Range - $0.0 \leq \text{value} \leq 10.0$ (sieverts)
Purpose - The lower dose limit for the linear dose response relationship. For doses less than ACTHRE, the linear-quadratic relationship is used.

Note: The parameter ACTHRE is used only in the EARLY module. It is not used in the CHRONC module.

Example Usage:

```
*  
* DOSE THRESHOLD FOR LINEAR DOSE RESPONSE (SV)  
*  
LCACTHRE001 1.5
```

Note: The next seven variables are supplied in a block of data as columns. An example of their usage will follow.

Variable Name - ACNAME
Variable Type - Character, Array
Allowed Range - $1 \leq \text{length} \leq 10$
Purpose - The name of each type of latent cancer effect. The user may specify any name. Apostrophes are mandatory if there are any embedded blanks. The user must supply NUMACA values in column one of the data block.

Variable Name - ORGNAM
Variable Type - Character, Array
Allowed Range - $2 \leq \text{length} \leq 10$
Purpose - The name of the target organ for each type of latent cancer effect. The target organ must be one of the organs listed in the organ definition data. The user must supply NUMACA values in column two of the data block.

Variable Name - ACSUSC
 Variable Type - Real, Array
 Allowed Range - $0.0 \leq \text{value} \leq 1.0$
 Purpose - The fraction of the population that is susceptible to the latent cancer. The user must supply NUMACA values in column three of the data block.

Variable Name - DOSEFA
 Variable Type - Real, Array
 Allowed Range - $0.0 \leq \text{value} \leq 2.0$
 Purpose - Defines the linear factor of the dose dependence in the cancer risk model. The user must supply NUMACA values in column four of the data block.

Variable Name - DOSEFB
 Variable Type - real, array
 Allowed Range - $0.0 \leq \text{value} \leq 2.0$
 Purpose - Defines the quadratic factor of the dose dependence in the cancer risk model which is used only by the EARLY module and not by the CHRONC module. Within EARLY, if the dose to the target organ is below ACTHRE, this parameter defines the quadratic term of the cancer dose response function. The user must supply NUMACA values in column five of the data block.

Variable Name - CFRISK
 Variable Type - real, array
 Allowed Range - $0.0 \leq \text{value} \leq 1.0$
 Purpose - Lifetime risk factor for cancer death. For calculating risk to individuals this parameter has the units (risk/sievert), while for calculating collective risk from ingestion and decontamination exposures it has the units (cases/person-sievert). The user must supply NUMACA values in column six of the data block.

Variable Name - CIRISK
 Variable Type - real, array
 Allowed Range - $0.0 \leq \text{value} \leq 1.0$
 Purpose - Lifetime risk factor for cancer injury. For calculating risk to individuals this parameter has the units (risk/sievert), while for calculating collective risk from ingestion and decontamination exposures it has the units (cases/person-sievert). The user must supply NUMACA values in column seven of the data block.

Example Usage of ACNAME, ACSUSC, DOSEFA, DOSEFB, CFRISK and CIRISK:

```
*
*          ACNAME          ORGNAM  ACSUSC  DOSEFA  DOSEFB  CFRISK  CIRISK
*
LCANCERS001 'LEUKEMIA'      'RED MARR'    1.    .39    .61  3.7E-3 3.7E-3
LCANCERS002 'BONE'          'BONE SUR'    1.    .39    .61  1.5E-4 1.5E-4
```

LCANCERS003	'BREAST'	'BREAST'	1.	1.	0.	6.0E-3	1.7E-2
LCANCERS004	'LUNG'	'LUNGS'	1.	.39	.61	5.1E-3	5.7E-3
LCANCERS005	'THYROID'	'THYROIDH'	1.	1.	0.	7.2E-4	7.2E-3
LCANCERS006	'GI'	'LOWER LI'	1.	.39	.61	1.5E-2	2.5E-2
LCANCERS007	'OTHER'	'LOWER LI'	1.	.39	.61	7.5E-3	1.3E-2

2.11 Generation of Consequence Distributions

Under the control of parameters supplied by the user on the EARLY and CHRONC User Input Files, the EARLY and CHRONC modules can calculate a variety of different consequence measures to portray the impact of a reactor accident on the surrounding region.

The user has total control over the results that will be produced. By choosing appropriate values in the user input files, the user can ensure that the code does not perform unnecessary calculations.

This affords a great deal of flexibility but it also requires that the user anticipate which results will be of interest. If any are omitted, it is necessary to correct the user input and rerun the program.

In this regard, please remember that a result can only be produced if the model needed for its calculation has been previously defined in the appropriate section. If any results pertaining to health effects are requested, risk factors for that model must have been supplied in the sections entitled Early Fatality (EF), Early Injury (EI), and Latent Cancer (LC).

EARLY can produce eight different types of results. These are described in the next eight sections of this document. Some of these eight types of results can also be calculated by CHRONC, but some cannot. For instance, both EARLY and CHRONC calculate cancer cases and population dose, but EARLY alone calculates early fatalities, and CHRONC alone calculates economic costs.

If the user requests EARLY to produce a result that can also be produced by CHRONC, the code will ensure that it will be produced by both EARLY and CHRONC. Whenever a result can be produced by both modules, this will be called out in the following eight sections.

Neither EARLY nor CHRONC generate Complementary Cumulative Distribution Functions (CCDFs) of the results that they calculate. As EARLY and CHRONC generate the requested consequence measures, those numbers are written to binary files on units 31 to 34 for later processing into CCDFs.

The generation of CCDFs is performed by the OUTPUT module of MACCS. It reads the binary files of consequence measures and automatically combines the results in a predetermined way. The user has no direct control over the OUTPUT module other than through the EARLY and CHRONC data blocks which control the generation of consequence measures.

The CCDF is an estimate of the distribution of consequence magnitudes. The variability of consequence values in MACCS CCDFs is due solely to the uncertainty of the weather conditions existing at the time of the accident.

If a consequence measure was calculated by both EARLY and CHRONC, the output module will present those results and their CCDFs separately for EARLY and CHRONC. Also, the output module will sum the results of EARLY and CHRONC and provide the CCDFs of their sums. The contribution of up to three sets of results generated by EARLY can be combined together according to the weighting fractions described in Section 2.6. These weighting fractions can apply to either consequence magnitude (fraction of the people), or the consequence probability (fraction of the time). The weighted sum of all consequence measures, calculated by summation of results from separate runs of EARLY, are presented at the beginning of each section of the listing produced by OUTPUT. Following the overall weighted sum, the results from each of its individual components are presented.

The following material describes the format of the listing produced by the OUTPUT module. It is recommended that the reader of this section refer to Appendix D.3 which presents a listing of the output from Sample Problem A. This output file, named LISTA, is included on microfiche with this report and is also included on the magnetic tape used for distribution of MACCS.

At the top of each page is printed the date and time of the run and a page number. The numbering of pages begins with the first page produced by the OUTPUT module.

The leftmost 38 columns of the page provide the name of the consequence measure. These names are split into two parts: the general and the specific. For example we have

"HEALTH EFFECTS CASES"

as the general name and

"ERL FAT/TOTAL 0-1609 KM"

as the specific part of the name. The consequence measure being presented on this line is the number of early fatality cases expected to occur in the region beginning at the reactor (0 km radius on our polar grid) and extending outward in a concentric ring to the spatial interval with an outer boundary at 1609 km.

Going across the page from left to right, there are ten columns of numeric data which provide a summary of the CCDF generated by the OUTPUT module. These are described as follows:

PROB NON-ZERO - Conditional probability of having a non-zero consequence estimate, conditional on the occurrence of the release under consideration.

- MEAN - The average (expected) consequence over all weather trials. This is calculated by taking the sum of all the products [(consequence value) X (associated probability of that value)] for each weather trial.
- 50TH QUANTILE - The median of the estimated distribution function.
- 90TH QUANTILE - Based on the estimated distribution function, there is a 10 percent chance this consequence magnitude will be exceeded.
- 95TH QUANTILE - Based on the estimated distribution function, there is a 5 percent chance this consequence magnitude will be exceeded.
- 99TH QUANTILE - Based on the estimated distribution function, there is a 1 percent chance this consequence magnitude will be exceeded.
- 99.9TH QUANTILE - Based on the estimated distribution function, there is a 0.1 percent chance this consequence magnitude will be exceeded.
- PEAK CONS - The largest consequence magnitude obtained from the full set of weather trials which were examined.
- PEAK PROB - The probability associated with the largest consequence magnitude.
- PEAK TRIAL - In the series of weather samples, the sequence number of the weather trial which gave rise to the largest consequence magnitude. By going back to the ATMOS output listing, the user can determine the start time (day and hour) of this weather sequence.

2.12 User Requested Cases of a Given Health Effect (T1)

EARLY can calculate the number of health effect cases which will occur within a range of distances. The risk models for these health effects must have been previously defined in the proper section.

Note: Any cancer results requested here are automatically produced by CHRONC so that the results can be combined by OUTPUT. In the results calculated by CHRONC, the cancer values include direct exposure cancers in the population residing in the region as well as the indirect exposure cancers resulting from both (1) consumption of food and water produced in the region and (2) exposure of decontamination workers working in the region.

Variable Name - NUM1
 Variable Type - Integer, Scalar
 Allowed Range - 0 <= value <= 40

Purpose - The number of results of this type to be calculated.

Variable Name - NAME

Variable Type - Character, Array

Allowed Range - $10 \leq \text{length} \leq 24$

Purpose - Defines the name of each Type 1 result for which the number of cases will be calculated. Depending on the value of NAME, six different types of results may be produced. They are listed below along with examples of their specification for input.

1. cases of early fatality; 'ERL FAT/TOTAL'
2. cases of a given early injury; 'ERL INJ/name of an injury'
3. cases of a given cancer death; 'CAN FAT/name of a cancer'
4. total cases of cancer death; 'CAN FAT/TOTAL'
5. cases of a given cancer injury; 'CAN INJ/name of a cancer'
6. total cases of cancer injury; 'CAN INJ/TOTAL'

Variable Name - I1DIS1

Variable Type - Integer, Array

Allowed Range - $1 \leq \text{value} \leq \text{NUMRAD}$

Purpose - Defines the inner spatial interval of the region of interest for this result. The user must supply NUM1 values in column two of the data block.

Variable Name - I2DIS1

Variable Type - Integer, Array

Allowed Range - $\text{I1DIS1} \leq \text{value} \leq \text{NUMRAD}$

Purpose - Defines the outer spatial interval of the region of interest for this result. The user must supply NUM1 values in column three of the data block.

Note: In order to obtain the CCDF tables of a consequence measure requested in this section, append the character string 'CCDF' to the line requesting that result as the fourth item on the data card. The CCDF tables will be printed on the List Output File (unit 6).

Example Usage:

*

* NUMBER OF DESIRED RESULTS OF THIS TYPE

*

TYPE1NUMBER 35

*

TYPE1OUT001	'ERL FAT/TOTAL'	1	26	CCDF (0 TO 1000 MILES
TYPE1OUT002	'ERL INJ/PRODRMAL VOMIT'	1	26	CCDF
TYPE1OUT003	'ERL INJ/DIARRHEA'	1	26	
TYPE1OUT004	'ERL INJ/PNEUMONITIS'	1	26	
TYPE1OUT005	'ERL INJ/THYROIDITIS'	1	26	
TYPE1OUT006	'ERL INJ/HYPOTHYROIDISM'	1	26	
TYPE1OUT007	'ERL INJ/SKIN ERYTHEMA'	1	26	

TYPEOUT008	'ERL INJ/TRANSEPIDERMAL'	1	26
TYPEOUT009	'CAN FAT/TOTAL'	1	26 CCDF
TYPEOUT010	'CAN FAT/LUNG'	1	26
TYPEOUT011	'CAN FAT/THYROID'	1	26
TYPEOUT012	'CAN FAT/BREAST'	1	26
TYPEOUT013	'CAN FAT/GI'	1	26
TYPEOUT014	'CAN FAT/LEUKEMIA'	1	26
TYPEOUT015	'CAN FAT/BONE'	1	26
TYPEOUT016	'CAN FAT/OTHER'	1	26
TYPEOUT017	'CAN INJ/TOTAL'	1	26
TYPEOUT018	'ERL FAT/TOTAL'	1	19 (0 TO 50 MILES)
TYPEOUT019	'ERL INJ/PRODRMAL VOMIT'	1	19
TYPEOUT020	'ERL INJ/DIARRHEA'	1	19
TYPEOUT021	'ERL INJ/PNEUMONITIS'	1	19
TYPEOUT022	'ERL INJ/THYROIDITIS'	1	19
TYPEOUT023	'ERL INJ/HYPOTHYROIDISM'	1	19
TYPEOUT024	'ERL INJ/SKIN ERYTHEMA'	1	19
TYPEOUT025	'ERL INJ/TRANSEPIDERMAL'	1	19
TYPEOUT026	'CAN FAT/TOTAL'	1	19
TYPEOUT027	'ERL FAT/TOTAL'	1	12 (0 TO 10 MILES)
TYPEOUT028	'ERL INJ/PRODRMAL VOMIT'	1	12
TYPEOUT029	'ERL INJ/DIARRHEA'	1	12
TYPEOUT030	'ERL INJ/PNEUMONITIS'	1	12
TYPEOUT031	'ERL INJ/THYROIDITIS'	1	12
TYPEOUT032	'ERL INJ/HYPOTHYROIDISM'	1	12
TYPEOUT033	'ERL INJ/SKIN ERYTHEMA'	1	12
TYPEOUT034	'ERL INJ/TRANSEPIDERMAL'	1	12
TYPEOUT035	'CAN FAT/TOTAL'	1	12

2.13 User Requested Early Fatality Radius (T2)

It may be of interest to know the greatest distance at which a specified level of early fatality risk is exceeded. By turning on this result, the user can obtain information about the size of the region in which early fatalities are predicted to occur.

Variable Name - NUM2

Variable Type - Integer, Scalar

Allowed Range - $0 \leq \text{value} \leq 10$

Purpose - The number of results of this type to be calculated.

Variable Name - RISTHR

Variable Type - Real, Scalar

Allowed Range - $0.0 \leq \text{value} \leq 1.0$

Purpose - Defines the risk threshold used for calculating the fatality radius (reported in kilometers). The user must supply NUM2 values in column one of the data block. This is the only array in the data block.

Note: In order to obtain the CCDF tables of a consequence measure requested in this section, append the character string 'CCDF' to the line requesting that result as the second item on the data

card. The CCDF tables will be printed on the List Output File (unit 6).

Example Usage:

```
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
TYPE2NUMBER  3
*
*           FATALITY RISK THRESHOLD
*
TYPE2OUT001 0.0   CCDF * DISTANCE AT WHICH ANY FATALITIES OCCURRED
TYPE2OUT002 0.005 * DISTANCE AT WHICH FATALITY RISK EXCEEDS 0.005
TYPE2OUT003 0.5   * DISTANCE AT WHICH FATALITY RISK EXCEEDS 0.5
```

2.14 User Requested Population Exceeding a Dose Threshold (T3)

Within the EARLY module alone, it may be of interest to know how many people received doses exceeding certain levels. This information can be obtained by requesting the production of the result described below. It is important to remember that this consequence measure is calculated solely on the basis of the dose calculations performed in the EARLY module. There is no provision for examining an analogous result for the CHRONC module, or for determining the number of people whose total dose from both EARLY and CHRONC exceeded a certain level.

The user can specify two type of doses to be used for the comparison: acute and lifetime. "Acute" dose is used by the code for calculating early fatality and early injury health effects (see Section 2.8). For each organ, the "acute" dose is calculated with set of dose reduction factors defined in that section. The lifetime dose is used for the calculation of cancer fatality and cancer injury health effects (see Section 2.10). It represents the 0 to 50 year lifetime dose commitment to a reference man which results from exposure during the emergency phase (EARLY) time period.

Variable Name - NUM3

Variable Type - Integer, Scalar

Allowed Range - $0 \leq \text{value} \leq 10$

Purpose - The number of results of this type to be calculated.

Variable Name - NAME

Variable Type - Character, Scalar

Allowed Range - $2 \leq \text{length} \leq 10$

Purpose - Defines the name of the organ to which the dose threshold applies. This organ must be found on the list of organs, ORGNAM. The user must supply NUM3 values in column one of the data block.

Variable Name - DOSTH3
 Variable Type - Real, Array
 Allowed Range - $0.0 \leq \text{value} \leq 1000.0$ (sieverts)
 Purpose - Defines the dose threshold which will be used for counting the population. The user must supply NUM3 values in column two of the data block.

Variable Name - DOSFLG
 Variable Type - Character, Array
 Allowed Value - 'ACUTE' or 'LIFETIME'
 Purpose - Defines the type of dose which will be used for counting the population. There are two options: "acute" dose and lifetime dose. If "acute" is specified, acute dose factors for that organ must have been defined (see Section 2.4). The user must supply NUM3 values in column three of the data block.

Note: In order to obtain the CCDF tables of a consequence measure requested in this section, append the character string 'CCDF' to the line requesting that result as the fourth item on the data card. The CCDF tables will be printed on the List Output File (unit 6).

Example Usage:

```
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
TYPE3NUMBER      3
*                ORGAN NAME      DOSE THRESHOLD (SV)      DOSE FLAG
*
TYPE3OUT001      'RED MARR'        1.5                    ACUTE
TYPE3OUT002      'LUNGS'          5.0                    ACUTE
TYPE3OUT003      'EDEWBODY'       0.05-                  LIFETIME
```

2.15 User Requested Average Individual Risk (T4)

Average individual risk is obtained by taking the sum of the risk values in all sectors at a given distance and dividing it by the number of sectors.

Note: Any cancer results requested here are automatically produced by CHRONC so that the results can be combined by OUTPUT. When this result is produced by CHRONC, it is only a measure of the risk from direct exposure to people at that distance. Direct exposure includes the cloudshine, groundshine, and inhalation dose to the people living around the reactor.

The risk presented in this result does not include doses from ingestion of food and water by the region's population or doses to decontamination workers working in the region.

Variable Name - NUM4
Variable Type - Integer, Scalar
Allowed Range - $0 \leq \text{value} \leq 20$
Purpose - The number of results of this type to be calculated.

Variable Name - I1DIS4
Variable Type - Integer, Array
Allowed Range - $1 \leq \text{value} \leq \text{NUMRAD}$
Purpose - Radial spatial interval of the distance of interest. The user must supply NUM4 values in column one of the data block.

Variable Name - NAME
Variable Type - Character, Array
Allowed Range - $10 \leq \text{length} \leq 24$
Purpose - Name of the health effect risk. Average individual risk may be calculated for five types of health effects.

1. risk of early fatality; 'ERL FAT/TOTAL'
2. risk of a given early injury; 'ERL INJ/name of an injury'
3. risk of a given cancer death; 'CAN FAT/name of a cancer'
4. risk of cancer death; 'CAN FAT/TOTAL'
5. risk of a given cancer injury; 'CAN INJ/name of a cancer'

The user must supply NUM4 values of NAME in column two of the data block.

Note: In order to obtain the CCDF tables of a consequence measure requested in this section, append the character string 'CCDF' to the line requesting that result as the third item on the data card. The CCDF tables will be printed on the List Output File (unit 6).

Example Usage:

```
*
* 360 DEGREE AVERAGE RISK OF A GIVEN EFFECT AT A GIVEN DISTANCE.
*
* POSSIBLE TYPES OF EFFECTS ARE:
*
*   'ERL FAT/TOTAL'
*   'ERL INJ/INJURY NAME'
*   'CAN FAT/CANCER NAME'
*   'CAN INJ/TOTAL'
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
TYPE4NUMBER      5
*
```

*	RADIAL INDEX	TYPE OF EFFECT
*		
TYPE4OUT001	1	'ERL FAT/TOTAL'
TYPE4OUT002	2	'ERL FAT/TOTAL'
TYPE4OUT003	3	'ERL FAT/TOTAL'
TYPE4OUT004	4	'ERL FAT/TOTAL'
TYPE4OUT005	5	'ERL FAT/TOTAL'

2.16 User Requested Population Dose (T5)

The total long-term population dose to a given organ resulting from the contamination of a specified region can be calculated. The user must supply the name of the target organ as well as the inner and outer spatial intervals of the region of interest. If only the EARLY module is being run, this result reflects only the pathways considered by EARLY. If both EARLY and CHRONC are being run, the population dose from all pathways is included in the calculation. The CHRONC pathways include both (1) food and water ingestion doses resulting from material deposited in the region and (2) doses to decontamination workers working in the region. On the output listing, population dose is presented in units of person-sieverts.

Variable Name - NUM5
Variable Type - Integer, Scalar
Allowed Range - 0 <= value <= 10
Purpose - The number of results of this type to be calculated.

Variable Name - NAME
Variable Type - Character, Scalar
Allowed Range - 2 <= length <= 10
Purpose - Defines the name of the organ to which the population dose applies. This organ must be found on the list of organs, ORGNAM. The user must supply NUM5 values in column one of the data block.

Variable Name - I1DIS5
Variable Type - Integer, Array
Allowed Range - 1 <= value <= NUMRAD
Purpose - Defines the inner spatial interval of the region of interest for this result. The user must supply NUM5 values in column two of the data block.

Variable Name - I2DIS5
Variable Type - Integer, Array
Allowed Range - I1DIS5 <= value <= NUMRAD
Purpose - Defines the outer spatial interval of the region of interest for this result. The user must supply NUM5 values in column three of the data block.

Note: In order to obtain the CCDF tables of a consequence measure requested in this section, append the character string 'CCDF' to the line requesting that result as the fourth item on the data card. The CCDF tables will be printed on the List Output File (unit 6).

Example Usage:

```
*
* TOTAL POPULATION DOSE TO A GIVEN ORGAN BETWEEN TWO DISTANCES.
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
TYPE5NUMBER      3
*
*          ORGAN      I1DIS5      I2DIS5
*
TYPE5OUT001 'EDEWBODY'      1      12      (0-10 MILES)
TYPE5OUT002 'EDEWBODY'      1      19      CCDF (0-50 MILES)
TYPE5OUT003 'EDEWBODY'      1      26      CCDF (0-1000 MILES)
```

2.17 User Requested Centerline Dose vs. Distance (T6)

If the straight-line plume model was chosen (IPLUME=1), the code can keep track of centerline dose between a range of distances for the various pathways. The centerline dose at each distance is treated as a separate result and OUTPUT will generate a set of results for each of the radial spatial intervals within the specified range.

Depending on the exposure pathways specified, this result will be calculated by EARLY and/or CHRONC (see below). If both EARLY and CHRONC are being run, then CHRONC will automatically produce all of the results for the pathways which it considers. If pathways 'GRD', 'RES LIF', or 'TOT LIF' are chosen, those results are automatically produced by CHRONC so that the results can be combined by OUTPUT. The other pathway values are only produced by EARLY.

For a description of effective acute dose, please refer to Section 2.8.

An alternative method for examining centerline dose from EARLY alone is to set the output control variable, IPRINT, to a value greater than zero. If this is done, a listing of dose vs. distance for all the organs will be printed on the list output. Since this is written for each weather trial, it is recommended that this be done only for single weather trial runs.

Variable Name - NUM6
Variable Type - Integer, Scalar
Allowed Range - 0 <= value <= 10
Purpose - The number of results of this type to be calculated.

Note: unless IPLUME=1, you must specify a value of zero.

<u>PATHNM</u>	<u>DESCRIPTION</u>
1. CLD	cloudshine dose (EARLY only),
2. GRD	groundshine dose (EARLY and CHRONC),

<u>PATHNM</u>	<u>DESCRIPTION</u>
3. INH ACU	effective acute dose from inhalation of the plume as it passed overhead (EARLY only),
4. INH LIF	lifetime dose commitment from inhalation of the plume as it passed overhead (EARLY only),
5. TOT ACU	total effective acute dose (EARLY only) being the sum of CLD, GRD, INH ACU, and RES ACU,
6. TOT LIF	total lifetime dose commitment from all direct exposure pathways (EARLY and CHRONC) being the sum of CLD, GRD, INH LIF, and RES LIF,
7. RES LIF	lifetime dose commitment from inhalation of resuspended material after plume passage (EARLY and CHRONC),
8. RES ACU	effective acute dose from inhalation of resuspended material after plume passage (EARLY only).

Note: The pathway name for 'SKIN' will ignored by the code since there is only one exposure pathway for skin (direct dry deposition to the skin). The user must supply a value for the pathway name in all cases. For the case of skin as the target organ, it does not matter which of the eight pathways listed above is supplied.

Variable Name - ORGNAM

Variable Type - Character, Scalar

Allowed Range - $2 \leq \text{length} \leq 10$

Purpose - Defines the names of the organs for which centerline doses are to be reported. These organs must be found on the list of organs, ORGNAM. The user must supply NUM6 values in column one of the data block.

Variable Name - PATHNM

Variable Type - Character, Scalar

Allowed Range - $3 \leq \text{length} \leq 7$

Purpose - Defines the names of the pathways for which centerline doses are to be reported. The name of each pathway must be on the list of pathways below. The user must supply NUM6 values in column two of the data block.

Variable Name - I1DIS6

Variable Type - Integer, Array

Allowed Range - $1 \leq \text{value} \leq \text{NUMRAD}$

Purpose - Defines the inner spatial interval of the region of interest for this result. The user must supply NUM6 values in column three of the data block.

Variable Name - I2DIS6
 Variable Type - Integer, Array
 Allowed Range - I1DIS6 <= value <= NUMRAD
 Purpose - Defines the outer spatial interval of the region of interest for this result. The user must supply NUM6 values in column four of the data block.

Note: In order to obtain the CCDF tables of a consequence measure requested in this section, append the character string 'CCDF' to the line requesting that result as the fifth item on the data card. The CCDF tables will be printed on the List Output File (unit 6).

Example Usage:

```
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
TYPE6NUMBER      3
*
*          ORGNAM      PATHNM I1DIS6  I2DIS6
*
TYPE6OUT001  'RED MARR'  'TOT ACU'  1      19      (0-50 MILES)
TYPE6OUT002  'LUNGS'     'TOT ACU'  1      19      (0-50 MILES)
TYPE6OUT003  'EDEWBODY'  'TOT LIF'  1      26      (0-1000 MILES)
```

2.18 User Requested Centerline Risk vs. Distance (T7)

If the straight-line plume model was chosen (IPLUME=1), the code can keep track of centerline risk between two specified spatial intervals for the various types of health effects. Centerline risk is calculated for hypothetical individuals located directly under the path of the plume who are exposed to the Gaussian peak of the air and ground concentrations. The centerline risk at each distance in the region is treated as a separate result and OUTPUT will generate a distribution of the consequence measure for each of the spatial intervals within the specified range.

Note: Any cancer results requested here are automatically produced by CHRONC so that the results can be combined by OUTPUT. When this result is produced by CHRONC, it is only a measure of the risk from direct exposure to people at those distances. Direct exposure includes the cloudshine, groundshine, and inhalation dose to the resident population in the specified region.

The risk presented in this result does not include societal doses from ingestion of any food and water contaminated as a result of the accident or doses to decontamination workers working in the contaminated area.

Variable Name - NUM7
Variable Type - Integer, Scalar
Allowed Range - $0 \leq \text{value} \leq 10$
Purpose - The number of results of this type to be calculated.

Note: Unless IPLUME=1, you must specify a value of zero.

Variable Name - NAME
Variable Type - Character, Array
Allowed Range - $10 \leq \text{length} \leq 24$
Purpose - Defines the option for results of Type 7, centerline risk of a given type of health effect. Depending on the value of NAME, six different types of results may be produced. They are listed below along with examples of their usage. The user must supply NUM7 values in column one of the data block.

1. risk of early fatality; 'ERL FAT/TOTAL'
2. risk of a given early injury; 'ERL INJ/name of an injury'
3. risk of a given cancer death; 'CAN FAT/name of a cancer'
4. risk of cancer death; 'CAN FAT/TOTAL'
5. risk of a given cancer injury; 'CAN INJ/name of a cancer'
6. risk of cancer injury; 'CAN INJ/TOTAL'

Variable Name - I1DIS7
Variable Type - Integer, Array
Allowed Range - $1 \leq \text{value} \leq \text{NUMRAD}$
Purpose - Defines the inner spatial interval of the region of interest for this result. The user must supply NUM7 values in column two of the data block.

Variable Name - I2DIS7
Variable Type - Integer, Array
Allowed Range - $\text{I1DIS7} \leq \text{value} \leq \text{NUMRAD}$
Purpose - Defines the outer spatial interval of the region of interest for this result. The user must supply NUM7 values in column three of the data block.

Note: In order to obtain the CCDF tables of a consequence measure requested in this section, append the character string 'CCDF' to the line requesting that result as the fourth item on the data card. The CCDF tables will be printed on the List Output File (unit 6).

Example Usage:

```
*  
* CENTERLINE RISK OF A GIVEN EFFECT VS DISTANCE  
*  
* NUMBER OF DESIRED RESULTS OF THIS TYPE  
*  
TYPE7NUMBER    2  
*
```

*	NAME	I1DIS7	I2DIS7	
*				
TYPE7OUT001	'ERL FAT/TOTAL'	1	19	(0-50 MILES)
TYPE7OUT002	'CAN FAT/TOTAL'	1	26	(0-1000 MILES)

2.19 User Requested Population Weighted Risk (T8)

Population weighted health effect risk is obtained by calculating the cases of a health effect in a certain region and then dividing by the total population in the region. It takes account of both the population distribution and the wind-rose.

Note: Any cancer results requested here are automatically produced by CHRONC so that the results can be combined by OUTPUT. When this result is produced by CHRONC, it is only a measure of the risk from direct exposure to the resident population in the specified region. The direct exposure pathways are: cloudshine, ground-shine, direct inhalation, and resuspension inhalation.

The exposure period considered by the CHRONC module has a duration of one million years and therefore it predicts the cancers expected to occur over that period of time. Population weighted risk in CHRONC is calculated by determining the expected cancer cases over a million years and dividing that by the current population in the region.

The risk presented in this result does not include the societal pathways of (1) ingestion of contaminated food and water or (2) doses to decontamination workers working in the area.

Variable Name - NUM8

Variable Type - Integer, Scalar

Allowed Range - 0 <= value <= 20

Purpose - The number of results of this type to be calculated.

Variable Name - NAME

Variable Type - Character, Array

Allowed Range - 10 <= length <= 24

Purpose - Defines the names of the Type 8 results to be calculated: population weighted risk of a given type health effect. Depending on the value of NAME, six different types of results may be produced. These six options are listed below along with examples of their usage. The user must supply NUM8 values in column one of the data block.

1. risk of early fatality - 'ERL FAT/TOTAL'
2. risk of a given early injury - 'ERL INJ/name of an injury'
3. risk of a given cancer death - 'CAN FAT/name of a cancer'
4. risk of cancer death - 'CAN FAT/TOTAL'
5. risk of a given cancer injury - 'CAN INJ/name of a cancer'
6. risk of cancer injury - 'CAN INJ/TOTAL'

Variable Name - I1DIS8
 Variable Type - Integer, Array
 Allowed Range - 1 <= value <= NUMRAD
 Purpose - Defines the inner spatial interval of the region of interest for this result. The user must supply NUM8 values in column two of the data block.

Variable Name - I2DIS8
 Variable Type - Integer, Array
 Allowed Range - 1 <= value <= NUMRAD
 Purpose - Defines the outer spatial interval of the region of interest for this result. The user must supply NUM8 values in column three of the data block.

Note: In order to obtain the CCDF tables of a consequence measure requested in this section, append the character string 'CCDF' to the line requesting that result as the fourth item on the data card. The CCDF tables will be printed on the List Output File (unit 6).

Example Usage:

```
*
* POPULATION WEIGHTED FATALITY RISK BETWEEN 2 DISTANCES
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
TYPE8NUMBER      2
*
*              NAME              I1DIS8      I2DIS8
*
TYPE8OUT001  'ERL FAT/TOTAL'      1           5  CCDF (0-EXCL ZONE + 1 MI)
TYPE8OUT002  'CAN FAT/TOTAL'      1          12  CCDF (0-10 MILES)
```

References

- Ev85 Evans, J.S., D.W. Moeller and D.W. Cooper, Health Effects Model for Nuclear Power Plant Consequence Analysis, Sandia National Laboratories, Albuquerque, NM, 87185, NUREG/CR-4214, SAND85-7815, July 1986.
- IC79 ICRP, Limits for Intake of Radionuclides by Workers, ICRP Publication 30, (Oxford: Pergamon Press, 1979).

3.0 CHRONC USER INPUT FILE

3.1 Introduction to CHRONC

The CHRONC module simulates the events which occur following the emergency phase time period modeled by EARLY. Various long-term protective actions may be taken during this time period to limit radiation doses to acceptable levels. The parameters defining these protective actions are under user-control and all of them are described in this chapter.

CHRONC calculates the individual health effects that result from both (1) direct exposure to contaminated ground and from inhalation of resuspended materials as well as (2) indirect health effects caused by the consumption of contaminated food and water by individuals who could reside both on and off of the computational grid. Both the direct and indirect exposure pathways are integrated over an essentially infinite period following the accident. That is, population dose and the resulting health effects are calculated for an exposure period which extends beyond the lifetime of those individuals alive at the time of the accident.

CHRONC also calculates the economic costs of the long-term protective actions as well as the cost of the emergency response actions which were modeled in the EARLY module of MACCS.

It is up to the user to specify the various parameters needed for these calculations. There are no default values for the parameters described in this section. In addition to specifying the characteristics of the model, the user has complete control over the output produced by CHRONC and must explicitly specify which results are to be produced. All of this information is supplied through the User Input File to CHRONC and all of the input parameters are described in this chapter.

The User Input File for the CHRONC module consists of eleven data blocks which define the simulation and an additional five data blocks used to specify the output desired by the user. These sixteen data blocks are described below. The other input data requirements and the output requirements of the CHRONC module are also discussed below.

3.2 Problem Identification Data

The problem identification data block is used to identify the CHRONC input data file and the calculations which are being performed.

Variable Name - CHNAME

Variable Type - Character, Scalar

Allowed Range - $1 \leq \text{length} \leq 80$

Purpose - Describes this particular CHRONC input data file. Choose a text string that briefly describes the input data file; the assumptions and model choices of this particular application of the CHRONC module.

This text will be printed on all of the MACCS list output as an aid in identification of the results. It is not necessary to include the date of the run since that information is automatically included.

Example Usage:

CHCHNAME001 'SURRY CHRONC INPUT FOR FINAL NUREG-1150 CALCULATIONS'

3.3 Emergency Response Cost Data

The emergency response cost data block is used to define the compensation costs for people who are subject to the emergency actions of evacuation, sheltering, or relocation. Evacuation is solely under the control of models defined in the EARLY module. Relocation of individuals can occur either during the EARLY emergency phase or during the CHRONC intermediate phase period. In the presentation of economic cost results (Section 3.15), the cost of evacuation and the cost of relocation are summed together and there is no possibility of examining them individually.

Variable Name - EVACST
Variable Type - Real, Scalar
Allowed Range - $0.0 \leq \text{value} \leq 1000.0$ (dollars/person-day)
Purpose - Defines the daily cost of compensation for evacuees and shelterees who are removed from their homes as a result of radiation exposure during the emergency phase period. This value could include the following components: food, housing, transportation, and lost income.

Example Usage:

CHEVACST001 27.00

Variable Name - RELCST
Variable Type - Real, Scalar
Allowed Range - $0.0 \leq \text{value} \leq 1000.0$ (dollars/person-day)
Purpose - Defines the daily cost of compensation for individuals relocated due to either hot-spot or normal relocation during the emergency phase period, or due to intermediate phase relocation modeled by CHRONC. This value could include the following components: food, housing, transportation, and lost income.

Example Usage:

CHRELCST001 27.00

3.4 Long-Term Protective Action Data

The long-term protective action data block defines the intermediate and long-term action time periods as well as the maximum doses which people are allowed to receive during these periods. The maximum allowable doses defined here are used to determine the need for relocation, decontamination, interdiction or condemnation.

Variable Name - TMIPND
 Variable Type - Real, Scalar
 Allowed Range - ENDEMP <= value <= 3.1536E+7 (seconds) (ONE YEAR)
 Purpose - Defines the time at which the intermediate phase period ends, measured from the time at which the deposition occurred. The intermediate phase period follows the emergency phase period. The value of ENDEMP is defined in the EARLY User Input File and passed to CHRONC.

Example Usage:

CHTMIPND001 604800. (7 DAYS, NO INTERMEDIATE PHASE)

Variable Name - TMPACT
 Variable Type - Real, Scalar
 Allowed Range - TMIPND <= value <= 1.E+10 (seconds)
 Purpose - Defines the long-term phase dose projection period. Protective actions such as decontamination, or decontamination followed by interdiction are evaluated to determine if the exposure of an individual during this period can be reduced so that it does not exceed the long-term phase allowable dose (DSCRLT) to the long-term phase critical organ (CRTOCR).

If temporary interdiction is required, individuals are returned to their homes at a time when it is estimated that they will receive a dose of exactly DSCRLT to the critical organ over an exposure period of this duration.

Once individuals are returned to their home, their long-term doses are integrated over an exposure period which is one million years long.

Example Usage:

CHTMPACT001 1.58E8 (5 YEARS)

Variable Name - DSCRTI
 Variable Type - Real, Scalar
 Allowed Range - 0. <= value <= 1.E+5 (sieverts)
 Purpose - Defines the intermediate phase dose criterion. This is the maximum allowable direct exposure dose commitment to the long-term critical organ (CRTOCR) during the intermediate phase period (TMIPND). The direct exposure pathways considered in this evaluation are groundshine and resuspension inhalation.

If the intermediate phase dose criterion (DSCRTI) would be exceeded for an individual remaining at some location for the entire intermediate phase period, the resident population there is relocated for the entire intermediate phase period.

Example Usage:

CHDSCRTI001 1.OE5 (NO INTERMEDIATE PHASE RELOCATION)

Variable Name - DSCRLT

Variable Type - Real, Scalar

Allowed Range - 1.E-20 <= value <= 1.E+5 (sieverts)

Purpose - Defines the long-term phase dose criterion. This is the maximum allowable direct exposure dose commitment to the long-term critical organ (CRTOCR) during the long-term phase action period (TMPACT).

If this dose criterion would be exceeded in any spatial element during the long-term action period, mitigative actions such as decontamination or decontamination followed by temporary interdiction would be employed in order to limit the dose to the critical organ so that the allowable dose level is not exceeded in that spatial grid element. The long-term critical organ is defined below in this data block.

If it is not possible to reduce doses to this level in a cost-effective manner, the property is condemned and the resident population is permanently relocated.

Example Usage:

CHDSCRLT001 0.04 (2 REM IN FIRST YEAR, 0.5 REM PER YEAR FOR YRS 2-5)

Variable Name - CRTOCR

Variable Type - Character, Scalar

Allowed Range - 2 <= length <= 10

Purpose - Defines the long-term phase critical organ. If the total direct exposure dose commitment to this organ in a grid element would exceed the dose criteria in either the intermediate phase period (TMIPND) or the long-term phase period (TMPACT), protective actions would be taken in order to limit that dose to acceptable levels.

Example Usage:

CHCRTOCR001 'EDEWBODY'

3.5 Decontamination Plan Data

The decontamination plan data block defines the decontamination actions which may be taken during the long-term period in order to reduce doses to acceptable levels. These data define the decontamination strategies which are possible, their effectiveness and their cost. Each decontamination level represents an alternative decontamination strategy that would reduce the projected long-term groundshine and resuspension doses by a factor called the dose reduction factor. Up to three levels of decontamination can be defined.

The object of decontamination is to reduce projected doses below the long-term dose criterion in a cost-effective manner. If the maximum decontamination level is insufficient to restore an area to immediate habitability, a period of temporary interdiction following that maximum decontamination level is considered in order to allow for dose reduction due to radioactive decay and weathering. If the property cannot be made habitable within thirty years or if the cost of reclaiming the habitability of the property exceeds the cost of condemning it, the property will be condemned and permanently withdrawn from use.

Decontamination cost is divided into two categories and these two types of cost are calculated separately. Area dependent decontamination cost represents the cost of farmland decontamination in a grid element. Area dependent decontamination is a function of the area of the grid element devoted to agriculture (see FRCFRM, defined in Section 3.9). Population dependent decontamination represents the cost of non-farmland decontamination. Population dependent decontamination cost is a function of the population residing in the grid element. The strategy of decontamination within a grid element is independent of the type of area being decontaminated.

For a given decontamination level, the same decontamination time and decontamination effectiveness apply to both farmland and non-farmland, but the two costs are unique and are maintained independently for each type of decontamination. Due to the requirement that the recovery of property must be cost-effective, it is possible, in a given element, that decontamination of non-farmland is performed, but farmland is instead condemned.

Decontamination of a grid element serves to reduce the contamination level in that element by the dose reduction factor associated with the decontamination effort which is being applied. Everything else being equal, a decontamination factor of ten will cause the integrated dose over any exposure period to be reduced by a factor of ten.

During the decontamination period, which is assumed to begin at the end of the intermediate phase time period (beginning of the long-term phase period) population from areas that will be decontaminated is assumed to be relocated to uncontaminated areas, and the associated cost from loss of use is calculated in the same manner as temporary interdiction.

While engaged in cleanup efforts, decontamination workers are assumed to wear respiratory protection devices. Therefore, they accumulate only groundshine doses. These doses and the cancer fatalities that they induce contribute to the aggregated doses and cases of cancer fatalities tabulated in the MACCS output.

Decontamination reduces direct exposure doses (both groundshine and resuspension) caused by contamination of land and buildings. Many decontamination processes (e.g., plowing, fire-hosing) reduce groundshine and resuspension doses by mixing surface contamination down into the ground. Since these processes may not move contamination out of the root zone, MACCS assumes that farmland decontamination reduces direct exposure doses to farmers without reducing uptake of radioactivity by root systems. Thus, decontamination of farmland does not reduce the ingestion doses produced by consumption of crops contaminated by root uptake.

Variable Name - LVLDEC
Variable Type - Integer, Scalar
Allowed Range - $1 \leq \text{value} \leq 3$
Purpose - Defines the number of decontamination levels which can be utilized.

Example Usage:

CHLVLDEC001 2

Variable Name - TIMDEC
Variable Type - Real, Array
Allowed Range - $1.E-35 \leq \text{value} \leq 3.15E7$ (seconds) (one year)
Purpose - Defines the time required for completion of each of the decontamination levels. The user must define a decontamination time for each of the LVLDEC decontamination levels. Decontamination begins at the end of the intermediate phase (TMIPND). The values must be monotonically increasing.

Example Usage:

CHTIMDEC001 5.184E6 1.0368E7 (60, 120 DAYS)

Variable Name - DSRFCT
Variable Type - Real, Array
Allowed Range - $1.0 \leq \text{value} \leq 100.0$ (unitless)
Purpose - Defines the effectiveness of the various decontamination levels in reducing dose. A dose reduction factor of three means that the resulting population dose at that location will be reduced to one-third of what it would be without decontamination. The values specified must be monotonically increasing.

Example Usage:

CHDSRFCT001 3. 15.

Variable Name - CDFRM
Variable Type - Real, Array
Allowed Range - $0.0 \leq \text{value} \leq 1.E+5$ (dollars/hectare)

Purpose - Defines the farmland decontamination cost. A value must be supplied for each of the LVLDEC decontamination levels and they are required to be monotonically increasing.

Example Usage:

CHCDFRM0001 562.5 1250.

Variable Name - CDNFRM

Variable Type - Real, Array

Allowed Range - $0.0 \leq \text{value} \leq 1.E+5$ (dollars/person)

Purpose - Defines the non-farmland decontamination cost. A value must be supplied for each of the LVLDEC decontamination levels and they are required to be monotonically increasing.

Example Usage:

CHCDNFRM001 3000. 8000.

Note to user: The remaining parameters in this section are used for the sole purpose of calculating the dose received by decontamination workers.

Variable Name - FRFDL

Variable Type - Real, Array

Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)

Purpose - Defines the fraction of the farmland decontamination cost that is due to labor. A value must be supplied for each of the LVLDEC decontamination levels.

Example Usage:

CHFRFDL0001 .3 .35

Variable Name - FRNFDL

Variable Type - Real, Array

Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)

Purpose - Defines the fraction of the non-farmland decontamination cost that is due to labor. A value must be supplied for each of the LVLDEC decontamination levels.

Example Usage:

CHFRNFDL001 .7 .5

Variable Name - TFWKF

Variable Type - Real, Array

Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)

Purpose - Defines the fraction of the decontamination period (TIMDEC) that a farmland decontamination worker spends in

the contaminated area. A value must be supplied for each of the LVLDEC decontamination levels.

Example Usage:

CHTFWKFO001 .10 .33

Variable Name - TFWKNF
Variable Type - Real, Array
Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)
Purpose - Defines the fraction of the decontamination period (ITMDEC) that a non-farmland decontamination worker spends in the contaminated area during the decontamination period. A value must be supplied for each of the LVLDEC decontamination levels.

Example Usage:

CHTFWKNF001 .33 .33

Variable Name - DLBCST
Variable Type - Real, Scalar
Allowed Range - $0.0 \leq \text{value} \leq 1.E+6$ (dollars/man-year)
Purpose - Defines the labor cost of a decontamination worker.

Example Usage:

CHDLBCST001 35000.

3.6 Interdiction Plan Cost Data

The Interdiction Plan Cost Data block defines the parameters needed for the calculation of the cost of interdiction. The data supplied here are combined with data in the Site Data File and the Regional Characteristics Data in the course of the calculations.

The model used in MACCS for assessing the cost of interdiction is based on the model described in Appendix VI of the Reactor Safety Study [NR75] as selected by Rick Burke [Bu84]. It is currently applied to calculate the economic cost of loss of use during both decontamination and temporary interdiction periods.

Variable Name - DPRATE
Variable Type - Real, Scalar
Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (per year)
Purpose - Defines the depreciation rate that applies to property improvements during a period of interdiction. This depreciation rate is intended to account for the loss of value of buildings and other structures resulting from a lack of habitation and maintenance.

Example Usage:

CHDPRATE001 .20

Variable Name - DSRATE
Variable Type - Real, Scalar
Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (per year)
Purpose - Defines the expected rate of return from land, buildings, equipment, etc. For example, the inflation adjusted real mortgage rate for land and buildings could be used.

Example Usage:

CHDSRATE001 .12

Variable Name - POPCST
Variable Type - Real, Scalar
Allowed Range - $1.E-35 \leq \text{value} \leq 1.E+6$ (dollars/person)
Purpose - Defines the per-capita removal cost for temporary or permanent relocation of population and businesses in a region rendered uninhabitable during the long-term phase time period. This cost is assessed if any of the following actions are required: decontamination alone, decontamination followed by interdiction, or condemnation. This value should be derived in a way that takes account of both personal and corporate income losses for a transitional period as well as moving expenses.

Example Usage:

CHPOPCST001 5000.

3.7 Groundshine Weathering Data

The groundshine weathering definition data block defines the groundshine weathering equation, Gale's equation [Ga64]. The groundshine weathering relationship is defined as

$$GW(t) = GWCOEF(1) * \exp[-\ln(2) * t / TGWHLF(1)] + \dots + \\ GWCOEF(n) * \exp[-\ln(2) * t / TGWHLF(n)]$$

where $GW(t)$ represents the groundshine weathering at time t , given the weathering coefficients, $GWCOEF$, and the weathering half-lives, $TGWHLF$. The user must specify the number of terms, n , in the relationship and values for the weathering coefficients and the weathering half-lives.

Variable Name - NGWTRM
Variable Type - Integer, Scalar
Allowed Range - $1 \leq \text{value} \leq 2$
Purpose - Defines the number of terms in the groundshine weathering relationship.

Example Usage:

CHNGWTRM001 2

Variable Name - GWCOEF
Variable Type - Real, Array
Allowed Range - 0.0 <= value <= 1.0 (unitless)
Purpose - Defines the array of NGWTRM coefficients in the ground-shine weathering equation.

Example Usage:

CHGWCOEF001 0.5 0.5 (JON HELTON)

Variable Name - TGWHLF
Variable Type - Real, Array
Allowed Range - 1.E-35 <= value <= 1.E+12 (seconds)
Purpose - Defines the array of NGWTRM half-lives in the groundshine weathering equation.

Example Usage:

CHTGWHLF001 1.6E7 2.8E9 (JON HELTON)

3.8 Resuspension Weathering Data

The resuspension weathering definition data block defines the resuspension weathering equation. The resuspension weathering relationship is defined as

$$RW(t) = RWCOEF(1)*exp[-ln(2)*t/TRWHLF(1)] + \dots + RWCOEF(n)*exp[-ln(2)*t/TRWHLF(n)]$$

where $RW(t)$ represents the resuspension weathering at time t , given the weathering coefficients, $RWCOEF$, and the weathering half-lives, $TRWHLF$. The user must specify the number of terms, n , in the relationship and the values for the weathering coefficients and weathering half-lives.

Variable Name - NRWTRM
Variable Type - Integer, Scalar
Allowed Range - 1 <= value <= 3
Purpose - Defines the number of terms in the resuspension weathering relationship.

Example Usage:

CHNRWTRM001 3

Variable Name - RWCOEF
Variable Type - Real, Array
Allowed Range - 0.0 <= value <= 1.0 (per meter)
Purpose - Defines the array of NRWTRM coefficients in the resuspension weathering equation.

Example Usage:

*
* RESUSPENSION CONCENTRATION COEFFICIENTS (/ METER)
* RELATIONSHIP BETWEEN GROUND CONCENTRATION AND INSTANTANEOUS AIR CONC.
*

CHRWCOEF001 1.0E-5 1.0E-7 1.0E-9 (JON HELTON)

Variable Name - TRWHLF
Variable Type - Real, Array
Allowed Range - 1.E-35 <= value <= 1.E+12 (seconds)
Purpose - Defines the array of NRWTRM half-lives in the resuspension weathering equation.

Example Usage:

*
* HALF-LIVES CORRESPONDING TO THE RESUSPENSION CONCENTRATION
* COEFFICIENTS(S)
*
CHTRWHLF001 1.6E7 1.6E8 1.6E9 (6 MONTHS, 5 YEARS, 50 YEARS)

3.9 Regional Characteristics Data

The Regional Characteristics data block defines the aggregate economic and agricultural characteristics of the area surrounding the accident site.

If mitigative actions are necessary to restrict exposure to allowable levels, this data is used to evaluate the cost-effectiveness of those actions. For instance, if the average property values supplied here indicate that reclaiming a piece of land will cost more than the cost of condemning it, the land will be condemned instead of reclaimed.

Once a set of actions at a certain distance is decided upon, these actions may be "rotated" around the circle if the user has chosen the option of IPLUME=1 or IPLUME=2 as defined in Section 2.2. Now, in some of these wind directions, there could be an extremely valuable property. It is implicit in our calculational method that the cost-effectiveness test can not take account of this non-homogeneity of the valuation field because of the need for performing a rotation of the chosen actions around the circle.

The choice of actions is always determined by the aggregate characteristics of the region, but the calculation of the resulting consequence measures can be done in two different ways depending on the value of the input variable POPFLG which is defined in Section 2.3.

When a uniform population distribution is being used (POPFLG=UNIFORM), all of data in this section is used for the calculation of the CHRONC consequence measures. However, if the user requests that a Site Data

File be utilized (POPFLG=FILE), the first four parameters defined in this section are not actually used in the calculations though they are all required to be supplied. When a Site Data File is being utilized, the values corresponding to these four parameters are obtained from the Site Data File for each individual spatial element on the computational grid.

Variable Name - FRACLD
Variable Type - Real, Scalar
Allowed Range - $1.E-35 \leq \text{value} \leq 1.0$ (unitless)
Purpose - Defines the fraction of the site region covered by land.
The remainder is assumed to be water.

Note: If a Site Data File is being used (POPFLG=FILE), the value of this input parameter is not used by the code, nevertheless a valid parameter value must be supplied.

Example Usage:

CHFRACLD001 0.95

Variable Name - FRCFRM
Variable Type - Real, Scalar
Allowed Range - $1.E-35 \leq \text{value} \leq 1.0$ (unitless)
Purpose - Defines the average fraction of land in the region devoted to farm production. The land area under cultivation is as follows:

$$\text{cultivated-area} = \text{total-area} * \text{FRACLD} * \text{FRCFRM}$$

Note: If a Site Data File is being used (POPFLG=FILE), the value of this input parameter is not used by the code, nevertheless a valid parameter value must be supplied.

Example Usage:

CHFRCFRM001 0.382 VIRGINIA

Variable Name - FRMPRD
Variable Type - Real, Scalar
Allowed Range - $0.0 \leq \text{value} \leq 1.E+5$ (dollars/hectare)
Purpose - Defines the value of the average annual farm production (gross sales) in the region.

Note: If a Site Data File is being used (POPFLG=FILE), the value of this input parameter is not used by the code, nevertheless a valid parameter value must be supplied.

Example Usage:

CHFRMPRD001 371.0 VIRGINIA

Variable Name - DPFRCT

Variable Type - Real, Scalar

Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)

Purpose - Defines the fraction of annual farm production (gross sales) in the region resulting from dairy production.

Note: If a Site Data File is being used (POPFLG=FILE), the value of this input parameter is not used by the code, nevertheless a valid parameter value must be supplied.

Example Usage:

CHDPFRCT001 0.198 VIRGINIA

Variable Name - VALWF

Variable Type - Real, Scalar

Allowed Range - $1.E-35 \leq \text{value} \leq 1.E+6$ (dollars/hectare)

Purpose - Defines the value of farm wealth in the region. This value should include both publicly and privately owned grazing lands, farmland, farm buildings, non-recoverable farm machinery, as well as any publicly owned infrastructure serving the farm industry.

Example Usage:

CHVALWF0001 2613.0 SURRY

Variable Name - FRFIM

Variable Type - Real, Scalar

Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)

Purpose - Defines the fraction of farm wealth in the region due to improvements. This value includes farm buildings, non-recoverable machinery, as well as any infrastructure such as silos or irrigation which are devoted exclusively to the support of farming.

Example Usage:

CHFRFIM0001 0.25 SURRY

Variable Name - VALWNF

Variable Type - Real, Scalar

Allowed Range - $1.E-35 \leq \text{value} \leq 1.E+6$ (dollars/person)

Purpose - Defines the value of the non-farm wealth in the region. Non-farm wealth includes all public and private property not associated with farming which would be unusable if the region was rendered either temporarily or permanently uninhabitable. This value should include the cost of land, buildings, infrastructure, and the cost of any non-recoverable equipment or machinery.

Example Usage:

CHVALWNFO01 84000. VIRGINIA

Variable Name - FRNFIM

Variable Type - Real, scalar

Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)

Purpose - Defines the fraction of non-farm wealth in the region due to improvements. This value includes buildings, infrastructure such as roads and utilities as well as any non-recoverable equipment or machinery.

Example Usage:

CHFRNFIM001 0.8

3.10 Ingestion Transfer Factors Data

When radioactive material is deposited on land some fraction of this material may make its way through the food chain and ultimately be consumed by man in the form of contaminated food or drinking water. The ingestion pathway is modeled in MACCS as a series of transfer processes which the material must traverse between the time of deposition and the consumption of the contaminated food products by humans and which decrease the amount of material passed on to the next step.

To calculate the population dose resulting from the accumulated contamination of an area, it is necessary to know the efficiency of the entire food chain taken as a whole in transferring material from the ground to man. MACCS calculates the overall efficiency of the two ingestion pathways (food and water) by multiplication of all of the individual transfer factors which are described below.

Variable Name - NFICRP

Variable Type - Integer, Scalar

Allowed Range - $1 \leq \text{value} \leq 10$

Purpose - Defines the number of crop categories which will be used by the food pathway model.

Variable Name - NAMCRP

Variable Type - Character, Array

Allowed Range - $6 \leq \text{length} \leq 20$

Purpose - Defines the name of a crop category used in the food pathway model. The user must supply NFICRP names in column one of the data block.

Note: Within the code, there is a distinction between two types of crops: those harvested at the end of the growing season, and those harvested continuously over the entire growing season. The first seven letters of the crop names supplied here are used to distinguish between these two types of crops.

If a crop's name begins with 'PASTURE', it is harvested continuously; if it doesn't, it is harvested at the end of the growing season.

Variable Name - FRCTCH
Variable Type - Real, Array
Allowed Range - 0. <= value <= 1. (unitless)
Purpose - Specifies the fraction of the edible portion of the harvested crop that is consumed by humans. The user must supply NFICRP values for this variable in column two of the data block.

Variable Name - FRCTCM
Variable Type - Real, Array
Allowed Range - 0. <= value <= 1. (unitless)
Purpose - Specifies the fraction of the edible portion of the harvested crop that is consumed by milk producing animals. The user must supply NFICRP values for this variable in column three of the data block.

Variable Name - FRCTCB
Variable Type - Real, Array
Allowed Range - 0. <= value <= 1. (unitless)
Purpose - Specifies the fraction of the edible portion of the harvested crop that is consumed by meat producing animals. The user must supply NFICRP values for this variable in column four of the data block.

Example Usage:

```
*
* NUMBER OF DEFINED CROPS IN THE CHRONC FOOD INGESTION MODEL
*
CHNFICRP001      7      (UP TO 10 ALLOWED)
*
* NOTE TO USER:  THE CODE MAKES SPECIAL TREATMENT OF CROP NAMES BEGINNING
* WITH 'PASTURE' DUE TO THE CONTINUOUS NATURE OF THE HARVESTING PROCESS.
*
* IF THE USER WISHES TO DEFINE A NEW CROP CATEGORY FOR RANGELAND PASTURE,
* IT SHOULD BE CALLED 'PASTURE-RANGE' OR 'PASTURE-DRY'
*
* TABLE OF CROP DEFINITIONS FOR THE CHRONC FOOD INGESTION MODEL
*
```

```

*
*                                FRACTION OF CROP CONSUMED BY
*
*                                DAIRY    MEAT
*                                MAN    ANIMALS  ANIMALS
*
*                                NAMCRP    FRCTCH  FRCTCM  FRCTCB
CHCRPTBL001 'PASTURE          ' 0.0    0.1    0.9
CHCRPTBL002 'STORED FORAGE    ' 0.0    0.13   0.87
CHCRPTBL003 'GRAINS           ' 0.35   0.040  0.61
CHCRPTBL004 'GRN LEAFY VEG.   ' 1.0    0.0    0.0
CHCRPTBL005 'OTHER FOOD CROPS ' 1.0    0.0    0.0
CHCRPTBL006 'LEGUMES AND SEEDS' 0.24   0.046  0.714
CHCRPTBL007 'ROOTS AND TUBERS ' 1.0    0.0    0.0

```

Note: The data in the following section describing the water ingestion factors is required to be supplied on the CHRONC User Input File but it is only used in the calculations if the user has chosen the option of a uniform population density surrounding the site (in Section 2.3, POPFLG='UNIFORM').

When radioactive material is deposited on the ground, it is expected that some fraction of this material will make its way into drinking water consumed by humans [He85]. MACCS models this uptake into drinking water as two separate paths: (1) deposition of material directly onto fresh water bodies, and (2) deposition of material onto land with subsequent washoff into fresh water bodies.

The water ingestion model assumes that the area surrounding the site is divided into two categories: water and land. The radioactive material deposited on a spatial element is apportioned between water and land according to the fraction of the region "covered by land" (see variable FRACLD in the previous section).

For coastal sites, where both fresh water and ocean need to be treated, it is recommended that the user supply a Site Data File where the limitation of having only one kind of watershed can be overcome. A Site Data File can define up to four types of watersheds. One of those watersheds, e.g., ocean, can be defined to have a zero uptake fraction.

The user is required to supply three numeric parameters in the following section, which define the behavior of the single watershed which is utilized if a uniform population density has been specified.

Of the material deposited directly onto water or transferred from land to water, the fraction represented by WINGF determines how much of that material will eventually be consumed by humans. There is no adjustment of WINGF within the code to account for radioactive decay.

Of the material that has been deposited on land, some fraction makes its way through runoff into the fresh water supply over a relatively short period after deposition. This fraction is specified by the value of WSHRTI.

The remainder of the material deposited on land is assumed to be washed off to the fresh water supply at a constant fractional rate over the time from $t=0$ to $t=\infty$. The rate at which this subsequent washoff occurs is specified by the value of the rate constant WSHRTA.

The code uses the values of the two variables, WSHRTI and WSHRTA, and evaluates the integral of the washoff fraction in a way which takes account of radioactive decay for the material deposited on land surfaces. The model is described in [He85]. The evaluation of this integral produces a numeric value, F, which represents the fraction of material falling on land that will be eventually transferred to surface water bodies that supply drinking water.

With this value of F, we can now calculate the uptake fraction for material deposited on solid ground. It is simply $WINGF * F$.

The input variable WINGF is the ratio between the total amount of a radionuclide consumed via the drinking water pathway (i.e., by the entire population of the region surrounding the reactor) and the amount of that radionuclide entering potable surface-water bodies. Typically, WINGF would be derived by the MACCS user from a model for radionuclide movement in the surface-water system in the surrounding region.

The models used to determine WINGF can vary in complexity from the very simple (e.g., a single uniformly mixed cell) to the very complex (e.g., three dimensional fluid transport with temporal and spatial variability). The value of WINGF supplied with the Sample Problem, 5.E-6, has been derived in a very simple manner.

Variable Name - NUMWPI

Variable Type - Integer, Scalar

Allowed Range - $1 \leq \text{value} \leq 10$

Purpose - Defines the number of nuclides to be considered by the drinking water pathway. The drinking water nuclides must be a subset of the food ingestion nuclides (defined by NFIISO and NAMIPI in the following text).

Variable Name - NAMWPI

Variable Type - Character, Array

Allowed Range - $2 \leq \text{length} \leq 10$

Purpose - Defines the name of a nuclide used in the drinking water pathway. The user must supply NUMWPI nuclide names in column one of the data block.

Note: For the purpose of calculating water ingestion doses, there is no provision for modeling the buildup of any radioactive daughter products which result from decay. There is no provision for accounting for the water ingestion dose resulting from radioactive daughter products of the water pathway nuclides defined in NAMWPI.

Variable Name - WSHFRI
 Variable Type - Real, Array
 Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)
 Purpose - Defines the initial washoff fraction for the specified nuclide. This is the fraction of material deposited on land which is easily washed off into the watershed drainage system immediately following the deposition of that nuclide. The user must supply NUMWPI values for this variable in column two of the data block.

Variable Name - WSHRTA
 Variable Type - Real, Array
 Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (per year)
 Purpose - Defines the annual washoff rate for the specified nuclide. This is the rate at which material deposited on land is washed off into the watershed drainage system following the initial deposition. The user must supply NUMWPI values for this variable in column three of the data block.

Variable Name - WINGF
 Variable Type - Real, Array
 Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)
 Purpose - Defines the water ingestion factor for the nuclide specified in column one of the data block. This factor specifies the fraction of the radioactivity washed into the drainage system of the watershed that is ultimately consumed by humans. The user must supply NUMWPI values for this variable in column four of the data block.

Note: If a Site Data File is being used (POPFLG=FILE), the value of WINGF is not used by the code, nevertheless a valid parameter value must be supplied.

Example Usage:

```
*
* NUMBER OF NUCLIDES IN THE CHRONC DRINKING WATER PATHWAY MODEL
*
CHNUMWPI001      4
*
* TABLE OF NUCLIDES, WASHOFF FRACTIONS, AND INGESTION FACTORS FOR THE
* CHRONIC DRINKING WATER PATHWAY MODEL. THE SET OF DRINKING WATER
* PATHWAY NUCLIDES MUST BE A SUBSET OF THE SET OF NUCLIDES SPECIFIED
* FOR THE FOOD PATHWAY MODEL.
*
```

*		INITIAL	ANNUAL	INGESTION FACTOR
*	WATER	WASHOFF	WASHOFF	[(BQ INGESTED)/
*	NUCLIDE	FRACTION	RATE	(BQ IN WATER)]
*				
*	NAMWPI	WSHFRI	WSHRTA	WINGF
CHWTRISO001	SR-89	0.01	0.004	5.0E-6
CHWTRISO002	SR-90	0.01	0.004	5.0E-6
CHWTRISO003	CS-134	0.005	0.001	5.0E-6
CHWTRISO004	CS-137	0.005	0.001	5.0E-6

Variable Name - NFIISO
Variable Type - Integer, Scalar
Allowed Range - NUMWPI <= value <= 10
Purpose - Defines the number of nuclides for which data will be specified for the food ingestion pathway.

Note: There is no provision for accounting for the food ingestion dose resulting from radioactive daughter products of the food pathway nuclides defined in NAMIPI.

Variable Name - NAMIPI
Variable Type - Character, Array
Allowed Range - 3 <= length <= 8
Purpose - Defines the name of a nuclide used in the food pathway model. The user must supply NFIISO nuclide names in column one of the data block. This list of nuclide names must include all of the nuclides that were specified for the drinking water pathway. The drinking water pathway nuclides must appear first in this data list and in the same order as they occurred in the nuclide list for the drinking water pathway, variable NAMWPI.

Variable Name - DCYPMH
Variable Type - Real, Array
Allowed Range - 0.0 <= value <= 1.0 (unitless)
Purpose - Transfer factor describing the processing losses and radioactive decay which occurs between the production and the consumption of milk products.

Specifically, DCYPMH is the ratio of the amount of a radionuclide in milk products at the time of consumption to the amount of that radionuclide in the milk at the time of its production (milking).

The values given here will be multiplied by the values given for TFMLK in order to define the efficiency of the milk-to-man food pathway. The user must supply NFIISO values for this variable in column two of the data block.

Variable Name - DCYPBH
Variable Type - Real, Array
Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)
Purpose - Transfer factor describing the processing losses and radioactive decay which occurs between the production and the consumption of meat products.

Specifically, DCYPBH is the ratio of the amount of a radionuclide in meat products at the time of consumption to the amount of that radionuclide in the meat at the time of its production (slaughter).

The values given here will be multiplied by the values given for TFBF in order to define the efficiency of the meat to man pathway. The user must supply NFIISO names in column three of the data block.

Variable Name - TFMLK
Variable Type - Real, Array
Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)
Purpose - Transfer factor describing how much of the material ingested by milk producing animals ends up in milk products consumed by humans.

Specifically, TFMLK is the ratio of the amount of a radionuclide in fresh milk to the amount of the radionuclide consumed by milk-producing animals.

It takes account of biological transport within the animal as well as excretion and radioactive decay.

This factor defines the fraction of the radioactive material ingested by an animal which is transferred to the milk produced by an animal. The values given here will be multiplied by the values given for DCYPMH in order to define the efficiency of the milk-to-man food pathway. The user must supply NFIISO values for this variable in column four of the data block.

Variable Name - TFBF
Variable Type - Real, Array
Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)
Purpose - Transfer factor describing how much of the material ingested by meat producing animals ends up in meat products consumed by humans.

Specifically, TFBF is the ratio of the amount of a radionuclide in edible meat at the time of slaughter to the amount of the radionuclide that was consumed by the meat producing animals.

It takes account of biological transport within the animals as well as excretion and radioactive decay.

This factor defines the fraction of the radioactive material ingested by the animal which is transferred to the meat products produced from the animal. The values given here will be multiplied by the values given for DCYBH to define the efficiency of the meat to man food pathway. The user must supply NFIISO values for this variable in column five of the data block.

Example Usage:

```
*
* NUMBER OF NUCLIDES IN THE CHRONC FOOD INGESTION MODEL
*
CHNFIISO001  6  (UP TO 10 ALLOWED, DAUGHTER BUILDUP IS NOT TREATED)
*
* TABLE OF NUCLIDE DEFINITIONS IN THE CHRONC INGESTION PATHWAY MODEL
*
* NUCLIDES THAT WERE DEFINED IN THE WATER PATHWAY DATA ABOVE MUST BE A
* SUBSET OF THE CHRONC INGESTION PATHWAY NUCLIDES.  THE WATER
* PATHWAY NUCLIDES MUST BE LISTED FIRST IN THIS DATA BLOCK AND IN
* THE SAME ORDER AS THEY WERE LISTED IN THE WATER PATHWAY DATA
* BLOCK
```

	INGESTION NUCLIDE	RETENTION FACTORS PROCESSING AND DECAY		TRANSFER FACTORS [(BQ TRANSFERRED)/ (BQ INGESTED)]	
		MILK/MAN	MEAT/MAN	MILK	MEAT
	NAMIPI	DCYPMH	DCYPBH	TFMLK	TFBF
CHISODEF001	SR-89	0.66	0.77	0.022	0.00022
CHISODEF002	SR-90	1.0	1.0	0.022	0.00022
CHISODEF003	CS-134	1.0	1.0	0.11	0.023
CHISODEF004	CS-137	1.0	1.0	0.11	0.024
CHISODEF005	I-131	0.28	0.18	0.13	0.0024
CHISODEF006	I-133	0.002	0.0	0.062	0.0011

Variable Name - TCROOT

Variable Type - Real, Array

Allowed Range - 0.0 <= value <= 1.0 (unitless)

Purpose - Defines the transfer factor for the long-term transfer of radionuclides from soil to edible crops.

Specifically, TCROOT is the ratio of the amount of a radionuclide ultimately taken up from soil into edible portions of a crop to the amount of that radionuclide that was deposited onto the soil.

The long-term transfer of nuclides from soil to plants occurs principally by uptake (sorption) by plant root systems. Transfer to plant surfaces by rainsplash and by deposition of materials resuspended from surface soil can also contribute to this pathway. In addition, the ingestion of contaminated soil by animals grazing on pastureland may also contribute to the overall dose.

The values of TCROOT supplied in the data block should be calculated by integrating the overall uptake rate over the period from time=zero to infinity. In other words, TCROOT incorporates the total uptake over all time after the initial deposition.

As nuclides are removed from the soil compartment not only by root uptake but also by radioactive decay, percolation, and irreversible chemical binding, all of these processes should be incorporated into the derivation of TCROOT.

The annual rate at which the material is made unavailable due to these processes is specified by the input variable QROOT which is defined at the end of this section.

Values of TCROOT must be specified for each crop category for all nuclides treated by the food pathway model (i.e., for all possible nuclide/crop combinations).

The required data are entered in a block as a two-dimensional array. The first column of the block repeats the list of food pathway nuclides. This list must be ordered exactly the same as the original definition of the variable NAMIPI.

All the other columns of the data block present values of TCROOT for one crop category and all food nuclides. The order of the columns in going from left to right is assumed to be the same as is specified by NAMCRP in Section 3.11.

Example Usage:

```
* TRANSFER FACTOR FROM SOIL TO PLANT BY ROOT-UP TAKE (AND BY SOIL
* INGESTION FOR GRAZING ON PASTURE) INTEGRATED OVER ALL TIME [(BQ TRANS-
* FERRED)/(BQ DEPOSITED)]
```

			STOR	GRN	OTHER	LEGUMES	ROOTS	
			ED	LEAFY	FOOD	AND	AND	
	NUCLIDE	PASTURE	FORAGE	GRAINS	VEG	CROPS	SEEDS	TUBERS
	NAMISO	TCROOT	TCROOT	TCROOT	TCROOT	TCROOT	TCROOT	TCROOT
CHTCROOT001	SR-89	4.1E-4	1.3E-3	4.3E-5	1.7E-4	8.6E-6	3.7E-4	1.1E-4
CHTCROOT002	SR-90	2.6E-2	9.0E-2	3.3E-3	1.3E-2	6.6E-4	2.8E-2	8.4E-3
CHTCROOT003	CS-134	1.3E-3	7.1E-4	3.5E-5	1.4E-5	1.1E-4	9.3E-5	5.6E-5
CHTCROOT004	CS-137	6.9E-3	1.5E-3	7.6E-5	3.0E-5	2.3E-4	2.0E-4	1.2E-4
CHTCROOT005	I-131	1.6E-4	0.0	0.0	0.0	0.0	0.0	0.0
CHTCROOT006	I-133	1.7E-6	0.0	0.0	0.0	0.0	0.0	0.0

Variable Name - DCYPCH

Variable Type - Real, Array

Allowed Range - 0.0 <= value <= 1.0 (unitless)

Purpose - This factor characterizes the loss due to radioactive decay occurring between the time of harvest and the time of the crop's consumption by humans.

Specifically, DCYPCH is the ratio between the amount of a radionuclide present in a crop at the time of its consumption and the amount of that radionuclide in the crop at the time of harvest after taking account of losses due to radioactive decay.

The data supplied here are used in calculating ingestion dose arising from both direct deposition onto growing crops and the long-term uptake processes of subsequent growing seasons.

This factor is applied only to crops that are directly consumed by humans (e.g., grains, vegetables, legumes, etc.). Any values supplied for crops not consumed by humans will have no impact on the calculations.

The values give here are multiplied by the corresponding values of FPLSCH, which characterizes processing losses, to obtain the overall transfer factor for this part of the food chain.

Values of DCYPCH must be specified for each crop category for all nuclides treated by the food pathway model (i.e., for all possible nuclide/crop combinations).

The required data are entered in a block as a two-dimensional array. The first column of the block repeats the list of food pathway nuclides. This list must be ordered exactly the same as the original definition of the variable NAMIPI.

All the other columns of the data block present values of DCYPCH for one crop category and all food nuclides. The order of the columns in going from left to right is assumed to be the same as is specified by NAMCRP in Section 3.11.

Example Usage:

* RADIOACTIVE DECAY RETENTION FACTORS (I.E., 1 - F WHERE F = FRACTION OF
* RADIOACTIVITY LOST BY DECAY) FOR NUCLIDES IN CROPS FROM TIME OF HARVEST
* TO TIME OF CONSUMPTION BY HUMANS (FRACTION RETAINED)

*					GRN	OTHER	LEGUMES	ROOTS
*			STORED		LEAFY	FOOD	AND	AND
*	NUCLIDE	PASTURE	FORAGE	GRAINS	VEG	CROPS	SEEDS	TUBERS
*								
*	NAMISO	DCYPCH	DCYPCH	DCYPCH	DCYPCH	DCYPCH	DCYPCH	DCYPCH
CHDCYPCH001	SR-89	0.0	0.0	0.18	0.67	0.21	0.18	0.18
CHDCYPCH002	SR-90	0.0	0.0	0.99	1.0	0.99	0.99	0.99
CHDCYPCH003	CS-134	0.0	0.0	0.84	0.96	0.85	0.84	0.84
CHDCYPCH004	CS-137	0.0	0.0	0.99	1.0	0.99	0.99	0.99
CHDCYPCH005	I-131	0.0	0.0	0.0099	0.21	0.024	0.0099	0.0099
CHDCYPCH006	I-133	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Variable Name - DCYPCM

Variable Type - Real, Array

Allowed Range - 0.0 <= value <= 1.0 (unitless)

Purpose - This factor characterizes the loss due to radioactive decay occurring between the time of harvest and the time of the crop's consumption by meat-producing animals.

Specifically, DCYPCM is the ratio of the amount of a radionuclide in the crop at the time of its consumption to the amount of that radionuclide in the crop at the time of harvest.

The data supplied here are used in calculating ingestion dose arising from both direct deposition onto growing crops and the long-term uptake processes of subsequent growing seasons.

This factor is applied only to crops that are directly consumed by milk-producing animals (e.g., pasture and forage). Any values supplied for crops not consumed by milk producing animals will have no impact on the calculations.

For pasture crops, harvest and consumption are simultaneous and so DCYPCM should be set to 1.0 for the pasture crop categories.

Values of DCYPCM must be specified for each crop category for all nuclides treated by the food pathway model (i.e., for all possible nuclide/crop combinations).

The required data are entered in a block as a two-dimensional array. The first column of the block repeats the list of food pathway nuclides. This list must be ordered exactly the same as the original definition of the variable NAMIPI.

All the other columns of the data block present values of DCYPCM for one crop category and all food nuclides. The order of the columns in going from left to right is assumed to be the same as is specified by NAMCRP in Section 3.11.

Example Usage:

* RETENTION FACTORS FOR NUCLIDES IN CROPS FROM TIME OF HARVEST TO TIME OF
* CONSUMPTION BY MILK-PRODUCING ANIMALS (FRACTION RETAINED). FACTORS
* REFLECTS LOSSES DUE TO RADIOACTIVE DECAY.

	NUCLIDE	PASTURE	STOR- ED FOR- AGE	GRN GRAINS	OTHER LEAFY VEG	FOOD CROPS	LEGUMES AND SEEDS	ROOTS AND TUBERS
	NAMISO	DCYPCM	DCYPCM	DCYPCM	DCYPCM	DCYPCM	DCYPCM	DCYPCM
CHDCYPCM001	SR-89	1.0	0.37	0.20	0.0	0.0	0.20	0.0
CHDCYPCM002	SR-90	1.0	0.99	0.99	0.0	0.0	0.99	0.0
CHDCYPCM003	CS-134	1.0	0.92	0.85	0.0	0.0	0.85	0.0
CHDCYPCM004	CS-137	1.0	0.99	0.99	0.0	0.0	0.99	0.0
CHDCYPCM005	I-131	1.0	0.063	0.032	0.0	0.0	0.032	0.0
CHDCYPCM006	I-133	1.0	0.0068	0.0034	0.0	0.0	0.0034	0.0

Variable Name - DCYPCB

Variable Type - Real, Array

Allowed Range - 0.0 <= value <= 1.0 (unitless)

Purpose - This factor specifies the retention of material after radioactive decay occurs between the time of harvest and the time of consumption by meat producing animals.

Specifically, DCYPCB is the ratio of the amount of a radionuclide in the crop at the time of its consumption to the amount of that radionuclide in the crop at the time of harvest.

This factor is applied only to crops that are directly consumed by meat-producing animals (e.g., pasture and forage). Any values supplied for crops not consumed by meat producing animals will have no impact on the calculations.

Values of DCYPCB must be specified for each crop category for all nuclides treated by the food pathway model (i.e., for all possible nuclide/crop combinations).

The required data are entered in a block as a two-dimensional array. The first column of the block repeats the list of food pathway nuclides. This list must be ordered exactly the same as the original definition of the variable NAMIPI.

All the other columns of the data block present values of DCYPCB for one crop category and all food nuclides. The order of the columns in going from left to right is assumed to be the same as is specified by NAMCRP in Section 3.11.

Example Usage:

* RETENTION FACTORS FOR NUCLIDES IN CROPS FROM TIME OF HARVEST TO TIME OF
* CONSUMPTION BY MEAT-PRODUCING ANIMALS (FRACTION RETAINED). FACTOR
* REFLECTS LOSSES DUE TO RADIOACTIVE DECAY.

			STOR	GRN	OTHER	LEGUMES	ROOTS	
			ED	LEAFY	FOOD	AND	AND	
	NUCLIDE	PASTURE	FORAGE	GRAINS	VEG	CROPS	SEEDS	TUBERS
	NAMISO	DCYPCB	DCYPCB	DCYPCB	DCYPCB	DCYPCB	DCYPCB	DCYPCB
CHDCYPCB001	SR-89	1.0	0.37	0.20	0.0	0.0	0.20	0.0
CHDCYPCB002	SR-90	1.0	0.99	0.99	0.0	0.0	0.99	0.0
CHDCYPCB003	CS-134	1.0	0.92	0.85	0.0	0.0	0.85	0.0
CHDCYPCB004	CS-137	1.0	0.99	0.99	0.0	0.0	0.99	0.0
CHDCYPCB005	I-131	1.0	0.063	0.032	0.0	0.0	0.032	0.0
CHDCYPCB006	I-133	1.0	0.0068	0.0034	0.0	0.0	0.0034	0.0

Variable Name - FPLSCH

Variable Type - Real, Array

Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)

Purpose - This factor specifies the fraction of material retained in the harvested crop after accounting for the losses resulting from its preparation for consumption by humans.

Specifically, FPLSCH is the ratio of the amount of a radionuclide in the crop after it has been processed for human consumption to the amount of that radionuclide in the crop before processing.

The retention factor reflects the fraction of radioactive material in the edible portion of the plant which is retained after washing, peeling, or cooking.

The values supplied here apply only to crops which are directly consumed by humans. Any values specified for crops such as pasture which are supplied here will have no impact on the calculations.

The values given here are multiplied with the corresponding values of DCYPCH in order to obtain the overall transfer factor for this part of the food chain.

Values of FPLSCH must be specified for each crop category for all nuclides treated by the food pathway model (i.e., for all possible nuclide/crop combinations).

The required data are entered in a block as a two-dimensional array. The first column of the block repeats the list of food pathway nuclides. This list must be ordered exactly the same as the original definition of the variable NAMIPI.

All the other columns of the data block present values of FPLSCH for one crop category and all food nuclides. The order of the columns in going from left to right is assumed to be the same as is specified by NAMCRP in Section 3.11.

Example Usage:

* CROP PROCESSING AND PREPARATION RETENTION FACTORS FOR NUCLIDES IN FOOD
 * CROPS CONSUMED BY HUMANS (FRACTION RETAINED). FACTORS REFLECT LOSS OF
 * NUCLIDES FROM FOODS DUE TO PROCESSING (E.G., WASHING OF FRUIT, PEELING
 * OF POTATOES, LOSSES DURING CANNING) AND FOOD PREPARATION (COOKING) FROM
 * THE TIME OF PROCESSING OF THE HARVESTED CROP TO THE TIME OF CONSUMPTION
 * BY HUMANS. FACTORS DO NOT REFLECT LOSSES DUE TO RADIOACTIVE DECAY.

*					GRN	OTHER	LEGUMES	ROOTS
*			STORED		LEAFY	FOOD	AND	AND
*	NUCLIDE	PASTURE	FORAGE	GRAINS	VEG	CROPS	SEEDS	TUBERS
*								
*	NAMISO	FPLSCH	FPLSCH	FPLSCH	FPLSCH	FPLSCH	FPLSCH	FPLSCH
CHFPLSCH001	SR-89	0.0	0.0	0.25	0.5	0.71	0.8	0.8
CHFPLSCH002	SR-90	0.0	0.0	0.25	0.5	0.71	0.8	0.8
CHFPLSCH003	CS-134	0.0	0.0	0.25	0.5	0.71	0.8	0.8
CHFPLSCH004	CS-137	0.0	0.0	0.25	0.5	0.71	0.8	0.8
CHFPLSCH005	I-131	0.0	0.0	0.33	0.5	0.71	0.8	0.8
CHFPLSCH006	I-133	0.0	0.0	0.33	0.5	0.71	0.8	0.8

When an accident occurs during the growing season, part of the radioactive material deposited on farmland will be retained on plant surfaces and the remainder will fall on the ground. Between the time of deposition and the time of harvest, radioactive material can be lost from plant surfaces due to weathering, radioactive decay, translocation to interior portions of the plant, and the harvesting process.

The fraction of radioactive material which is removed from the air due to dry and wet deposition that ends up in edible portions of the harvested plant is here called the growing crop retention factor. Specifically, this factor is defined to be the ratio between the amount of a radionuclide present in the crop at harvest and the total amount of material initially deposited onto the land used for producing that crop.

For all crops except pasture, harvesting occurs at the end of the growing season. The harvesting of pasture differs from the other crops in that it is a continuous process. In MACCS it is assumed that grazing takes exactly one growing season to harvest the year's entire production of the pasture crop. The numerical integration used in the pasture dose calculations is therefore different from that used for the other crop categories. The type of integration performed by the code is determined by the name given to the crop categories. Crop names beginning with "PASTURE" are treated differently from the rest.

For crops where the edible portion of the plant is exposed to the environment, weathering losses over the period from deposition to harvesting will decrease the amount of retained as a function of time. That is, the longer the time between deposition and harvesting, the lower the resultant dose.

Crops such as grains and legumes with the edible portions internal to the plant may show the opposite behavior with material being absorbed into the plant over time. Since this is a slow process and data on the translocation rate is hard to obtain, the user should try to define an average retention factor appropriate for deposition onto crops that is independent of time in the growing season and not use the weathering model for these types of crops.

The situation is further complicated by the fact that the available data suggests that total retention for grains is greatest when the deposition occurs near the middle of the growing season rather than at the end of it.

Both types of crops are modeled with a weathering equation that can have up to three exponential terms, each with a different weathering rate. For the types of crops not subject to weathering losses (i.e., grains, legumes) a very long half-life can be specified for the weathering rate as a way of replacing the weathering function with a constant transfer fraction.

In MACCS the removal of radioactivity from plant surfaces by weathering is treated as a sum of terms that have the following form:

$$CTCOEF \bullet e^{-\lambda t}$$

where CTCOEf represents the fraction of material, deposited on a cultivated field that is removed by weathering with a decay rate of λ .

CTCOEF equals the product of two quantities: the interception fraction and the availability fraction. The interception fraction is the fraction of material deposited onto a field that is intercepted by crop surfaces and the availability fraction is the fraction of material deposited onto crop surfaces that is weathered away with the half-life CTHALF.

Because translocation from the plant surface to interior portions influences the retention of radioactivity for grains, legumes, and root crops, the weathering model just described is not appropriate for these crop categories but as discussed in the next paragraph, the model can be modified through user-defined input parameters to, in effect, yield a transfer function which is constant with respect to time.

For the sample data presented in this section, the efficiency of grains, legumes, and root crops in transferring radioactivity was not derived in the same way as the data was derived for the other types of crops. For the grain, legume, and "other" categories, an empirical transfer factor derived from fallout studies was used, where the empirical factor represents the combined effects of interception, weathering, translocation to seeds, and root-uptake.

Since long-term uptake is treated separately from the growing-season pathway, this may cause the long-term uptake dose from grains and legumes to be double counted in the first growing season. However, as root uptake in a single season is typically small relative to the contamination resulting from direct deposition, the potential impact of such a double-counting is unlikely to be significant.

For convenience, this empirical factor is input as a value of CTCOEF. Since this empirical value includes the effects of weathering, the exponential part of the weathering decay expression associated with this empirical value for CTCOEF is reduced to a value close to unity by setting CTHALF equal to one million years (3.15×10^{13} seconds).

For all food pathway nuclides, values of CTCOEF and CTHALF are required for each term in the weathering expression for each crop category. Unnecessary weathering terms are eliminated by setting CTCOEF equal to zero and CTHALF equal to unity for those terms.

Variable Name - NTTRM
Variable Type - Integer, Scalar
Allowed Range - $1 \leq \text{value} \leq 3$
Purpose - Defines the number of terms used in the growing crop retention model.

Example Usage:

*
* NUMBER OF TERMS IN THE GROWING CROP RETENTION MODEL
*

CHNTRTRM001 2

Variable Name - CTCOEF
Variable Type - Real, Array
Allowed Range - $0.0 \leq \text{value} \leq 1.0$ (unitless)
Purpose - For crops with exposed edible portions, defines the product of the interception fraction and the availability fraction for each term in the weathering model. For plants with edible portions internal to the plant, defines the combined transfer fraction for interception, weathering, and translocation to seeds averaged over an entire growing season.

For each term of the weathering equation (and there can be up to three of them) values of CTCOEF must be specified for each crop category for all nuclides treated by the food pathway model.

The required data are entered in up to three data blocks for each of the possible terms of the weathering equation with each of the data blocks being arranged in the same manner as the variables described earlier (FPLSCH, DCYPCH, etc.).

The values of CTCOEF entered in different data blocks are distinguished from each other by the ninth character in the record identifier. For variable CTCOEF, the record identifier has the form CHCTCOEFNMM where N is one for the first weathering term, two for the second weathering term, and three for the third weathering term, and MM varies from 01 for the first food pathway nuclide to NN for the last food pathway nuclide.

The data format for CTCOEF is identical to that used for the subsequent variable CTHALF. There should be a one-to-one correspondence between the data supplied for these two variables.

Example Usage:

*
* LOSSES DUE TO WEATHERING FROM PLANT SURFACES AND DURING TRANSLOCATION
* FROM PLANT SURFACES TO INTERIOR EDIBLE PORTIONS OF PLANTS ARE MODELED
* USING THE FOLLOWING EQUATION:
*
* $\text{FRACTION RETAINED} = \text{CTCOEF1} \cdot \exp(-\text{LN2}/\text{CTHALF1}) + \text{CTCOEF2} \cdot \exp(-\text{LN2}/$
* $\text{CTHALF2})$
*

* FOR PASTURE, STORED FORAGE, GREEN LEAFY VEGETABLES, AND OTHER FOOD
 * CROPS, THIS EQUATION IS USED AS A TWO TERM WEATHERING EQUATION. FOR
 * GRAINS, LEGUMES AND SEEDS, AND ROOTS AND TUBERS WHERE RADIOACTIVITY IS
 * CONSUMED ONLY IF TRANSLOCATED TO EDIBLE PORTIONS OF THE PLANT, THIS
 * EQUATION IS REDUCED TO A TRANSLOCATION TRANSFER FACTOR BY SETTING
 * CTCOE2 TO ZERO, CTHALF2 TO ONE SECOND, AND CTHALF1 TO ABOUT ONE
 * MILLION YEARS (1E13 SECONDS). WHEN USED TO MODEL TRANSLOCATION, THE
 * VALUE OF THE TRANSLOCATION TRANSFER FACTOR IS DEVELOPED FROM FALLOUT
 * DATA AND IS INPUT AS THE VALUE OF CTCOE1.

* TWO TIME PERIODS ARE USED FOR WEATHERING, THE FIRST IS 14 DAYS LONG
 * (1.21E6 SECONDS) AND THE SECOND IS 50 DAYS LONG (4.32E6 SECONDS).

* DIRECT DEPOSITION TRANSFER COEFFICIENTS BY CHRONIC INGESTION MODEL
 * NUCLIDE [(BQ TRANSFERRED)/(BQ DEPOSITED)]

*					GRN	OTHER	LEGUMES	ROOTS
*			STORED		LEAFY	FOOD	AND	AND
*	NUCLIDE	PASTURE	FORAGE	GRAINS	VEG	CROPS	SEEDS	TUBERS
* TERM1								
CHCTCOEF101	SR-89	0.3	0.2	0.01	0.24	0.2	0.005	0.0006
CHCTCOEF102	SR-90	0.3	0.2	0.01	0.24	0.2	0.005	0.0006
CHCTCOEF103	CS-134	0.3	0.2	0.05	0.24	0.2	0.01	0.025
CHCTCOEF104	CS-137	0.3	0.2	0.05	0.24	0.2	0.01	0.025
CHCTCOEF105	I-131	0.3	0.2	0.0	0.24	0.2	0.0	0.0
CHCTCOEF106	I-133	0.3	0.2	0.0	0.24	0.2	0.0	0.0
* TERM 2								
CHCTCOEF201	SR-89	0.076	0.05	0.0	0.06	0.05	0.0	0.0
CHCTCOEF202	SR-90	0.076	0.05	0.0	0.06	0.05	0.0	0.0
CHCTCOEF203	CS-134	0.076	0.05	0.0	0.06	0.05	0.0	0.0
CHCTCOEF204	CS-137	0.076	0.05	0.0	0.06	0.05	0.0	0.0
CHCTCOEF205	I-131	0.076	0.05	0.0	0.06	0.05	0.0	0.0
CHCTCOEF206	I-133	0.076	0.05	0.0	0.06	0.05	0.0	0.0

Variable Name - CTHALF

Variable Type - Real, Array

Allowed Range - 1. <= value <= 1.E14 (seconds)

Purpose - Half-life values for the various terms of the weathering model. The values supplied for CTHALF in this data block must be properly paired with the corresponding values of CTCOE defined in the previous data block.

For each term of the weathering equation (there can be up to three) values of CTHALF must be specified for each crop category for all nuclides treated by the food pathway model.

The required data are entered in up to three data blocks for each of the possible terms of the weathering equation with each of the data blocks being arranged in the same manner as the variables described earlier (FPLSCH, DCYPCH, etc.).

The values of CTHALF entered in different data blocks are distinguished from each other by the ninth character in the record identifier. For variable CTHALF, the record identifier identifier has the form CHCTHALFNMM where N is one for the first weathering term, two for the second weathering term, and three for the third weathering term, and MM varies from 01 for the first food pathway nuclide to NN for the last food pathway nuclide.

The data format for CTHALF is identical to that used for the preceding variable CTCOEF. There should be a one-to-one correspondence between the data supplied for these two variables.

Example Usage:

```

*
* CROP TRANSFER HALF-LIVES BY CHRONC INGESTION MODEL NUCLIDE (SECONDS)
*
*
*              GRN   OTHER   LEGUMES   ROOTS
*              LEAFY  FOOD     AND      AND
*              VEG    CROPS   SEEDS   TUBERS
*
*      NUCLIDE  PASTURE  STORED  GRAINS
*
* TERM1
CHCTHALF101  SR-89   1.21E6   1.21E6   1E13   1.21E6   1.21E6   1E13   1E13
CHCTHALF102  SR-90   1.21E6   1.21E6   1E13   1.21E6   1.21E6   1E13   1E13
CHCTHALF103  CS-134   1.21E6   1.21E6   1E13   1.21E6   1.21E6   1E13   1E13
CHCTHALF104  CS-137   1.21E6   1.21E6   1E13   1.21E6   1.21E6   1E13   1E13
CHCTHALF105  I-131   1.21E6   1.21E6   1.0    1.21E6   1.21E6   1.0    1.0
CHCTHALF106  I-133   1.21E6   1.21E6   1.0    1.21E6   1.21E6   1.0    1.0
*
* TERM2
CHCTHALF201  SR-89   4.32E6   4.32E6   1.0    4.32E6   4.32E6   1.0    1.0
CHCTHALF202  SR-90   4.32E6   4.32E6   1.0    4.32E6   4.32E6   1.0    1.0
CHCTHALF203  CS-134   4.32E6   4.32E6   1.0    4.32E6   4.32E6   1.0    1.0
CHCTHALF204  CS-137   4.32E6   4.32E6   1.0    4.32E6   4.32E6   1.0    1.0
CHCTHALF205  I-131   4.32E6   4.32E6   1.0    4.32E6   4.32E6   1.0    1.0
CHCTHALF206  I-133   4.32E6   4.32E6   1.0    4.32E6   4.32E6   1.0    1.0

```

3.11 Crop Share and Growing Season Data

In the previous section, the user has defined the characteristics of a number of different crop categories with regard to their efficiency in transferring radioactive material to man through the food chain. If MACCS is being used without a Site Data File (see Section 2.3), the data in this section is used to supply the information necessary to calculate the doses resulting from the food ingestion pathway.

Note: In the current implementation, the data in this section is always required to be supplied. But if the user is supplying a Site Data File (POPFLG = 'FILE' in Section 2.3), then the data supplied here will have no impact on the calculations because it will be superseded by the corresponding data on that file.

Variable Name - NAMCRP
 Variable Type - Character, Array
 Allowed Range - 6 <= length <= 20
 Purpose - Specifies the crop categories for which this set of growing season and farm fraction data will apply. The user must supply NFICRP crop category names in column one of the data block.

Note: The list of crop names specified here must be identical to the list of names specified in the previous section.

Variable Name - TGSBEG
 Variable Type - Real, Array
 Allowed Range - 1.0 <= value <= 365.0
 Purpose - Defines the start of the growing season for the named crop category in terms of the day in the year (January 1 is day 1). The user must supply NFICRP values in column two of the data block.

Variable Name - TGSEND
 Variable type - Real, Array
 Allowed Range - TGSBEG <= value <= 365.0
 Purpose - Defines the end of the growing season for the named crop category in terms of the day in the year (January 1 is day 1). The user must supply NFICRP values in column three of the data block.

Variable Name - FRCTFL
 Variable Type - Real, Array
 Allowed Range - 0.0 <= value <= 1.0
 Purpose - Defines the fraction of cultivated farmland that is used to grow the named crop category. The user must supply NFICRP values in column four of the data block.

Example Usage:

		GROWING		
		SEASON (DAYS)		FARMLAND
	CROP NAME	START	END	SHARE
	NAMCRP	TGSBEG	TGSEND	FRCTFL
CHCRPRGN001	'PASTURE	' 90.	270.	0.41
CHCRPRGN002	'STORED FORAGE	' 150.	240.	0.13
CHCRPRGN003	'GRAINS	' 150.	240.	0.21
CHCRPRGN004	'GRN LEAFY VEGETABLES'	150.	240.	0.002
CHCRPRGN005	'OTHER FOOD CROPS	' 150.	240.	0.004
CHCRPRGN006	'LEGUMES AND SEEDS	' 150.	240.	0.15
CHCRPRGN007	'ROOTS AND TUBERS	' 150.	240.	0.003

3.12 Food Pathway Protective Action Guide Data

In the event of an accident at a nuclear power plant, it is likely that an assessment of the accident's impact on agricultural production in the surrounding region will be performed. Based on a projection of dose to an individual consuming locally produced food products, the local authorities will determine if these food products are safe to eat. If the food production is judged to be unsafe, two kinds of actions can be taken: disposal of already growing crops, and restriction of agricultural production in subsequent growing seasons.

The stringency (degree of protection) for both types of mitigative actions are specified by the user through input parameters described in this section. All of these parameters are specified in terms of allowable ground concentration and will be referred to as "action guides."

For an accident that occurs during the growing season, there are two types of actions which can occur: (1) disposal of milk and its products, and (2) disposal of crops other than milk (non-milk crops). All agricultural production is divided between these two categories. The action guides used for determining if these two actions are necessary are the input variables PSCMLK and PSCOTH which are defined below.

For high levels of contamination, it may be necessary to restrict agricultural production for a number of years subsequent to the accident. In order to evaluate if this is necessary, a single set of values for allowable ground concentration (variable GCMAXR) is used. During the long-term interdiction period, either all crops (both milk and non-milk) can be produced, or no crops can be produced.

For accidents which occur outside of the growing season, MACCS will, in all cases, evaluate only the long-term action guide (GCMAXR). Outside of the growing season, the growing season action guides PSCMLK and PSCOTH are never evaluated since crop disposal can only occur during the growing season.

For accidents which occur during the growing season however, both types of criteria (growing-season and long-term) may be evaluated by the code. It is up to the user to determine whether these two types of evaluation are performed either (1) independently of each other (uncoupled), or (2) in such a way that the exceedance of one type of criteria will automatically force the exceedance of the other criteria (coupled). The choice of these two options is defined by the user-specified input parameter, COUPLD, defined below.

When the two types of criteria are chosen to be evaluated independently, there are no interactions between the growing-season pathway and the long-term pathway. The resultant doses and economic costs from these two components of the food model are calculated in a completely independent manner.

If the user chooses the option of a coupled evaluation, the following rules define the interactions between two types of actions. Whenever the long-term criteria (GCMAXR) are exceeded, the disposal of any growing crops (both milk and non-milk) will automatically be triggered. Alternatively, whenever both milk and non-milk crop disposal are called for as a result of exceeding both the PSCMLK and PSCOTH criteria, the code will automatically impose at least one year of long-term farmland interdiction.

Variable Name - COUPLD
 Variable Type - Logical
 Allowed Value - .TRUE. or .FALSE.
 Purpose - Defines whether the growing-season and the long-term action guides are evaluated in a manner where they are coupled together (COUPLD=.TRUE.) or in a totally independent manner (COUPLD=.FALSE.)

Example Usage:

CHCOUPLD001 .FALSE. (THE TWO TYPES OF TESTS ARE INDEPENDENT)

Variable Name - NAMAPI
 Variable Type - Character, Array
 Allowed Range - 3 <= length <= 8
 Purpose - Defines the names of the ingestion model nuclides for which growing-season protective action guides will be specified. The user must supply all of the NFIISO names in column one of the data block in the same order as they were originally defined for variable NAMAPI in the previous section.

Variable Name - PSCMLK
 Variable Type - Real, Array
 Allowed Range - 1.E-20 <= value <= 1.E20 (becquerels / square-meter)
 Purpose - Defines the growing-season protective action guide (permissible surface concentration) for milk and milk products for the named nuclide. The user must define NFIISO protective action guide values in column two of the data block.

Variable Name - PSCOTH
 Variable Type - Real, Array
 Allowed Range - 1.E-20 <= value <= 1.E20 (becquerels / square-meter)
 Purpose - Defines the growing-season protective action guide (permissible surface concentration) for non-milk crops and their products for the named nuclide. The user must define NFIISO protective action guide values in column three of the data block.

Example Usage:

```

*
* PROTECTIVE ACTION GUIDES FOR THE DIRECT DEPOSITION PATHWAY TO MILK AND
* ITS PRODUCTS AND TO OTHER CROPS AND THEIR PRODUCTS BY FOOD INGESTION
* MODEL NUCLIDE (PERMISSIBLE SURFACE CONCENTRATION IN BECQUERELS PER
* SQUARE METER)
*
*
*          NUCLIDE          MILK AND  OTHER CROPS
*          NUCLIDE          PRODUCTS  AND PRODUCTS
*
*          NAMIP1          PSCMLK    PSCOTH
CHPAGMCP001  SR-89          2.2E07    2.2E07    0.05  SV  EDEWBODY
CHPAGMCP002  SR-90          2.4E05    2.4E05    0.05  SV  EDEWBODY
CHPAGMCP003  CS-134         2.2E05    2.2E05    0.05  SV  EDEWBODY
CHPAGMCP004  CS-137         2.7E05    2.7E05    0.05  SV  EDEWBODY
CHPAGMCP005  I-131          1.3E06    8.0E06    0.15  SV  THYROID
CHPAGMCP006  I-133          1.0E10    1.0E20

```

The long-term uptake fractions for root-uptake and soil ingestion by animals have been previously defined by variable TCROOT. These uptake fractions are integrated over all time, that is, from $t=0$ to $t=\infty$. MACCS allows the user to define a model for the temporary interdiction of the long-term uptake pathway if certain ground contamination levels are exceeded at the time of the accident. If this model is activated, and temporary interdiction of long-term uptake is needed, the period of temporary interdiction is the shortest number of whole years which allow the long-term criteria to be met. The longest allowed period of long-term interdiction is eight years. If eight years of weathering and radioactive decay are insufficient, the farmland is condemned and permanently removed from production.

The data defining this interdiction model is defined below. It consists of two parts: the criteria to be met for each ingestion nuclide, and a rate constant for the decrease of the nuclide's availability over the temporary interdiction period. Values for these parameters must be supplied in the same order as was originally used to define the list of nuclides used in the ingestion model, the initial definition of NAMIP1.

Variable Name - NAMIP1

Variable Type - Character, Array

Allowed Range - $3 \leq \text{length} \leq 8$

Purpose - Defines the name of the food ingestion nuclide whose permissible surface concentration (protective action guide) for long-term production and weathering depletion rate are being defined in the adjacent two columns. The user must name the NFISO food ingestion nuclides in column one of the data block in the same order as they were originally defined.

Variable Name - GCMAXR
 Variable Type - Real, Array
 Allowed Range - $1.E-35 \leq \text{value} \leq 1.E35$ (becquerels / square-meter)
 Purpose - Defines the permissible surface concentration (protective action guide) for long-term crop production for the named nuclide. The user must supply NFIISO values for this parameter in column two of the data block.

Variable Name - QROOT
 Variable Type - Real, Array
 Allowed Range - $0. \leq \text{value} \leq 1.E35$ (per year)
 Purpose - Defines the rate constant for the decrease in availability of the named nuclide. The following processes should be considered in the specification of the value for this parameter:

1. radioactive decay,
2. irreversible chemical binding to the soil,
3. percolation downwards into the soil,
4. uptake into plants or ingestion by animals.

The value assigned to QROOT is used to determine how effective temporary interdiction of the long-term agricultural pathway will be in reducing ingestion doses. For example, if the depletion rate is .5 per year, a year of temporary interdiction will cause the integrated dose to be $\text{EXP}(-.5)$ of what it would be if there were no interdiction.

The user must define NFIISO values for this parameter in column three of the data block.

Example Usage:

	NUCLIDE	PERMISSIBLE SURFACE CONCENTRATION	ANNUAL DEPLETION RATE	
*	NAMIPI	GCMAXR	QROOT	
CHPAGLTS001	SR-89	1.8E08	4.9	0.005 SV EDEWBODY
CHPAGLTS002	SR-90	3.7E04	0.065	INTEGRATED FROM
CHPAGLTS003	CS-134	4.1E06	0.59	T=0 TO T-INFINITY
CHPAGLTS004	CS-137	1.8E06	0.28	
CHPAGLTS005	I-131	1.0E20	32.0	
CHPAGLTS006	I-133	1.0E20	290.0	

3.13 Diagnostic Trace Options

The diagnostic options data block is defined to allow a user to select as special output eight different diagnostic results generated during the use of the CHRONC module. These selected diagnostic results are written to the List Output File, FORTRAN unit 6.

Variable Name - KSWTCH
 Variable Type - Integer, Array
 Allowed Range - $0 \leq \text{value} \leq 10$
 Purpose - Defines the set of special diagnostics to be printed by CHRONC. This variable is used to enable the generation and printing of intermediate calculations on the output listing. The user should understand that the amount of output generated by these options can be very large. The definition of the output option associated with each element of the array KSWTCH follows:

KSWTCH(1) - chronic and economic detail print
 KSWTCH(2) - dose factor print
 KSWTCH(3) - direct deposit transfer print
 KSWTCH(4) - ground concentration print
 KSWTCH(5) - long-term transfer fraction print
 KSWTCH(6) - dummy variable, no longer used
 KSWTCH(7) - chronic risks print
 KSWTCH(8) - chronic doses and costs print.

It is recommended that the user set the value of each of these options to zero for normal calculations. Specification of any value greater than zero will generate a large amount of printed output. Therefore, the trace output option should only be used for single weather trial runs. The most useful of these options is KSWTCH (8). An investigation into the CHRONC intermediate results should begin with setting KSWTCH (8) to one.

Example Usage:

```
*
* DETAILED PRINT OPTION CONTROL SWITCHES
*      (KCEPNT, KDFPNT, KDTPNT, KGCPNT, KLTPNT, KWTPNT, KSWRSK, KSWDSC)
*
CHKSWTCH001  0      0      0      0      0      0      0      0
```

3.14 User Requested Population Dose Results

The CHRONC module calculates the long-term population dose broken down by pathway for each of the cancer target organs defined on the EARLY User Input File (see Section 2.10). The option to examine this breakdown of long-term population doses for selected cancer organs is controlled by the user as defined in this section. The breakdown of long-term population dose results has no corresponding result in the EARLY module. The EARLY module produces only one consequence measure relating to population dose, the TYPE 5 result, total population dose.

No long-term population dose results for a defined cancer organ are produced on the output listing unless the user specifically requests them. Each request for the breakdown of the long-term population dose to an organ produces the block of twelve dose results identified below (each

result identification consists of the capitalized result name followed by a description of the result). All of the dose results are computed in person-sieverts.

1. Total Long-Term Pathways Dose - total long-term population dose from groundshine and resuspension, from the consumption of contaminated food, from the ingestion of contaminated surface water, and from decontamination work,
2. Long-Term Direct Exposure Pathways - total long-term population dose to resident population from groundshine and resuspension,
3. Total Ingestion Pathways Dose - total long-term population dose from the consumption of contaminated dairy products, contaminated non-dairy products and contaminated water,
4. Long-Term Groundshine Dose - total long-term population dose received by resident population from groundshine,
5. Long-Term Resuspension Dose - total long-term population dose received by resident population from resuspension,
6. Pop. Dependent Decontamination Dose - total long-term population dose received from groundshine by workers performing "population dependent" (non-farm) decontamination (decontamination workers receive no inhalation dose),
7. Area Dependent Decontamination Dose - total long-term population dose received from groundshine by workers performing "area dependent" (farmland) decontamination (decontamination workers receive no inhalation dose),
8. Milk Growing-Season Dose - total long-term population dose resulting from consumption of milk and dairy products contaminated as a result of deposition onto crops during the growing season,
9. Crop Growing-Season Dose - total long-term population dose resulting from consumption of non-milk food products contaminated as a result of deposition onto crops during the growing season,
10. Milk Long-Term Dose - total long-term population dose resulting from consumption of milk and dairy products contaminated by long-term uptake in the period following the accident,
11. Crop Long-Term Dose - total long-term population dose resulting from consumption of non-dairy crops and their products contaminated by long-term uptake in the period following the accident,
12. Water Ingestion Dose - total long-term population dose from ingestion of contaminated surface water.

Variable Name - NXUM9

Variable Type - Integer, Scalar

Allowed Range - $0 \leq \text{value} \leq 10$
Purpose - Specifies the number of long-term population dose result blocks to be printed.

Variable Name - ORGNAM
Variable Type - Character, Scalar
Allowed Range - $2 \leq \text{length} \leq 10$
Purpose - Defines the name of the organ for which the long-term dose breakdown is to be reported. This organ name must either (1) be included in the list of cancer target organs defined for the EARLY module defined in Section 2.10, or (2) appear as the second organ on the list of EARLY organs defined in Section 2.4. The user must supply NXUM9 organ names in column one of the data block.

Variable Name - IX1DS9
Variable Type - Integer, Scalar
Allowed Range - $1 \leq \text{value} \leq \text{NUMRAD}$
Purpose - Defines the inner spatial interval of the region of interest for this result block. The user must supply NXUM9 values in column two of the data block.

Variable Name - IX2DS9
Variable Type - Integer, Scalar
Allowed Range - $\text{IX1DS9} \leq \text{value} \leq \text{NUMRAD}$
Purpose - Defines the outer spatial interval of the region of interest for this result block. The user must supply NXUM9 values in column three of the data block.

Note: The region of interest, as specified above, is used to determine the size of the potentially contaminated area being evaluated. In the context of this consequence measure, the population dose "within" a region is the population dose which occurs as a result of material deposited within the region. For the direct exposure pathways of groundshine and resuspension, the dose is received by the resident population, but for the indirect exposure pathways of ingestion and decontamination, the dose could be received by individuals who reside elsewhere.

Additional Note: In order to obtain the CCDF tables of a consequence measure requested in this section, append the character string 'CCDF' to the line requesting that result as the fourth item on the data card. The CCDF tables will be printed on the List Output File (unit 6).

Example Usage:

```
*  
* DEFINE THE TYPE 9 RESULTS  
*  
* LONG-TERM POPULATION DOSE IN A GIVEN REGION BROKEN DOWN BY  
* THE 12 PATHWAYS  
*  
* NUMBER OF RESULTS OF THIS TYPE THAT ARE BEING REQUESTED
```


* FOR EACH RESULT YOU REQUEST, THE CODE WILL PRODUCE A SET OF 12

*

TYPE9NUMBER 2 (UP TO 10 ALLOWED)

*

* ORGNAM INNER OUTER

*

TYPE9OUT001 'EDEWBODY' 1 26 'CCDF' (0-1000 MILES)

TYPE9OUT002 'EDEWBODY' 1 19 (0-50 MILES)

3.15 User Requested Economic Costs Results

The CHRONC module calculates the economic costs of all the long-term protective actions as well as the cost of the emergency response actions which were treated in the EARLY module. The option to print these economic results is controlled by the user.

No economic costs are printed unless the user specifically requests them. Each request for economic results produces the block of twelve economic results described below. Each result is identified by the result name used on the output file together with a description of the result (each result identification consists of the capitalized result name followed by a description of the result). All of the economic costs are computed in dollars.

Total Economic Cost - the sum of Pop. and Area Dependent Costs,

Pop. Dependent Costs - the sum of Pop. Dependent Decontamination, Interdiction, and Condemnation Costs,

Area Dependent Costs - the sum of Area Dependent Decontamination, Interdiction, Condemnation Costs as well as Milk and Crop Disposal Costs,

Pop. Dependent Decontamination Cost - non-farm property decontamination cost,

Area Dependent Decontamination Cost - farm property decontamination cost,

Pop. Dependent Interdiction Cost - depreciation and deterioration of non-farm property during the period it cannot be used during both decontamination and interdiction plus the cost of population removal (POPCST in Section 3.6),

Area Dependent Interdiction Cost - depreciation and deterioration of farm property during the period it cannot be used during both decontamination and interdiction,

Pop. Dependent Condemnation Cost - compensation paid for permanent loss of non-farm property plus the cost of

population removal (POPCST in Section 3.6),

Area Dependent Condemnation Cost - compensation paid for permanent loss of farm property,

Evacuation and Relocation Cost - per diem costs to compensate people for being away from home due to evacuation and relocation during the emergency phase (EARLY) and also for relocation during the intermediate phase (CHRONC),

Note: When more than one emergency response scenario is being evaluated by the EARLY module, the presentation of evacuation and relocation cost is calculated on the basis of the scenario which was defined last.

Milk Disposal Cost - compensation for lost milk sales during a quarter of a year. This cost is incurred if the accident occurs during the growing season and any of the following conditions are found:

1. the growing-season milk action guide (PSCMLK) is exceeded, or
2. any decontamination actions are required, or
3. if COUPLD=.TRUE. AND any long-term interdiction is required,

Crop Disposal Cost - compensation for lost non-milk crop sales during a full year. This cost is incurred if the accident occurs during the growing season and any of the following conditions are found:

1. the growing-season non-milk action guide (PSCOTH) is exceeded, or
2. any decontamination actions are required, or
3. if COUPLD=.TRUE. AND any long-term interdiction is required.

Variable Name - NXUM10

Variable Type - Integer, Scalar

Allowed Range - $0 \leq \text{value} \leq 10$

Purpose - Specifies the number of economic result blocks to be printed.

Variable Name - I1DS10

Variable Type - Integer, Scalar

Allowed Range - $1 \leq \text{value} \leq \text{NUMRAD}$

Purpose - Defines the inner spatial interval of the region of interest for this result block. The user must supply NXUM10 values in column one of the data block.

Variable Name - I2DS10
 Variable Type - Integer, Scalar
 Allowed Range - I1DS10 <= value <= NUMRAD
 Purpose - Defines the outer spatial interval of the region of interest for this result block. The user must supply NXUM10 values in column two of the data block.

Note: In order to obtain the CCDF tables of a consequence measure requested in this section, append the character string 'CCDF' to the line requesting that result as the third item on the data card. The CCDF tables will be printed on the List Output File (unit 6).

Example Usage:

```
*
* ECONOMIC COST RESULTS IN A REGION BROKEN DOWN BY 12 TYPES OF COSTS
*
* NUMBER OF RESULTS OF THIS TYPE THAT ARE BEING REQUESTED
* FOR EACH RESULT YOU REQUEST, THE CODE WILL PRODUCE A SET OF 12
*
TYP10NUMBER      2      (UP TO 10 ALLOWED)
*
*              INNER      OUTER
*
TYP10OUT001      1          26      'CCDF' (0-1000 MILES)
TYP10OUT002      1          19          (0-50 MILES)
```

3.16 User Requested Action Distance Results

The long-term protective actions that result from the calculations of the CHRONC module depend on the data supplied by the user. Associated with the long-term actions of decontamination, interdiction and crop disposal are the maximum distances to which these actions are implemented. The user must specify whether or not these maximum action distance results are to be printed.

The option to print or not print these long-term action distances is controlled by a flag specified by the user. The flag value .TRUE. will produce the eight maximum action distance results that are described below. Each result is identified by the result name used on the output file together with a description of the result (each result identification consists of the capitalized result name followed by a description of the result). All of the distances are reported in kilometers (km).

Area Dependent Decontamination Dist. - maximum distance at which farmland decontamination is required,

Pop. Dependent Decontamination Dist. - maximum distance at which non-farmland decontamination is required,

Area Dependent Interdiction Dist. - maximum distance at which farmland decontamination or interdiction is required,

Pop. Dependent Interdiction Dist. - maximum distance at which non-farmland decontamination or interdiction is required,

Area Dependent Condemnation Dist. - maximum distance at which farmland condemnation is required,

Pop. Dependent Condemnation Dist. - maximum distance at which non-farmland condemnation is required,

Milk Disposal Dist. - maximum distance at which the loss of three months of milk and dairy products sales is required,

Crop Disposal Dist. - maximum distance at which the loss of one year of non-milk crop sales is required.

The flag value .FALSE. will eliminate the maximum action distance results from the output.

Variable Name - FLAG11

Variable Type - Logical, Scalar

Allowed Value - .TRUE. or .FALSE.

Purpose - Specifies the print flag for the maximum action distance results.

Note: In order to obtain the CCDF tables of a consequence measure requested in this section, append the character string 'CCDF' to the line requesting that result as the second item on the data card. The CCDF tables will be printed on the List Output File (unit 6).

Example Usage:

*

* DEFINE A FLAG THAT CONTROLS THE PRODUCTION OF THE ACTION DISTANCE

* RESULTS

*

* SPECIFYING A VALUE OF .TRUE. TURNS ON ALL 8 OF THE ACTION DISTANCE

* RESULTS, A VALUE OF .FALSE. WILL ELIMINATE THE ACTION DISTANCE RESULTS

* FROM THE OUTPUT.

*

TP11FLAG11 .TRUE. CCDF * WILL BE PRODUCED FOR EACH OF THE SIX RESULTS

3.17 User Requested Impacted Area/Population Results

The long-term protective actions that result from the calculations of the CHRONC module depend on the data supplied by the user. Associated with the long-term actions of decontamination, interdiction, condemnation, and

crop disposal are the areas and populations which are impacted by these actions. The option to print these impacted area/population results is controlled by the user.

No impacted area/population results are printed unless the user specifically requests them. Each request for impacted area/population results produces the block of eight results identified below (each result identification consists of the capitalized result name followed by a description of the result). All area results are reported in hectares and all population results are reported as number of individuals.

Decontamination Area (Hectares) - area within which farmland decontamination was required,

Decontamination Pop. (Individuals) - population of areas that required decontamination of non-farm property,

Interdiction Area (Hectares) - farmland area which required either decontamination or interdiction,

Interdiction Pop. (Individuals) - population of areas that required either decontamination or interdiction of non-farm property,

Condemnation Area (Hectares) - area within which farmland condemnation was required,

Condemnation Pop. (Individuals) - population of areas that required condemnation of non-farm property,

Milk Disposal Area (Hectares) - affected area requiring the loss of milk and dairy products sales for three months,

Crop Disposal Area (Hectares) - affected area requiring the loss of non-milk crop sales for a year.

Variable Name - NUM12
Variable Type - Integer, Scalar
Allowed Range - $0 \leq \text{value} \leq 10$
Purpose - Specifies the number of impacted area/population result blocks to be printed.

Variable Name - I1DS12
Variable Type - Integer, Scalar
Allowed Range - $1 \leq \text{value} \leq \text{NUMRAD}$
Purpose - Defines the inner spatial interval of the region of interest for this result block. The user must supply NUM12 values in column one of the data block.

Variable Name - I2DS12
 Variable Type - Integer, Scalar
 Allowed Range - I1DS12 <= value <= NUMRAD
 Purpose - Defines the outer spatial interval of the region of interest for this result block. The user must supply NUM12 values in column two of the data block.

Note: In order to obtain the CCDF tables of a consequence measure requested in this section, append the character string 'CCDF' to the line requesting that result as the third item on the data card. The CCDF tables will be printed on the List Output File (unit 6).

Example Usage:

```
*
* IMPACTED AREA/POPULATION RESULTS IN A REGION BROKEN DOWN BY 8 TYPES OF
* IMPACTS
*
* NUMBER OF RESULTS OF THIS TYPE THAT ARE BEING REQUESTED
* FOR EACH RESULT YOU REQUEST, THE CODE WILL PRODUCE A SET OF 8
*
TYP12NUMBER      2          (UP TO 10 ALLOWED)
*
*              INNER          OUTER
*
TYP12OUT001      1           26      CCDF (0-1000 MILES)
TYP12OUT002      1           19          (0-50 MILES)
```

References

- Bu84 Burke, R.P., D.C. Aldrich, and N.C. Rasmussen, Economic Risks of Nuclear Power Reactor Accidents, NUREG/CR-3673, SAND84-0178, Sandia National Laboratories, Albuquerque, NM, April 1984.
- Ga64 Gale, H.J., D.L.O. Miller and E.M.R. Fisher, "Weathering of Caesium-137 in Soil," Nature, Vol. 201, pp. 257-261, 1964.
- He85 Helton, J.C., A.B. Muller and A. Bayer, "Contamination of Surface Water Bodies After Reactor Accidents by Erosion of Atmospherically Deposited Radionclides," Health Physics, Vol. 48, No. 6 (1985).
- NR75 U.S. Nuclear Regulatory Commission, Reactor Safety Study: An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants, Washington, DC, WASH-1400, 1975.

APPENDIX A

GLOSSARY OF VARIABLES IN THE USER INPUT FILES

A.1 Alphabetized Glossary

This appendix is a glossary of the input names for the MACCS code. The name of the User Input File in which each variable belongs is noted. The location in the User's Guide where the variable is defined is given by section number. Each variable name is also briefly described.

<u>VARIABLE</u> <u>NAME</u>	<u>INPUT</u> <u>FILE</u>	<u>SECT.</u>	<u>DESCRIPTION</u>
ACNAME	EARLY	2.10	Latent Cancer Effect Table
ACSUSC	EARLY	2.10	Population Susceptible to Cancer
ACTHRE	EARLY	2.10	Linear Response Dose Threshold
ATNAM1	ATMOS	1.2	Text Describing the ATMOS Assumptions
ATNAM2	ATMOS	1.11	Text Describing the Source Term
BNDMXH	ATMOS	1.14	Boundary Weather Mixing Layer Height
BNDRAN	ATMOS	1.14	Boundary Weather Rain Rate
BNDWND	ATMOS	1.14	Boundary Weather Wind Speed
BRKPNT	ATMOS	1.8	Break Point Time for Plume Meander
BRRATE	EARLY	2.5	Breathing Rate Table
BUILDH	ATMOS	1.10	Reactor Building Height
BUILDW	ATMOS	1.10	Reactor Building Width
CDFRM	CHRONC	3.5	Farmland Decontamination Cost Table
CDNFRM	CHRONC	3.5	Non-Farm Decontamination Cost Table
CFRISK	EARLY	2.10	Lifetime Cancer Fatality Risk Factors
CHNAME	CHRONC	3.2	CHRONC Problem Identification
CIRISK	EARLY	2.10	Lifetime Cancer Injury Risk Factors
CORINV	ATMOS	1.11	Table of Core Inventory by Nuclide
CORSCA	ATMOS	1.11	Linear Scaling Factor On Core Inventory
COUPLD	CHRONC	3.12	Coupling Flag for Food Actions
CRIORG	EARLY	2.7	Critical Organ for Emergency Phase
CRTOCR	CHRONC	3.4	Critical Organ for Long-Term Mitigation
CSFACT	EARLY	2.5	Cloudshine Shielding Factor Table
CTCOEF	CHRONC	3.10	Growing-Season Transfer Coefficient
CTHALF	CHRONC	3.10	Growing-Season Weathering Half-Life
CWASH1	ATMOS	1.5	Linear Coefficient for Washout
CWASH2	ATMOS	1.5	Exponential Term for Washout
CYSIGA	ATMOS	1.7	Linear Coefficient for Sigma-y
CYSIGB	ATMOS	1.7	Exponential Term for Sigma-y
CZSIGA	ATMOS	1.7	Linear Coefficient for Sigma-z
CZSIGB	ATMOS	1.7	Exponential Term for Sigma-z
DCYPBH	CHRONC	3.10	Decay/Processing Retention Meat-to-Humans
DCYPCB	CHRONC	3.10	Decay/Processing Retention Crops-to-Meat
DCYPCB	CHRONC	3.10	Decay/Processing Retention Crops-to-Humans
DCYPCB	CHRONC	3.10	Decay/Processing Retention Crops-to-Milk
DCYPMH	CHRONC	3.10	Decay/Processing Retention Milk-to-Humans
DLBCST	CHRONC	3.5	Decontamination Worker Labor Cost
DOSEFA	EARLY	2.10	Cancer Dose Response Alpha Factors

<u>VARIABLE</u> <u>NAME</u>	<u>INPUT</u> <u>FILE</u>	<u>SECT.</u>	<u>DESCRIPTION</u>
DOSEFB	EARLY	2.10	Cancer Dose Response Beta Factors
DOSFLG	EARLY	2.14	Acute/Lifetime Flag for Result 3
DOSHOT	EARLY	2.7	Normal Relocation Dose Threshold
DOSNRM	EARLY	2.7	Hot Spot Relocation Dose Threshold
DOSTH3	EARLY	2.14	Dose Threshold for Result 3
DPFRCT	CHRONC	3.9	Farm Production Dairy Fraction
DPRATE	CHRONC	3.6	Property Depreciation Rate
DRYDEP	ATMOS	1.4	Dry Deposition Flag Table
DSCRLT	CHRONC	3.4	Long-Term Phase Dose Criterion
DSCRTI	CHRONC	3.4	Intermediate Phase Dose Criterion
DSRATE	CHRONC	3.6	Societal Discount Rate for Property
DSRFCT	CHRONC	3.5	Table of Decontamination Factors
EANAM1	EARLY	2.2	Text Describing the EARLY Assumptions
EANAM2	EARLY	2.6	Text Describing the Emergency Response
EDELAY	EARLY	2.6	Evacuation Delay Times for 3 Rings
EFFACA	EARLY	2.8	Hazard Function Fatal Alpha Factors
EFFACB	EARLY	2.8	Hazard Function Fatal Beta Factors
EIFACA	EARLY	2.9	Hazard Function Injury Alpha Factors
EIFACB	EARLY	2.9	Hazard Function Injury Beta Factors
EINAME	EARLY	2.9	Table of Early Injury Effect Names
EISUSC	EARLY	2.9	Susceptible Population Fraction Table
EITHRE	EARLY	2.9	Early Injury Dose Threshold Table
ENDAT1	ATMOS	1.2	Flag Indicating Only Run Atmos
ENDAT2	EARLY	2.2	Flag Indicating Only Run Atmos and Early
ENDEMP	EARLY	2.7	Duration of the Early Phase
ESPEED	EARLY	2.6	Radial Evacuation Speed
EVACST	CHRONC	3.3	Evacuation Cost Per Person-Day
FLAG11	CHRONC	3.16	Flag for Maximum Distance Results
FPLSCH	CHRONC	3.10	Food Processing Losses Crops-to-Humans
FRACLD	CHRONC	3.9	Fraction of Site Area That is Land
FRCFRM	CHRONC	3.9	Fraction of Site Land Used for Farming
FRCTCB	CHRONC	3.10	Fraction of Crop Consumed by Meat Animals
FRCTCH	CHRONC	3.10	Fraction of Crop Consumed by Humans
FRCTCM	CHRONC	3.10	Fraction of Crop Consumed by Milk Animals
FRCTFL	CHRONC	3.11	Fraction of Farmland Used for Each Crop
FRFDL	CHRONC	3.5	Farm Labor Cost Fraction Table
FRFIM	CHRONC	3.9	Farm Wealth Improvements Fraction
FRMPRD	CHRONC	3.9	Average Annual Farm Production Value
FRNFDL	CHRONC	3.5	Non-Farm Labor Cost Fraction Table
FRNFIM	CHRONC	3.9	Non-Farm Wealth Improvements Fraction
GCMAXR	CHRONC	3.12	Long-Term Uptake to Milk or Crops Pags
GSHFAC	EARLY	2.5	Groundshine Shielding Factor Table
GWCOEF	CHRONC	3.7	Groundshine Weathering Coefficients
HAFLIF	ATMOS	1.4	Table of Nuclide Half-Lives
HRMXHT	ATMOS	1.17	Table of Mixing Layer Heights
HRRAIN	ATMOS	1.17	Table of Rain Rates
HRWNDV	ATMOS	1.17	Table of Wind Speeds
I1DIS1	EARLY	2.12	Inner Spatial Interval for Result 1
I1DIS4	EARLY	2.15	Spatial Interval for Result 4

<u>VARIABLE</u> <u>NAME</u>	<u>INPUT</u> <u>FILE</u>	<u>SECT.</u>	<u>DESCRIPTION</u>
I1DIS5	EARLY	2.16	Inner Spatial Interval for Result 5
I1DIS6	EARLY	2.17	Inner Spatial Interval for Result 6
I1DIS7	EARLY	2.18	Inner Spatial Interval for Result 7
I1DIS8	EARLY	2.19	Inner Spatial Interval for Result 8
I1DS10	CHRONC	3.15	Inner Spatial Interval for Result 10
I1DS12	CHRONC	3.17	Inner Spatial Interval for Result 12
I2DIS1	EARLY	2.12	Outer Spatial Interval for Result 1
I2DIS5	EARLY	2.16	Outer Spatial Interval for Result 5
I2DIS6	EARLY	2.17	Outer Spatial Interval for Result 6
I2DIS7	EARLY	2.18	Outer Spatial Interval for Result 7
I2DIS8	EARLY	2.19	Outer Spatial Interval for Result 8
I2DS10	CHRONC	3.15	Outer Spatial Interval for Result 10
I2DS12	CHRONC	3.17	Outer Spatial Interval for Result 12
IBDSTB	ATMOS	1.14	Boundary Weather Stability Class
IBEGIN	EARLY	2.3	Interval at Which Population Begins
IDEBUG	ATMOS	1.12	Debug Switch for Dispersion Print
IGROUP	ATMOS	1.4	Table of the Nuclide Groups
IHRDIR	ATMOS	1.17	Table of Wind Directions
IHRSTB	ATMOS	1.17	Table of Stability Classes
INIEVA	EARLY	2.6	First Evacuation Interval
INDXBN	ATMOS	1.16	Index to Bin Number Used for Met Sample
INWGHT	ATMOS	1.16	Number of Samples to Take From the Bin
IPLUME	ATMOS	2.2	Plume Model Dispersion Code
IPRINT	EARLY	2.2	Quantity of Early Debug Output
IRSEED	ATMOS	1.16	Seed for Random Number Generator
ISTRDY	ATMOS	1.15	Starting Day of the Accident
ISTRHR	ATMOS	1.15	Starting Hour of the Accident
KSWTCH	CHRONC	3.13	Diagnostic Output Option Switch Table
LASEVA	EARLY	2.6	Table of Last Evacuating Intervals
LASHE2	EARLY	2.7	Last Ring of Outer Shelter Zone
LASMOV	EARLY	2.6	Last Evacuation Movement Interval
LIMSPA	ATMOS	1.14	Last Spatial Interval for Recorded Weather
LVLDEC	CHRONC	3.5	Number of Decontamination Levels
MAXGRP	ATMOS	1.4	Number of Nuclide Groups
MAXRIS	ATMOS	1.11	Selection of Risk Dominant Plume
METCOD	ATMOS	1.13	Meteorological Sampling Option Code
NAMCRP	CHRONC	3.10	Names of the Crop Categories
NAMCRP	CHRONC	3.11	Names of the Crop Categories
NAME	EARLY	2.12	Result Type 1 Health Effect Name
"	EARLY	2.14	Result Type 3 Organ Name
"	EARLY	2.15	Result Type 4 Health Effect Name
"	EARLY	2.16	Result Type 5 Organ Name
"	EARLY	2.18	Result Type 7 Health Effect Name
"	EARLY	2.19	Result Type 8 Health Effect Name
NAMIPI	CHRONC	3.10	Names of Food Ingestion Nuclides
NAMIPI	CHRONC	3.12	Names of Food Ingestion Nuclides
NAMWPI	CHRONC	3.10	Names of Water Ingestion Nuclides
NFICRP	CHRONC	3.10	Number of Crop Categories
NFIISO	CHRONC	3.10	Number of Nuclides for Food Ingestion

<u>VARIABLE NAME</u>	<u>INPUT FILE</u>	<u>SECT.</u>	<u>DESCRIPTION</u>
NGWTRM	CHRONC	3.7	Terms in Groundshine Weathering Equation
NPSGRP	ATMOS	1.6	Number of Particle Size Groups
NRINTN	ATMOS	1.16	Number of Rain Intensity Breakpoints
NRNINT	ATMOS	1.16	Number of Rain Distance Intervals
NRWTRM	CHRONC	3.8	Terms in Resuspension Weathering Equation
NSBINS	ATMOS	1.16	Number of Weather Bins to Sample
NSMPLS	ATMOS	1.16	Number of Weather Samples Per Bin
NTTRM	CHRONC	3.10	Number of Terms Growing-Season to Food
NUCNAM	ATMOS	1.4	Table of the Nuclide Names
NUCOUT	ATMOS	1.12	Nuclide Used in Dispersion Print
NUM1	EARLY	2.12	Number of Health Effect Results
NUM2	EARLY	2.13	Number of Early Fatality Radius Results
NUM3	EARLY	2.14	Number of Early Dose Threshold Results
NUM4	EARLY	2.15	Number of Avg Individual Risk Results
NUM5	EARLY	2.16	Number of Population Dose Results
NUM6	EARLY	2.17	Number of Centerline Dose/Distance Results
NUM7	EARLY	2.18	Number of Centerline Risk/Distance Results
NUM8	EARLY	2.19	Number of Population Weighted Risk Results
NUM12	CHRONC	3.17	Number of Affected Area Results
NUMACA	EARLY	2.10	Number of Acute Exposure Cancers
NUMEFA	EARLY	2.8	Number of Early Fatality Effects
NUMEIN	EARLY	2.9	Number of Early Injury Effects
NUMFIN	EARLY	2.2	Number of Fine Grid Subdivisions
NUMISO	ATMOS	1.4	Number of Defined Nuclides
NUMORG	EARLY	2.4	Number of Defined Organs
NUMRAD	ATMOS	1.3	Number of Spatial Intervals
NUMREL	ATMOS	1.11	Number of Released Plume Segments
NUMWPI	CHRONC	3.10	Number of Nuclides for Water Ingestion
NXUM10	CHRONC	3.15	Number of Economic Cost Results
OALARM	ATMOS	1.11	Off-Site Alarm Time
ORGNAM	EARLY	2.4	Table of Defined Organ Names
"	EARLY	2.8	Early Fatality Target Organ Table
"	EARLY	2.9	Early Injury Target Organ Table
"	EARLY	2.10	Latent Cancer Target Organ Table
"	EARLY	2.17	Organ Name of the Centerline Doses
OVERRID	EARLY	2.2	Wind-Rose Probability Override
PARENT	ATMOS	1.4	Table of Nuclide Parent Names
PDELAY	ATMOS	1.11	Table of Plume Release Times
PATHNM	EARLY	2.17	Pathway Code for Result 6
PLHEAT	ATMOS	1.11	Table of Plume Heat Contents
PLHITE	ATMOS	1.11	Table of Plume Release Heights
PLUDUR	ATMOS	1.11	Table of Plume Segment Durations
POPCST	CHRONC	3.6	Population Removal Cost
POPDEN	EARLY	2.3	Average Regional Population Density
POPFLG	EARLY	2.3	Population Distribution Flag
PROTIN	EARLY	2.5	Inhalation Protection Factor Table
PSCMLK	CHRONC	3.12	Growing-Season to Milk P.A.G.
PSCOTH	CHRONC	3.12	Growing-Season to Crops P.A.G.
PSDIST	ATMOS	1.11	Particle Size Distribution by Group

VARIABLE NAME	INPUT FILE	SECT.	DESCRIPTION
QROOT	CHRONC	3.12	Long-Term Uptake Effectiveness Decay Rate
REFTIM	ATMOS	1.11	Plume Reference Time Point
RELCST	CHRONC	3.3	Relocation Cost Per Person-Day
RELFRC	ATMOS	1.11	Table of Release Fractions by Group
RESCON	EARLY	2.5	Resuspension Concentration Coefficient
RESHAF	EARLY	2.5	Resuspension Concentration Half-Life
RISCAT	EARLY	2.2	Risk by Weather Category Flag
RISTHR	EARLY	2.13	Risk Threshold for Fatality Radius
RNDSTS	ATMOS	1.16	Rain Distances Used for Binning
RNRATE	ATMOS	1.16	Rain Intensities Used for Binning
RWCOEF	CHRONC	3.8	Resuspension Weathering Coefficients
SCLADP	ATMOS	1.9	Scaling Factor for A-D Plume Rise
SCLCRW	ATMOS	1.9	Scaling Factor for Critical Wind Speed
SCLEFP	ATMOS	1.9	Scaling Factor for E-F Plume Rise
SHELT1	EARLY	2.7	Shelter Duration for Inner Zone
SHELT2	EARLY	2.7	Shelter Duration for Outer Zone
SKPFAC	EARLY	2.5	Skin Protection Factor Table
SPAEND	ATMOS	1.3	Endpoints of Spatial Intervals
TCROOT	CHRONC	3.10	Transfer Factor Long-Term Uptake
TFBF	CHRONC	3.10	Transfer Factor Animal-to-Meat
TFMILK	CHRONC	3.10	Transfer Factor Animal-to-Milk
TFWKF	CHRONC	3.5	Table of Farm Worker's Work Fraction
TFWKNF	CHRONC	3.5	Table Non-Farm Workers Work Fraction
TGSBEG	CHRONC	3.11	Growing Season Start Time for Each Crop
TGSEND	CHRONC	3.11	Growing Season End Time for Each Crop
TGWHLF	CHRONC	3.7	Groundshine Weathering Half-Lives
TIMBAS	ATMOS	1.8	Time Base for Plume Meander
TIMDEC	CHRONC	3.5	Table of Decontamination Times
TIMHOT	EARLY	2.7	Hot Spot Relocation Time
TIMNRM	EARLY	2.7	Normal Relocation Time
TMIPND	CHRONC	3.4	Time Intermediate Phase Ends
TMPACT	CHRONC	3.4	Time Action Period Ends
TRWHLF	CHRONC	3.8	Resuspension Weathering Half-Lives
TTOSH1	EARLY	2.7	Take Shelter Time for Inner Zone
TTOSH2	EARLY	2.7	Take Shelter Time for Outer Zone
VALWF	CHRONC	3.9	Value of Farm Wealth
VALWNF	CHRONC	3.9	Value of Non-Farm Wealth
VDEPOS	ATMOS	1.6	Table of Dry Deposition Velocities
WETDEP	ATMOS	1.4	Wet Deposition Flag Table
WINGF	CHRONC	3.10	Water Transfer Fraction to Humans
WINROS	EARLY	2.2	Table of Wind-Rose Probabilities
WSHFRI	CHRONC	3.10	Initial Water Washoff Fraction
WSHRTA	CHRONC	3.10	Annual Water Washoff Fraction
WTFRAC	EARLY	2.6	Weighting Fraction for Combined Results
WTNAME	EARLY	2.6	Type of Weighting (People, Time)
XPFAC1	ATMOS	1.8	Base Time Meander Expansion Factor
XPFAC2	ATMOS	1.8	Break Point Time Expansion Factor
YSCALE	ATMOS	1.7	Scale Factor for Horizontal Dispersion
ZSCALE	ATMOS	1.7	Scale Factor for Vertical Dispersion

APPENDIX B

AUXILIARY INPUT FILES

B.1 Meteorological Data File Format

For METCOD values of 1, 2 or 5 (see Section 1.13), a meteorological data file must be provided by the user. The file consists of one year of hourly recordings (8760) of the wind direction, wind speed, atmospheric stability and accumulated precipitation. Generally, the data are taken from either the reactor site or from a nearby weather station.

The meteorological data file used in MACCS is a formatted file of eye-readable text. The format is similar to that used in the CRAC2 consequence model. If an additional title card is added at the beginning of the file, CRAC2 meteorological data files may be used with MACCS. There are a total of 8763 records in the meteorological data file. The first two records contain identification information. Up to 80 characters may be used on each line. This header information is printed on the output listing. Records 3 through 8762 contain hourly meteorological observations, one hour per line. The format of the information is as follows:

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Information</u>	<u>Range</u>
2-4	I3	ISTRDY	Julian day of the year	1 to 365
6-7	I2	ISTRHR	Hour of the day	1 to 24
9-10	I2 :	WINDIR	Direction the wind is blowing TOWARD (N to NNW)	1 to 16
11-13	I3	WINDSPD	Wind speed (10ths of meters per second)	1 to 300*
14	I1	ISTAB	Stability Category (Pasquill A through G)	1 to 7**
15-17	I3	RNMM	Accumulated precipitation (100ths of inches)	-1 to 999***

*Values between 1 and 4 are automatically changed to 5 (0.5 m/s).

**A value of 7 is automatically changed to 6 by the code.

***Some meteorological data files use -1 to indicate a trace of precipitation during the hour. MACCS assumes these values to be zero.

The 8763rd record contains a table of eight values of mixing layer height. Two values of mixing height are supplied for each of the four seasons of the year. The first of these two values corresponds to the morning mixing height and the second to the afternoon height. In the current implementation, the larger of these two values and the value of the boundary weather mixing height is used by the code.

In its present form, that atmospheric model implemented in MACCS does not allow a change in mixing layer to occur during transport of the plume. Mixing layer height is assumed to be constant and therefore only a single value is used by the code. Only seasonal variability can be considered for this parameter. The start day of each weather sequence determines the season in which that sequence lies.

Note: The following data is supplied in units of hundreds of meters.

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Information</u>	<u>Range</u>
1-10	F10.0	HEIGHT(1,1)	Morning-winter mixing height	0. to 999.
11-20	F10.0	HEIGHT(2,1)	Morning-spring mixing height	0. to 999.
21-30	F10.0	HEIGHT(3,1)	Morning-summer mixing height	0. to 999.
31-40	F10.0	HEIGHT(4,1)	Morning-autumn mixing height	0. to 999.
41-50	F10.0	HEIGHT(1,2)	Afternoon-winter mixing height	0. to 999.
51-60	F10.0	HEIGHT(2,2)	Afternoon-spring mixing height	0. to 999.
61-70	F10.0	HEIGHT(3,2)	Afternoon-summer mixing height	0. to 999.
71-80	F10.0	HEIGHT(4,2)	Afternoon-autumn mixing height	0. to 999.

An example of the meteorological data file is given in below. The figure shows the first and last ten records of the file. For example, the weather conditions for day one, hour one (record number three) are: wind direction - blowing toward the SE, wind speed of 2.6 m/sec, stability 4 (category D), and accumulated precipitation of 0.07 inches (1.8 mm) in the hour. The winter, spring, summer and autumn mixing heights for neutral and unstable conditions (record 8763) are all 1200 meters.

Portion of the Meteorological Data File Used In MACCS

The first and last ten records are shown.

U.S. NATIONAL WEATHER SERVICE METEOROLOGICAL DATA FILE FOR NEW YORK, NY.
USED FOR THE INDIAN POINT REACTOR SITE. D. CHANIN, SANDIA 505 846 5447

```

1 1 70264 7
1 2 60624 7
1 3 80414 2
1 4 80364 -1
1 5 90314 0
1 6 110464 0
1 7 110264 -1

```

1 8 110414 -1
.
.
.
365 16 120154 4
365 17 110154 4
365 18 130214 4
365 19 130154 3
365 20 130104 2
365 21 130154 2
365 22 140104 2
365 23 130104 2
365 24 140104 2

12. 12. 12. 12.

B.2 Dose Conversion Factors File Format

A dosimetry data file is required for both the EARLY and CHRONC modules. Since the dosimetry data file is generally the same for all calculations, the file is attached directly by the procedure files used to run MACCS; the user does not need to specify the name of the dosimetry file. The dosimetry data in the file are dose factors for: cloudshine ($\text{Sv-m}^{**3}/\text{Bq-sec}$), groundshine integrated for 8 hours ($\text{Sv-m}^{**2}/\text{Bq}$), groundshine integrated for 7 days ($\text{Sv-m}^{**2}/\text{Bq}$), groundshine dose rate ($\text{Sv-m}^{**2}/\text{Bq-sec}$), internal doses from inhalation used with the early health effects model (Sv/Bq), internal doses from inhalation for lifetime exposure (Sv/Bq), and internal doses from ingestion (Sv/Bq). If an organ is not considered in the early health effects model, no internal dose for early exposure from inhalation is given; the values are set to -1.0. The integrated dose factors for groundshine include any contribution from daughter nuclides.

The current dosimetry file contains data for 60 radionuclides and 12 organs. A description of the method used to calculate the dosimetry data is provided in Appendix D of the MACCS Model Description (Volume 2 of this document).

The dosimetry data file used in MACCS is a formatted file. The first two records contain identification information. Up to 80 characters may be used on each line. This header information is printed on the output listing. The next line gives the number of organs included in the file. The format for this line is I10. The organ names are specified next, one name per line. The spelling must be the same as that used in all other program data files. Next the number of nuclides included in the file is given. The format is again I10. The names of the nuclides are given on the following lines, one name per line. The spelling of the nuclide names must again be the same as in all other program modules. Following the list of nuclides, there are two lines in the dosimetry data file that are not read but aid user understanding of the file. On the next line is the name of the first nuclide followed on the next lines by the organ names and the associated dosimetry data. The format of the dosimetry data is as follows:

<u>Column</u>	<u>Variable</u>	<u>Format</u>	<u>Identification</u>
1-10	FILORG	A10	Name of the organ
11-20	CDCF	F10.0	Cloudshine dose conversion factor
21-30	IGDCF(I,J,1)	F10.0	8-hour integrated groundshine dose factor
31-40	IGDCF(I,J,2)	F10.0	7-day integrated groundshine dose factor

<u>Column</u>	<u>Variable</u>	<u>Format</u>	<u>Identification</u>
41-50	GRDCF	F10.0	Groundshine dose-rate factor
51-60	IDCF(I,J,1)	F10.0	Inhalation dose factor used only with the early health effects model
61-70	IDCF(I,J,2)	F10.0	Inhalation dose factor for lifetime exposure
71-80	DFING	F10.0	Ingestion dose factor

A complete listing of the current MACCS Dose Conversion Factors Data File is included in this document as Appendix D.1.

B.3 Site Data File Format

In the Site Data File, the user specifies the population distribution and land use information for the region surrounding the site. Contained in the Site Data File are the geometry data used for the site (spatial intervals), population distribution, fraction of the area that is land, watershed data for the liquid pathways model, information on agricultural land use and growing seasons, and regional economic information. An example of a Site Data File is provided in Appendix D.2.

The decision on whether to use a Site Data File is determined by a flag set in the EARLY User Input File (see Section 2.3). If a Site Data File is not being used, the EARLY User Input File determines the population density to be used by both the EARLY and CHRONC modules. It is not possible for the user to supply differing population data for the two modules.

The Site Data File used in MACCS is a formatted file. The data must appear exactly as described in this Appendix and in exactly the same order. In contrast to the User Input Files for MACCS, which are processed by a free-format input processor, the Site Data File is processed with fixed format FORTRAN READ statements.

The use of fixed format READ statements requires that the user exercise special attention to line up the data items in their proper fields. Any numeric items specified in exponential format (e.g., 1.E-6) must be right-justified in the field.

In contrast to the User Input Files, where every value is validated by the code to ensure that it lies within a range of allowable values, the validation performed on the Site Data is only partially complete. Some of the input parameters on this file are rigorously checked to ensure that they fall within the allowed range, while other values are not checked at all. It is recommended that the user exercise scrupulous care in constructing a Site Data File. It is very important that all items appear in their proper fields and that all numeric values lie within the range of acceptable values. Failure to conform to these requirements may lead to the generation of spurious results.

The first two records of the Site Data File contain identification information. Up to 80 characters may be used on each line. This header information is printed on the output listing.

Following the descriptive text fields, there are six data cards which specify the amount of data which is being supplied on the file. The values defined on these data cards must be consistent with the MACCS model definition data defined by the ATMOS, EARLY, and CHRONC User Input Files. In other words, the value of the Site Data File input variable and the corresponding comparison variable must be identical. If any

inconsistencies are detected, execution of the program will be terminated.

An example of the data cards described up to this point is included for the purpose of illustration.

MACCS SITE DATA FILE FOR SURRY (JLS, 11/10/88)
SECPop POP DISTRIBUTION FROM 1980 CENSUS DATA ALTERED USING 0-10 MI NRC
26 SPATIAL INTERVALS
16 WIND DIRECTIONS
7 CROP CATEGORIES
4 WATER PATHWAY ISOTOPES
2 WATERSHEDS
59 ECONOMIC REGIONS

The format of the data is as follows:

<u>Line</u>	<u>Columns</u>	<u>Format</u>	<u>Input Variable</u>	<u>Identification</u>	<u>Comparison Variable</u>	<u>Allowed Range</u>
3	1-4	I4	NSPDTS	Number of spatial intervals	NUMRAD	2 - 35
4	1-4	I4	NWDIR	Number of wind direction sectors	NUMCOR	16 - 16
5	1-4	I4	NCPGZN	Number of crops to be considered	NFICRP	1 - 10
6	1-4	I4	NWPISO	Number of water pathway nuclides	NUMWPI	1 - 10
7	1-4	I4	NWTRSH	Number of watershed categories	NUMWPA	1 - 4
8	1-4	I4	NECRGN	Number of economic regions	N.A.	1 - 99

Eight blocks of site data follow the introductory block described above. Each of these data blocks is introduced by a separator line that identifies the block of data to follow. The first line of each data block must be the separator for that block. Since each separator is read with a format of 1X,A22, the first character of the separator line is ignored and the following 22 characters must match the identification field for that specific data block.

Geometry Data Block

Geometry information is used to specify the population and land use data. The geometry data consist of the distance in kilometers to the endpoints of the spatial intervals. This grid definition must agree with the grid used in the ATMOS User Input File (see Section 1.3). A relative error of 10 percent in the endpoint distances is allowed. For larger discrepancies in the geometry data, the error flag will be set and execution will terminate upon completion of the Site Data File input processing.

The first line of the geometry information contains the 22 character separator beginning with "SPATIAL DISTANCES" in column 2. Next, the endpoint distances in kilometers are specified, eight values per line, using the format described below. As many lines as are needed to define the spatial distances are used. The formatting of this information is illustrated below by presentation of the spatial distance data for a single wind direction sector.

Note: The spacing between adjacent spatial intervals should be at least 0.1 kilometer.

SPATIAL DISTANCES

0.16	0.52	1.21	1.61	2.13	3.22	4.02	4.83
5.63	8.05	11.27	16.09	20.92	25.75	32.19	40.23
48.28	64.37	80.47	112.65	160.93	241.14	321.87	563.27
804.67	1609.34						

The format used to process the data is as follows:

<u>Columns</u>	<u>Format</u>	<u>Input Variable</u>	<u>Information</u>	<u>Comparison Variable</u>	<u>Allowed Range</u>
1-80	8E10.2	SPDSTS	Spatial interval endpoints (km)	SPAEND	0.001 - 9999.0

Population Data Block

The population data for each element in the spatial grid is defined here. The first line of the data block contains the 22 character separator beginning with "POPULATION" in column 2. Next, the number of people in each element is given for the first sector (The first sector is assumed to be centered on North). The population data are specified, eight values per line, using the format described below. As many lines as needed to cover all the spatial elements in the sector are used. Proceeding in a clockwise rotation, the population data for the second (NNE) and subsequent sectors follow. Data for all 16 wind directions (sectors) must be provided. Data for each sector begins on a new line. The formatting of this information is illustrated below by presentation

of the population data for a single wind direction sector for 26 radial distance elements.

POPULATION

```

      0.      0.      0.      0.      0.      0.      4.      5.
      6.     25.    3341.    7107.    2173.      0.    1305.    474.
    2252.   2945.   5403.   20169. 112004.  3431358. 1355700. 2742710.
2487346. 104331.

```

The format used to process the data is as follows:

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Identification</u>	<u>Allowed Range</u>
1-80	8E10.0	POPDAT	Population data	0.0 - 1.E9

Land Fraction Block

The fraction of each spatial element that is land (as opposed to lakes, oceans, etc.) must be defined. The first line of the data block contains the 22 character separator beginning with "LAND FRACTION" in column 2. Next, the fraction of area that is land in each radial spatial interval of the first sector is given. All values must be between zero and one. A value of zero means the element has no land, a value of one means the element is all land. The land fraction data are specified, 16 values per line, with the format described below. As many lines as needed to define all the spatial intervals in the sector are used. The land fraction data for the second and subsequent sectors follow in a clockwise rotation. Data for all 16 wind direction sectors must be provided. The data for each sector begins on a new line. The formatting of this information is illustrated below by presentation of the land fraction data for a single wind direction sector.

LAND FRACTION

```

1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.80 1.00 1.00 0.95
0.75 0.70 0.85

```

The format used to process the data is as follows:

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Identification</u>	<u>Allowed Range</u>
1-80	16F5.2	FRCLND	Land fraction	0.0 - 1.0

Region Identification Block

This data block identifies each of the spatial intervals with an economic region. A region can be a state, a county, or any division desired. A

The format used to process the data is as follows:

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Identification</u>	<u>Allowed Range</u>
1-80	40I2	INDWTR	Watershed index	1 - NWTRSH

Agricultural Data Block

The length of the growing season and the average fraction of the farmland area at the site devoted to each crop type must be specified. These fractions, FRCLP, need not sum to exactly one, but their sum should not exceed a value of one. If these values sum to a value less than one, that sum indicates the fraction of farmland in production in an average year (some fraction of farmland may be fallow). Data must be given for each of the NCPGZN crop categories. The data block begins with the separator "CROP SEASON AND SHARE" in column 2. The formatting of this information is illustrated below by the presentation of the agricultural data for the seven crop categories used in the example Site Data File.

CROP SEASON AND SHARE

1 PASTURE	90. 270.	0.41
2 STORED FORAGE	150. 240.	0.13
3 GRAINS	150. 240.	0.21
4 GRN LEAFY VEGETABLES	150. 240.	0.002
5 OTHER FOOD CROPS	150. 240.	0.004
6 LEGUMES AND SEEDS	150. 240.	0.15
7 ROOTS AND TUBERS	150. 240.	0.003

The format used to process the data is as follows:

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Identification</u>	<u>Allowed Range</u>
1-4	I4	I	Crop index	1 - NCPGZN
6-25	A20	CROP	Crop name	N.A.
26-30	F5.0	GBEG	Day of the year the growing season begins	1.0 - GEND
31-35	F5.0	GEND	Day of the year the growing season ends	GBEG - 365.0
36-45	F10.0	FRCLCP	Fraction of the site-averaged farmland devoted to this crop	0.0 - 1.0

Watershed Data Block

The data block begins with the 22 character separator beginning with "WATERSHED DEFINITION" in column 2. For each of the NUMWPI (NWPIISO) nuclides considered in the liquid pathways model, an initial washoff fraction and an annual washoff rate (fraction/year) must be specified together with an ingestion factor (becquerel-ingested/becquerel-in-water) for each of the NUMWPA (NWTRSH) watershed classes. The formatting of this information is illustrated below by the presentation of the watershed data for the four water ingestion nuclides used on the example Site Data File.

WATERSHED DEFINITION	RIVER	OCEAN	LAKE
1 SR-89	5.0E-6	0.0	2.0E-7
2 SR-90	5.0E-6	0.0	2.0E-7
3 CS-134	5.0E-6	0.0	2.0E-6
4 CS-137	5.0E-6	0.0	4.0E-6

The format used to process the data is as follows:

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Identification</u>	<u>Allowed Range</u>
1-4	I4	I	Nuclide index	1 - NWPIISO
6-13	A8	NMISO	Nuclide name	N.A.
16-25	E10.1	DUMMY	No longer used	N.A.
26-35	E10.1	DUMMY	No longer used	N.A.
36-45	E10.1	WTRINF(1)	Ingestion factor for watershed class 1	0.0 - 1.0
46-55	E10.1	WTRINF(2)	Ingestion factor for watershed class 2	0.0 - 1.0
56-65	E10.1	WTRINF(3)	Ingestion factor for watershed class 3	0.0 - 1.0
66-75	E10.1	WTRINF(4)	Ingestion factor for watershed class 4	0.0 - 1.0

Regional Economic Data Block

Economic data must be specified for each of the NECRGN economic regions. The data block begins with the separator "REGIONAL ECONOMIC DATA" in column 2. An economic region can be a county, a state or any other user-specified region. The data provided in this block are similar to those contained in the CRAC2 "Economic" subgroup but converted to metric units.

The index of the region is used with the "REGION INDEX" data block (described earlier in this Appendix) to associate each element of the spatial grid with an economic region. The formatting of this information is illustrated below by the presentation of the economic data for the first economic region on the example Site Data File, Alabama.

REGIONAL ECONOMIC DATA

1 ALA .354 .040 459. 1824. 62000.

The format used to process this data is as follows:

<u>Columns</u>	<u>Format</u>	<u>Variable</u>	<u>Identification</u>	<u>Allowed Range</u>
1-4	I4	I	Region index number	1 - NECRGN
6-15	A10	NMRGN	Region identification	N.A.
21-25	F5.3	FRMFRC	Fraction of land devoted to farming in the region	0.0 - 1.0
26-30	F5.3	DPF	Fraction of farm sales resulting from dairy production in the region	0.0 - 1.0
31-40	F10.1	ASFP	Annual average farm sales for the region (\$/hectare)	0.0 - 1.E9
41-50	F10.1	VFRM	Average farmland value for the region (\$/hectare)	0.0 - 1.E9
51-60	F10.1	VNFRM	Average non-farm value for the region (\$/person)	0.0 - 1.E9

A complete listing of a sample Site Data File is supplied in this document as Appendix D.2.

APPENDIX C

PROCEDURE FILES TO RUN MACCS

C.1 MACCS Procedure File

MACCS has been installed on a VAX/VMS computer system at Sandia National Laboratories in Albuquerque and on a Cray UNICOS system at the Idaho National Engineering Laboratories. Instructions are provided here for using the VAX/VMS versions of MACCS.

VAX/VMS Command File to run MACCS

On VAX machines, MACCS is executed under the control of command file MACCS.COM. The argument list for MACCS.COM consists of six file names that define the data files which can be used by MACCS for both input and output. A parameter with a default value can be skipped by specifying the null string "".

Example Usage of MACCS:

```
@MACCS IN1A IN2A IN3A METSUR SURSIT LISTA
(list output is written to LISTA.OUT)
```

```
@MACCS IN1A IN2A IN3A METSUR SURSIT LISTA
```

Parameter List for execution of MACCS;

1. **ATMOS User Input File: IN1A**
This parameter is always required. It must be a valid pathname to a previously created file to which the user has read access.
2. **EARLY User Input File: IN2A**
This parameter can be omitted if the user is only exercising the ATMOS module (ENDAT1 set to .TRUE. on the ATMOS input). If this parameter is specified, it must be a valid pathname to a previously created file to which the user has read access.
3. **CHRONC User Input File: IN3A**
This parameter can be omitted if the user is skipping the CHRONC module (if ENDAT1 was set to .TRUE. on the ATMOS input or ENDAT2 was set to .TRUE. on the EARLY input). If this parameter is specified, it must be a valid pathname to a previously created file to which the user has read access.
4. **Meteorological Data File: METSUR**
Name of a weather data file with a year of hourly recordings. This file is described in Appendix B.1 of this document. The name supplied here must be a valid pathname to a previously created file to which the user has read access. The parameter may be omitted if

a single weather sequence is defined on the ATMOS User Input File (METCOD = 3 or 4).

5. Site Data File: SIRSIT

Name of a Site Data File for the surrounding region. This file is described in Appendix B.3 of this document. The name supplied here must be a valid pathname to a previously created file to which the user has read access. The parameter may be omitted if a uniform population density is defined on the EARLY User Input File (POPFLG = .TRUE.).

6. List Output File: LISTA

Name of the file on which to write the list output of the run. If this argument is omitted, the results will be written to the system default for FORTRAN unit number 6. If a name is specified here, it must be a valid pathname to a file which the user can write upon.

APPENDIX D

SAMPLE PROBLEM INPUT AND OUTPUT FILES

In order to illustrate their appearance, two input files and one output file are included in this appendix. The two input files are the Dose Conversion Factors File and the Sample Problem Site Data File. The formats of those input files are described in Appendices B.2 and B.3. The output file presented here is that produced by Sample Problem A which illustrates how MACCS can be used for PRA applications. Sample Problem A is described on page 9 of this document.

D.1 Dose Conversion Factors File - DOSDATA

MACCS DOSE CONVERSION FILE: CHANGED BY D. CHANIN 1-NOV-89, 15:18:00

APPLY THE THYROID REDUCTION FACTORS TO ONLY I-131

12 ORGANS DEFINED IN THIS FILE:

STOMACH
SMALL IN
LUNGS
RED MARR
THYROID
LOWER LI
BONE SUR
BREAST
TESTES
OVARIES
EDEWBODY
THYROIDH

60 NUCLIDES DEFINED IN THIS FILE:

CO-58
CO-60
KR-85
KR-85M
KR-87
KR-88
RB-86
SR-89
SR-90
SR-91
SR-92
Y-90
Y-91
Y-92
Y-93
ZR-95
ZR-97
NB-95
MO-99
TC-99M
RU-103
RU-105
RU-106
RH-105
SB-127
SB-129
TE-127
TE-127M
TE-129
TE-129M
TE-131M
TE-132
I-131

I-132
 I-133
 I-134
 I-135
 XE-133
 XE-135
 CS-134
 CS-136
 CS-137
 BA-139
 BA-140
 LA-140
 LA-141
 LA-142
 CE-141
 CE-143
 CE-144
 PR-143
 ND-147
 NP-239
 PU-238
 PU-239
 PU-240
 PU-241
 AM-241
 CM-242
 CM-244

	CLOUDSHINE	GROUND	GROUND	GROUND	INHALED	INHALED	INGESTION
	SHINE	SHINE 8HR	SHINE 7DAY	SHINE RATE	ACUTE	CHRONIC	
CO-58							
STOMACH	3.520E-14	1.979E-11	4.023E-10	6.881E-16	1.558E-10	1.394E-09	3.853E-10
SMALL IN	3.203E-14	1.796E-11	3.652E-10	6.247E-16	3.307E-10	7.495E-10	1.130E-09
LUNGS	3.805E-14	2.143E-11	4.356E-10	7.452E-16	7.599E-10	1.601E-08	8.510E-11
RED MARR	3.869E-14	2.179E-11	4.430E-10	7.579E-16	1.577E-10	9.228E-10	2.601E-10
THYROID	4.788E-14	2.690E-11	5.469E-10	9.354E-16	-1.000E+00	8.704E-10	6.308E-11
LOWER LI	3.456E-14	1.942E-11	3.948E-10	6.754E-16	9.144E-10	1.989E-09	3.962E-09
BONE SUR	4.249E-14	2.389E-11	4.857E-10	8.308E-16	-1.000E+00	6.926E-10	1.252E-10
BREAST	4.566E-14	2.571E-11	5.228E-10	8.942E-16	-1.000E+00	9.367E-10	1.788E-10
TESTES	5.074E-14	2.845E-11	5.784E-10	9.894E-16	-1.000E+00	1.060E-10	1.614E-10
OVARIES	3.456E-14	1.942E-11	3.948E-10	6.754E-16	-1.000E+00	6.166E-10	1.041E-09
EDEWBODY	4.398E-14	2.459E-11	5.000E-10	8.553E-16	-1.000E+00	3.088E-09	8.206E-10
THYROIDH	4.788E-14	2.690E-11	5.469E-10	9.354E-16	6.142E-11	8.704E-10	6.308E-11
CO-60							
STOMACH	9.132E-14	4.602E-11	9.655E-10	1.598E-15	3.840E-10	2.726E-08	1.611E-09
SMALL IN	8.530E-14	4.301E-11	9.022E-10	1.494E-15	8.077E-10	7.046E-09	3.591E-09
LUNGS	9.862E-14	4.986E-11	1.046E-09	1.731E-15	3.511E-09	3.448E-07	8.768E-10
RED MARR	9.957E-14	5.032E-11	1.055E-09	1.747E-15	3.986E-10	1.718E-08	1.311E-09
THYROID	1.230E-13	6.219E-11	1.305E-09	2.159E-15	-1.000E+00	1.615E-08	7.843E-10
LOWER LI	9.069E-14	4.575E-11	9.597E-10	1.589E-15	2.386E-09	7.916E-09	1.113E-08
BONE SUR	1.056E-13	5.333E-11	1.119E-09	1.852E-15	-1.000E+00	1.353E-08	9.415E-10
BREAST	1.164E-13	5.872E-11	1.232E-09	2.039E-15	-1.000E+00	1.843E-08	1.100E-09
TESTES	1.297E-13	6.548E-11	1.373E-09	2.274E-15	-1.000E+00	1.697E-09	1.075E-09

OVARIES	8.879E-14	4.484E-11	9.406E-10	1.557E-15	-1.000E+00	4.753E-09	3.187E-09
EDEWBODY	1.125E-13	5.666E-11	1.189E-09	1.968E-15	-1.000E+00	5.948E-08	2.839E-09
THYROIDH	1.230E-13	6.219E-11	1.305E-09	2.159E-15	1.465E-10	1.615E-08	7.843E-10
KR-85							
STOMACH	7.674E-17	0.000E+00	0.000E+00	0.000E+00	6.757E-14	7.007E-14	0.000E+00
SMALL IN	6.881E-17	0.000E+00	0.000E+00	0.000E+00	6.781E-14	7.007E-14	0.000E+00
LUNGS	8.340E-17	0.000E+00	0.000E+00	0.000E+00	4.671E-13	4.708E-13	0.000E+00
RED MARR	8.562E-17	0.000E+00	0.000E+00	0.000E+00	6.808E-14	7.007E-14	0.000E+00
THYROID	1.037E-16	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	7.007E-14	0.000E+00
LOWER LI	7.484E-17	0.000E+00	0.000E+00	0.000E+00	6.781E-14	7.007E-14	0.000E+00
BONE SUR	9.767E-17	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	7.007E-14	0.000E+00
BREAST	1.037E-16	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	7.007E-14	0.000E+00
TESTES	1.123E-16	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	7.007E-14	0.000E+00
OVARIES	7.484E-17	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	7.007E-14	0.000E+00
EDEWBODY	2.315E-16	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	1.180E-13	0.000E+00
THYROIDH	1.037E-16	0.000E+00	0.000E+00	0.000E+00	6.689E-14	7.007E-14	0.000E+00
KR-85M							
STOMACH	5.232E-15	0.000E+00	0.000E+00	0.000E+00	6.098E-14	6.101E-14	0.000E+00
SMALL IN	4.566E-15	0.000E+00	0.000E+00	0.000E+00	6.101E-14	6.104E-14	0.000E+00
LUNGS	5.771E-15	0.000E+00	0.000E+00	0.000E+00	4.804E-13	4.804E-13	0.000E+00
RED MARR	5.549E-15	0.000E+00	0.000E+00	0.000E+00	6.369E-14	6.372E-14	0.000E+00
THYROID	7.737E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	5.532E-14	0.000E+00
LOWER LI	5.105E-15	0.000E+00	0.000E+00	0.000E+00	5.912E-14	5.915E-14	0.000E+00
BONE SUR	8.467E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	6.103E-14	0.000E+00
BREAST	8.593E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	5.722E-14	0.000E+00
TESTES	7.959E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	5.514E-14	0.000E+00
OVARIES	4.630E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	5.995E-14	0.000E+00
EDEWBODY	7.222E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	1.110E-13	0.000E+00
THYROIDH	7.737E-15	0.000E+00	0.000E+00	0.000E+00	5.529E-14	5.532E-14	0.000E+00
KR-87							
STOMACH	3.161E-14	0.000E+00	0.000E+00	0.000E+00	2.218E-13	2.218E-13	0.000E+00
SMALL IN	2.946E-14	0.000E+00	0.000E+00	0.000E+00	2.210E-13	2.210E-13	0.000E+00
LUNGS	3.393E-14	0.000E+00	0.000E+00	0.000E+00	2.386E-12	2.386E-12	0.000E+00
RED MARR	3.456E-14	0.000E+00	0.000E+00	0.000E+00	2.179E-13	2.179E-13	0.000E+00
THYROID	4.091E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.149E-13	0.000E+00
LOWER LI	3.133E-14	0.000E+00	0.000E+00	0.000E+00	2.250E-13	2.250E-13	0.000E+00
BONE SUR	3.678E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.139E-13	0.000E+00
BREAST	4.091E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.139E-13	0.000E+00
TESTES	4.439E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.140E-13	0.000E+00
OVARIES	2.933E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.220E-13	0.000E+00
EDEWBODY	3.958E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	4.816E-13	0.000E+00
THYROIDH	4.091E-14	0.000E+00	0.000E+00	0.000E+00	2.149E-13	2.149E-13	0.000E+00
KR-88							
STOMACH	1.064E-13	0.000E+00	0.000E+00	0.000E+00	3.745E-13	3.745E-13	0.000E+00
SMALL IN	1.001E-13	0.000E+00	0.000E+00	0.000E+00	3.780E-13	3.780E-13	0.000E+00
LUNGS	1.140E-13	0.000E+00	0.000E+00	0.000E+00	4.218E-12	4.218E-12	0.000E+00
RED MARR	1.156E-13	0.000E+00	0.000E+00	0.000E+00	3.666E-13	3.666E-13	0.000E+00
THYROID	1.367E-13	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	3.538E-13	0.000E+00
LOWER LI	1.059E-13	0.000E+00	0.000E+00	0.000E+00	3.971E-13	3.972E-13	0.000E+00
BONE SUR	1.205E-13	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	3.508E-13	0.000E+00
BREAST	1.357E-13	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	3.556E-13	0.000E+00
TESTES	1.481E-13	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	3.512E-13	0.000E+00

OVARIES	9.881E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	3.890E-13	0.000E+00
EDEWBODY	9.850E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	8.454E-13	0.000E+00
THYROIDH	1.367E-13	0.000E+00	0.000E+00	0.000E+00	3.537E-13	3.538E-13	0.000E+00
RB-86							
STOMACH	3.488E-15	1.806E-12	3.361E-11	6.310E-17	3.020E-10	1.453E-09	2.912E-09
SMALL IN	3.203E-15	1.670E-12	3.108E-11	5.835E-17	2.042E-10	1.347E-09	2.163E-09
LUNGS	3.742E-15	1.951E-12	3.631E-11	6.818E-17	1.539E-09	3.298E-09	2.137E-09
RED MARR	3.805E-15	1.979E-12	3.682E-11	6.913E-17	8.078E-10	2.362E-09	3.789E-09
THYROID	4.725E-15	2.460E-12	4.577E-11	8.593E-17	-1.000E+00	1.333E-09	2.137E-09
LOWER LI	3.425E-15	1.788E-12	3.327E-11	6.247E-17	2.041E-10	1.349E-09	2.167E-09
BONE SUR	4.059E-15	2.115E-12	3.935E-11	7.388E-17	-1.000E+00	4.260E-09	6.841E-09
BREAST	4.439E-15	2.305E-12	4.290E-11	8.054E-17	-1.000E+00	1.336E-09	2.142E-09
TESTES	4.947E-15	2.578E-12	4.797E-11	9.006E-17	-1.000E+00	1.346E-09	2.160E-09
OVARIES	3.393E-15	1.770E-12	3.293E-11	6.183E-17	-1.000E+00	1.332E-09	2.137E-09
EDEWBODY	4.722E-15	3.909E-12	7.274E-11	1.366E-16	-1.000E+00	1.801E-09	2.545E-09
THYROIDH	4.725E-15	2.460E-12	4.577E-11	8.593E-17	2.497E-10	1.333E-09	2.137E-09
SR-89							
STOMACH	5.042E-18	2.743E-15	5.505E-14	9.545E-20	1.904E-10	5.510E-10	9.321E-10
SMALL IN	4.598E-18	2.497E-15	5.011E-14	8.689E-20	2.759E-10	6.284E-10	1.433E-09
LUNGS	5.422E-18	2.952E-15	5.925E-14	1.027E-19	1.302E-09	2.186E-09	2.584E-10
RED MARR	5.518E-18	2.998E-15	6.017E-14	1.043E-19	9.360E-10	5.651E-09	3.261E-09
THYROID	6.849E-18	3.727E-15	7.480E-14	1.297E-19	-1.000E+00	4.475E-10	2.584E-10
LOWER LI	4.947E-18	2.697E-15	5.413E-14	9.386E-20	1.980E-09	3.586E-09	2.063E-08
BONE SUR	5.961E-18	3.235E-15	6.492E-14	1.126E-19	-1.000E+00	8.355E-09	4.820E-09
BREAST	6.437E-18	3.508E-15	7.041E-14	1.221E-19	-1.000E+00	4.475E-10	2.584E-10
TESTES	7.198E-18	3.909E-15	7.846E-14	1.360E-19	-1.000E+00	4.475E-10	2.584E-10
OVARIES	4.947E-18	2.688E-15	5.395E-14	9.354E-20	-1.000E+00	4.476E-10	2.584E-10
EDEWBODY	3.796E-16	1.457E-12	2.924E-11	5.069E-17	-1.000E+00	1.787E-09	2.503E-09
THYROIDH	6.849E-18	3.727E-15	7.480E-14	1.297E-19	8.878E-11	4.475E-10	2.584E-10
SR-90							
STOMACH	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.219E-10	2.365E-09	1.570E-09
SMALL IN	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.686E-10	2.402E-09	1.802E-09
LUNGS	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.993E-10	3.422E-09	1.333E-09
RED MARR	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.725E-09	3.051E-07	1.752E-07
THYROID	0.000E+00	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.328E-09	1.333E-09
LOWER LI	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.611E-09	5.133E-09	1.943E-08
BONE SUR	0.000E+00	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	6.758E-07	3.881E-07
BREAST	0.000E+00	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.328E-09	1.333E-09
TESTES	0.000E+00	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.328E-09	1.333E-09
OVARIES	0.000E+00	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.328E-09	1.333E-09
EDEWBODY	9.537E-17	2.464E-13	3.113E-11	5.000E-18	-1.000E+00	5.919E-08	3.518E-08
THYROIDH	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.138E-10	2.328E-09	1.333E-09
SR-91							
STOMACH	3.581E-14	1.456E-11	3.424E-11	6.938E-16	1.653E-10	1.731E-10	8.625E-10
SMALL IN	3.254E-14	1.324E-11	3.112E-11	6.305E-16	2.333E-10	2.419E-10	1.353E-09
LUNGS	3.873E-14	1.575E-11	3.702E-11	7.501E-16	8.672E-10	9.243E-10	3.289E-11
RED MARR	3.936E-14	1.599E-11	3.760E-11	7.620E-16	7.944E-11	1.446E-10	1.233E-10
THYROID	4.869E-14	1.971E-11	4.633E-11	9.388E-16	-1.000E+00	4.434E-11	2.641E-11
LOWER LI	3.516E-14	1.425E-11	3.350E-11	6.787E-16	5.220E-10	6.234E-10	3.929E-09
BONE SUR	4.322E-14	1.756E-11	4.133E-11	8.375E-16	-1.000E+00	1.424E-10	9.812E-11
BREAST	4.662E-14	1.895E-11	4.458E-11	9.034E-16	-1.000E+00	4.814E-11	5.224E-11
TESTES	5.136E-14	2.089E-11	4.914E-11	9.957E-16	-1.000E+00	4.335E-11	4.141E-11

OVARIES	3.507E-14	1.425E-11	3.350E-11	6.787E-16	-1.000E+00	6.763E-11	2.120E-10
EDEWBODY	3.160E-14	1.404E-11	3.184E-11	6.435E-16	-1.000E+00	2.615E-10	6.790E-10
THYROIDH	4.869E-14	1.971E-11	4.633E-11	9.388E-16	3.583E-11	4.434E-11	2.641E-11
SR-92							
STOMACH	4.883E-14	1.157E-11	1.422E-11	8.403E-16	1.104E-10	1.108E-10	5.294E-10
SMALL IN	4.566E-14	1.081E-11	1.327E-11	7.864E-16	1.857E-10	1.861E-10	1.081E-09
LUNGS	5.264E-14	1.253E-11	1.539E-11	9.101E-16	7.104E-10	7.173E-10	1.948E-11
RED MARR	5.327E-14	1.266E-11	1.556E-11	9.196E-16	4.114E-11	4.213E-11	4.225E-11
THYROID	6.532E-14	1.556E-11	1.913E-11	1.129E-15	-1.000E+00	2.288E-11	1.418E-11
LOWER LI	4.852E-14	1.152E-11	1.415E-11	8.371E-16	3.252E-10	3.369E-10	2.179E-09
BONE SUR	5.644E-14	1.343E-11	1.653E-11	9.735E-16	-1.000E+00	5.591E-11	3.874E-11
BREAST	6.247E-14	1.481E-11	1.821E-11	1.075E-15	-1.000E+00	2.549E-11	2.743E-11
TESTES	6.913E-14	1.643E-11	2.020E-11	1.192E-15	-1.000E+00	2.176E-11	1.903E-11
OVARIES	4.725E-14	1.123E-11	1.381E-11	8.149E-16	-1.000E+00	3.134E-11	8.079E-11
EDEWBODY	6.019E-14	1.536E-11	1.953E-11	1.043E-15	-1.000E+00	1.741E-10	4.451E-10
THYROIDH	6.532E-14	1.556E-11	1.913E-11	1.129E-15	2.241E-11	2.288E-11	1.418E-11
Y-90							
STOMACH	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.745E-10	4.263E-10	1.060E-09
SMALL IN	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.713E-10	1.022E-09	2.557E-09
LUNGS	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.311E-09	9.309E-09	1.264E-14
RED MARR	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.668E-12	1.507E-11	3.664E-13
THYROID	0.000E+00	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	5.183E-13	1.264E-14
LOWER LI	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.544E-09	1.262E-08	3.145E-08
BONE SUR	0.000E+00	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	1.507E-11	3.664E-13
BREAST	0.000E+00	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	5.184E-13	1.268E-14
TESTES	0.000E+00	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	5.183E-13	1.264E-14
OVARIES	0.000E+00	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	5.191E-13	1.438E-14
EDEWBODY	6.308E-16	2.379E-12	2.404E-11	8.623E-17	-1.000E+00	2.281E-09	2.905E-09
THYROIDH	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.153E-13	5.183E-13	1.264E-14
Y-91							
STOMACH	1.316E-16	6.690E-14	1.351E-12	2.328E-18	2.740E-10	3.431E-10	6.914E-10
SMALL IN	1.224E-16	6.234E-14	1.259E-12	2.169E-18	6.656E-10	8.421E-10	1.737E-09
LUNGS	1.424E-16	7.246E-14	1.463E-12	2.521E-18	5.123E-09	9.836E-08	2.017E-13
RED MARR	1.436E-16	7.310E-14	1.476E-12	2.543E-18	2.798E-11	3.174E-10	6.562E-12
THYROID	1.782E-16	9.060E-14	1.830E-12	3.152E-18	-1.000E+00	8.479E-12	1.288E-13
LOWER LI	1.306E-16	6.644E-14	1.342E-12	2.312E-18	6.908E-09	1.455E-08	3.027E-08
BONE SUR	1.528E-16	7.765E-14	1.568E-12	2.702E-18	-1.000E+00	3.166E-10	6.108E-12
BREAST	1.677E-16	8.540E-14	1.725E-12	2.971E-18	-1.000E+00	8.908E-12	5.545E-13
TESTES	1.874E-16	9.570E-14	1.933E-12	3.330E-18	-1.000E+00	6.404E-12	4.137E-13
OVARIES	1.284E-16	6.535E-14	1.320E-12	2.274E-18	-1.000E+00	8.190E-12	3.532E-12
EDEWBODY	5.509E-16	1.594E-12	3.218E-11	5.544E-17	-1.000E+00	1.312E-08	2.571E-09
THYROIDH	1.782E-16	9.060E-14	1.830E-12	3.152E-18	6.243E-13	8.479E-12	1.288E-13
Y-92							
STOMACH	9.228E-15	2.473E-12	3.125E-12	1.700E-16	1.703E-10	1.705E-10	1.420E-09
SMALL IN	8.498E-15	2.274E-12	2.875E-12	1.563E-16	2.382E-10	2.390E-10	2.000E-09
LUNGS	9.989E-15	2.671E-12	3.376E-12	1.836E-16	1.242E-09	1.249E-09	1.393E-12
RED MARR	1.012E-14	2.708E-12	3.423E-12	1.861E-16	2.061E-12	2.079E-12	4.930E-12
THYROID	1.249E-14	3.344E-12	4.227E-12	2.299E-16	-1.000E+00	1.054E-12	1.776E-13
LOWER LI	9.132E-15	2.440E-12	3.084E-12	1.677E-16	1.959E-10	2.090E-10	1.749E-09
BONE SUR	1.088E-14	2.920E-12	3.691E-12	2.007E-16	-1.000E+00	1.512E-12	1.754E-12
BREAST	1.186E-14	3.178E-12	4.017E-12	2.185E-16	-1.000E+00	1.503E-12	3.564E-12
TESTES	1.316E-14	3.529E-12	4.460E-12	2.426E-16	-1.000E+00	3.494E-13	1.399E-12

OVARIES	9.006E-15	2.413E-12	3.049E-12	1.658E-16	-1.000E+00	2.628E-12	1.971E-11
EDEWBODY	1.238E-14	5.018E-12	6.342E-12	3.449E-16	-1.000E+00	2.125E-10	5.153E-10
THYROIDH	1.249E-14	3.344E-12	4.227E-12	2.299E-16	1.049E-12	1.054E-12	1.776E-13
Y-93							
STOMACH	3.361E-15	1.321E-12	3.127E-12	5.961E-17	2.810E-10	2.896E-10	1.280E-09
SMALL IN	3.127E-15	1.223E-12	2.895E-12	5.518E-17	5.455E-10	5.711E-10	2.524E-09
LUNGS	3.647E-15	1.427E-12	3.377E-12	6.437E-17	2.176E-09	2.524E-09	8.661E-13
RED MARR	3.710E-15	1.448E-12	3.427E-12	6.532E-17	3.495E-12	4.018E-12	4.936E-12
THYROID	4.503E-15	1.771E-12	4.192E-12	7.991E-17	-1.000E+00	9.250E-13	1.259E-13
LOWER LI	3.361E-15	1.307E-12	3.094E-12	5.898E-17	1.398E-09	1.997E-09	8.844E-09
BONE SUR	4.059E-15	1.602E-12	3.793E-12	7.230E-17	-1.000E+00	3.134E-12	1.726E-12
BREAST	4.439E-15	1.757E-12	4.159E-12	7.927E-17	-1.000E+00	1.742E-12	3.121E-12
TESTES	4.788E-15	1.883E-12	4.458E-12	8.498E-17	-1.000E+00	6.650E-13	1.777E-12
OVARIES	3.203E-15	1.251E-12	2.961E-12	5.644E-17	-1.000E+00	5.307E-12	2.194E-11
EDEWBODY	4.977E-15	4.053E-12	9.594E-12	1.829E-16	-1.000E+00	5.829E-10	1.232E-09
THYROIDH	4.503E-15	1.771E-12	4.192E-12	7.991E-17	8.313E-13	9.250E-13	1.259E-13
ZR-95							
STOMACH	2.660E-14	1.509E-11	3.258E-10	5.232E-16	1.541E-10	1.085E-09	3.568E-10
SMALL IN	2.407E-14	1.363E-11	2.943E-10	4.725E-16	3.296E-10	9.802E-10	1.119E-09
LUNGS	2.876E-14	1.628E-11	3.516E-10	5.644E-16	1.137E-09	1.843E-08	2.342E-11
RED MARR	2.924E-14	1.656E-11	3.575E-10	5.740E-16	2.845E-10	3.207E-09	2.135E-10
THYROID	3.615E-14	2.049E-11	4.425E-10	7.103E-16	-1.000E+00	7.790E-10	8.238E-12
LOWER LI	2.607E-14	1.473E-11	3.181E-10	5.105E-16	1.573E-09	4.164E-09	7.778E-09
BONE SUR	3.203E-14	1.811E-11	3.910E-10	6.279E-16	-1.000E+00	2.172E-08	4.860E-10
BREAST	3.456E-14	1.948E-11	4.207E-10	6.754E-16	-1.000E+00	9.280E-10	1.047E-10
TESTES	3.837E-14	2.159E-11	4.661E-10	7.484E-16	-1.000E+00	3.023E-10	8.032E-11
OVARIES	2.616E-14	1.482E-11	3.199E-10	5.137E-16	-1.000E+00	8.361E-10	8.153E-10
EDEWBODY	3.299E-14	1.873E-11	4.043E-10	6.493E-16	-1.000E+00	4.327E-09	1.027E-09
THYROIDH	3.615E-14	2.049E-11	4.425E-10	7.103E-16	6.141E-11	7.790E-10	8.238E-12
ZR-97							
STOMACH	5.527E-14	2.431E-11	9.498E-11	1.083E-15	3.772E-10	4.175E-10	1.213E-09
SMALL IN	5.004E-14	2.202E-11	8.599E-11	9.807E-16	7.834E-10	8.857E-10	3.389E-09
LUNGS	5.975E-14	2.626E-11	1.026E-10	1.170E-15	2.789E-09	3.957E-09	1.759E-11
RED MARR	6.084E-14	2.673E-11	1.044E-10	1.191E-15	1.079E-10	1.396E-10	1.297E-10
THYROID	7.481E-14	3.301E-11	1.290E-10	1.471E-15	-1.000E+00	3.744E-11	2.662E-12
LOWER LI	5.419E-14	2.387E-11	9.324E-11	1.063E-15	2.609E-09	4.271E-09	1.795E-08
BONE SUR	6.691E-14	2.949E-11	1.153E-10	1.315E-15	-1.000E+00	1.217E-10	4.538E-11
BREAST	7.210E-14	3.172E-11	1.240E-10	1.414E-15	-1.000E+00	5.790E-11	8.094E-11
TESTES	7.937E-14	3.496E-11	1.366E-10	1.558E-15	-1.000E+00	2.986E-11	5.200E-11
OVARIES	5.415E-14	2.380E-11	9.302E-11	1.061E-15	-1.000E+00	1.696E-10	6.219E-10
EDEWBODY	8.623E-15	5.200E-12	1.857E-11	2.118E-16	-1.000E+00	1.067E-09	2.288E-09
THYROIDH	7.481E-14	3.301E-11	1.290E-10	1.471E-15	2.788E-11	3.744E-11	2.662E-12
NB-95							
STOMACH	2.778E-14	1.557E-11	3.063E-10	5.422E-16	1.287E-10	6.362E-10	2.796E-10
SMALL IN	2.515E-14	1.411E-11	2.776E-10	4.915E-16	2.838E-10	5.201E-10	9.116E-10
LUNGS	3.000E-14	1.684E-11	3.314E-10	5.866E-16	5.701E-10	8.319E-09	2.743E-11
RED MARR	3.051E-14	1.711E-11	3.367E-10	5.961E-16	1.212E-10	4.425E-10	1.993E-10
THYROID	3.773E-14	2.121E-11	4.173E-10	7.388E-16	-1.000E+00	3.582E-10	1.184E-11
LOWER LI	2.724E-14	1.529E-11	3.009E-10	5.327E-16	9.234E-10	1.928E-09	4.009E-09
BONE SUR	3.330E-14	1.866E-11	3.672E-10	6.501E-16	-1.000E+00	5.161E-10	2.965E-10
BREAST	3.583E-14	2.012E-11	3.959E-10	7.008E-16	-1.000E+00	4.062E-10	1.074E-10
TESTES	3.995E-14	2.230E-11	4.388E-10	7.769E-16	-1.000E+00	6.507E-11	9.664E-11

OVARIES	2.730E-14	1.529E-11	3.009E-10	5.327E-16	-1.000E+00	4.310E-10	8.030E-10
EDEWBODY	3.449E-14	1.937E-11	3.812E-10	6.748E-16	-1.000E+00	1.652E-09	7.029E-10
THYROIDH	3.773E-14	2.121E-11	4.173E-10	7.388E-16	4.278E-11	3.582E-10	1.184E-11
MO-99							
STOMACH	5.518E-15	3.820E-12	5.368E-11	1.100E-16	1.894E-10	2.325E-10	5.135E-10
SMALL IN	4.978E-15	3.408E-12	4.751E-11	9.894E-17	4.221E-10	5.189E-10	1.249E-09
LUNGS	5.993E-15	4.163E-12	5.884E-11	1.192E-16	1.482E-09	4.292E-09	1.506E-11
RED MARR	6.057E-15	4.111E-12	5.687E-11	1.202E-16	3.096E-11	5.074E-11	7.972E-11
THYROID	7.579E-15	5.376E-12	7.737E-11	1.513E-16	-1.000E+00	1.516E-11	1.034E-11
LOWER LI	5.422E-15	3.740E-12	5.251E-11	1.078E-16	2.860E-09	5.516E-09	1.367E-08
BONE SUR	6.913E-15	5.189E-12	7.849E-11	1.386E-16	-1.000E+00	4.290E-11	6.669E-11
BREAST	7.388E-15	5.483E-12	8.176E-11	1.487E-16	-1.000E+00	2.748E-11	3.422E-11
TESTES	7.991E-15	5.622E-12	8.026E-11	1.595E-16	-1.000E+00	1.220E-11	2.719E-11
OVARIES	5.359E-15	3.624E-12	4.983E-11	1.065E-16	-1.000E+00	9.503E-11	2.174E-10
EDEWBODY	7.164E-15	5.694E-12	7.867E-11	1.667E-16	-1.000E+00	1.075E-09	1.362E-09
THYROIDH	7.579E-15	5.376E-12	7.737E-11	1.513E-16	5.884E-12	1.516E-11	1.034E-11
TC-99M							
STOMACH	4.154E-15	1.731E-12	2.875E-12	9.196E-17	1.437E-11	1.519E-11	7.169E-11
SMALL IN	3.583E-15	1.498E-12	2.489E-12	7.959E-17	3.397E-12	3.520E-12	2.227E-11
LUNGS	4.598E-15	1.928E-12	3.203E-12	1.024E-16	2.918E-11	3.061E-11	3.151E-12
RED MARR	4.217E-15	1.755E-12	2.915E-12	9.323E-17	2.296E-12	2.389E-12	6.273E-12
THYROID	6.342E-15	2.656E-12	4.412E-12	1.411E-16	-1.000E+00	2.088E-11	8.449E-11
LOWER LI	4.027E-15	1.689E-12	2.806E-12	8.974E-17	3.371E-12	3.834E-12	2.545E-11
BONE SUR	7.230E-15	3.020E-12	5.017E-12	1.605E-16	-1.000E+00	1.784E-12	4.064E-12
BREAST	7.230E-15	3.050E-12	5.067E-12	1.620E-16	-1.000E+00	1.520E-12	3.563E-12
TESTES	6.437E-15	2.698E-12	4.482E-12	1.433E-16	-1.000E+00	5.222E-13	2.294E-12
OVARIES	3.615E-15	1.510E-12	2.509E-12	8.023E-17	-1.000E+00	1.703E-12	9.738E-12
EDEWBODY	5.729E-15	2.418E-12	4.017E-12	1.285E-16	-1.000E+00	7.451E-12	1.673E-11
THYROIDH	6.342E-15	2.656E-12	4.412E-12	1.411E-16	1.968E-11	2.088E-11	8.449E-11
RU-103							
STOMACH	1.662E-14	9.838E-12	1.950E-10	3.426E-16	1.212E-10	5.047E-10	3.143E-10
SMALL IN	1.487E-14	8.816E-12	1.747E-10	3.070E-16	2.683E-10	4.713E-10	8.509E-10
LUNGS	1.808E-14	1.075E-11	2.131E-10	3.745E-16	9.950E-10	1.560E-08	7.350E-11
RED MARR	1.849E-14	1.093E-11	2.166E-10	3.806E-16	8.176E-11	3.183E-10	1.666E-10
THYROID	2.246E-14	1.331E-11	2.638E-10	4.635E-16	-1.000E+00	2.564E-10	6.289E-11
LOWER LI	1.624E-14	9.656E-12	1.914E-10	3.363E-16	1.489E-09	3.135E-09	6.534E-09
BONE SUR	2.119E-14	1.258E-11	2.493E-10	4.381E-16	-1.000E+00	2.371E-10	9.661E-11
BREAST	2.257E-14	1.346E-11	2.671E-10	4.694E-16	-1.000E+00	3.103E-10	1.200E-10
TESTES	2.427E-14	1.442E-11	2.859E-10	5.023E-16	-1.000E+00	6.971E-11	1.220E-10
OVARIES	1.614E-14	9.565E-12	1.896E-10	3.331E-16	-1.000E+00	3.070E-10	5.712E-10
EDEWBODY	2.107E-14	1.249E-11	2.476E-10	4.351E-16	-1.000E+00	2.485E-09	8.278E-10
THYROIDH	2.246E-14	1.331E-11	2.638E-10	4.635E-16	2.856E-11	2.564E-10	6.289E-11
RU-105							
STOMACH	2.784E-14	9.261E-12	1.410E-11	5.581E-16	7.924E-11	8.095E-11	4.980E-10
SMALL IN	2.511E-14	8.313E-12	1.265E-11	5.010E-16	1.205E-10	1.248E-10	7.898E-10
LUNGS	3.019E-14	9.999E-12	1.525E-11	6.025E-16	4.975E-10	5.725E-10	6.210E-12
RED MARR	3.076E-14	1.021E-11	1.558E-11	6.152E-16	7.221E-12	7.688E-12	2.340E-11
THYROID	3.805E-14	1.258E-11	1.919E-11	7.579E-16	-1.000E+00	4.145E-12	1.813E-12
LOWER LI	2.727E-14	9.051E-12	1.379E-11	5.454E-16	2.058E-10	3.048E-10	1.339E-09
BONE SUR	3.456E-14	1.154E-11	1.775E-11	6.944E-16	-1.000E+00	4.616E-12	8.893E-12
BREAST	3.710E-14	1.232E-11	1.893E-11	7.420E-16	-1.000E+00	6.609E-12	1.591E-11
TESTES	4.027E-14	1.337E-11	2.040E-11	8.054E-16	-1.000E+00	1.523E-12	7.596E-12

OVARIES	2.714E-14	8.994E-12	1.365E-11	5.422E-16	-1.000E+00	1.590E-11	9.669E-11
EDEWBODY	3.519E-14	1.210E-11	1.848E-11	7.292E-16	-1.000E+00	1.235E-10	2.868E-10
THYROIDH	3.805E-14	1.258E-11	1.919E-11	7.579E-16	3.876E-12	4.145E-12	1.813E-12
RU-106							
STOMACH	7.293E-15	4.175E-12	8.726E-11	1.452E-16	6.984E-10	2.938E-09	3.119E-09
SMALL IN	6.564E-15	3.765E-12	7.869E-11	1.310E-16	1.589E-09	3.397E-09	5.548E-09
LUNGS	7.896E-15	4.531E-12	9.469E-11	1.576E-16	2.088E-08	1.037E-06	1.435E-09
RED MARR	8.054E-15	4.622E-12	9.660E-11	1.608E-16	8.744E-11	1.770E-09	1.483E-09
THYROID	9.862E-15	5.652E-12	1.181E-10	1.966E-16	-1.000E+00	1.733E-09	1.432E-09
LOWER LI	7.135E-15	4.093E-12	8.555E-11	1.424E-16	1.604E-08	3.713E-08	7.087E-08
BONE SUR	9.037E-15	5.187E-12	1.084E-10	1.804E-16	-1.000E+00	1.620E-09	1.445E-09
BREAST	9.672E-15	5.552E-12	1.160E-10	1.931E-16	-1.000E+00	1.798E-09	1.457E-09
TESTES	1.056E-14	6.053E-12	1.265E-10	2.106E-16	-1.000E+00	1.154E-09	1.474E-09
OVARIES	7.103E-15	4.075E-12	8.517E-11	1.417E-16	-1.000E+00	1.308E-09	1.656E-09
EDEWBODY	1.010E-14	9.017E-12	1.885E-10	3.137E-16	-1.000E+00	1.289E-07	7.419E-09
THYROIDH	9.862E-15	5.652E-12	1.181E-10	1.966E-16	4.022E-11	1.733E-09	1.432E-09
RH-105							
STOMACH	2.600E-15	1.488E-12	9.870E-12	5.581E-17	6.353E-11	7.262E-11	1.946E-10
SMALL IN	2.315E-15	1.327E-12	8.804E-12	4.978E-17	1.353E-10	1.578E-10	4.427E-10
LUNGS	2.841E-15	1.631E-12	1.082E-11	6.120E-17	4.797E-10	9.509E-10	3.847E-12
RED MARR	2.936E-15	1.682E-12	1.116E-11	6.310E-17	5.385E-12	7.746E-12	1.463E-11
THYROID	3.615E-15	2.071E-12	1.374E-11	7.769E-17	-1.000E+00	2.878E-12	2.894E-12
LOWER LI	2.556E-15	1.462E-12	9.701E-12	5.486E-17	7.389E-10	1.347E-09	3.781E-09
BONE SUR	3.647E-15	2.088E-12	1.385E-11	7.832E-17	-1.000E+00	4.441E-12	6.731E-12
BREAST	3.805E-15	2.189E-12	1.452E-11	8.213E-17	-1.000E+00	5.592E-12	8.959E-12
TESTES	3.837E-15	2.206E-12	1.464E-11	8.276E-17	-1.000E+00	2.827E-12	7.209E-12
OVARIES	2.416E-15	1.386E-12	9.197E-12	5.200E-17	-1.000E+00	2.105E-11	5.798E-11
EDEWBODY	3.449E-15	2.012E-12	1.335E-11	7.546E-17	-1.000E+00	2.573E-10	3.980E-10
THYROIDH	3.615E-15	2.071E-12	1.374E-11	7.769E-17	1.432E-12	2.878E-12	2.894E-12
SB-127							
STOMACH	2.337E-14	1.314E-11	1.623E-10	4.693E-16	2.278E-10	3.267E-10	5.597E-10
SMALL IN	2.106E-14	1.181E-11	1.459E-10	4.217E-16	5.199E-10	7.090E-10	1.630E-09
LUNGS	2.534E-14	1.420E-11	1.755E-10	5.074E-16	1.712E-09	6.915E-09	1.574E-11
RED MARR	2.584E-14	1.456E-11	1.799E-10	5.200E-16	9.334E-11	1.547E-10	1.317E-10
THYROID	3.171E-14	1.784E-11	2.205E-10	6.374E-16	-1.000E+00	6.144E-11	4.642E-12
LOWER LI	2.289E-14	1.287E-11	1.590E-10	4.598E-16	3.663E-09	7.432E-09	1.959E-08
BONE SUR	2.908E-14	1.634E-11	2.019E-10	5.835E-16	-1.000E+00	1.331E-10	5.225E-11
BREAST	3.111E-14	1.749E-11	2.161E-10	6.247E-16	-1.000E+00	9.102E-11	7.574E-11
TESTES	3.393E-14	1.909E-11	2.358E-10	6.818E-16	-1.000E+00	4.588E-11	5.894E-11
OVARIES	2.280E-14	1.278E-11	1.579E-10	4.566E-16	-1.000E+00	2.521E-10	6.148E-10
EDEWBODY	2.951E-14	1.702E-11	2.093E-10	6.088E-16	-1.000E+00	1.633E-09	1.948E-09
THYROIDH	3.171E-14	1.784E-11	2.205E-10	6.374E-16	2.443E-11	6.144E-11	4.642E-12
SB-129							
STOMACH	5.264E-14	1.651E-11	2.316E-11	9.830E-16	1.226E-10	1.235E-10	7.245E-10
SMALL IN	4.820E-14	1.512E-11	2.120E-11	9.006E-16	1.888E-10	1.912E-10	1.473E-09
LUNGS	5.676E-14	1.785E-11	2.503E-11	1.062E-15	8.357E-10	8.954E-10	9.379E-12
RED MARR	5.771E-14	1.811E-11	2.540E-11	1.078E-15	1.608E-11	1.654E-11	3.661E-11
THYROID	7.103E-14	2.233E-11	3.132E-11	1.329E-15	-1.000E+00	9.720E-12	1.464E-12
LOWER LI	5.169E-14	1.624E-11	2.278E-11	9.672E-16	2.014E-10	2.321E-10	1.929E-09
BONE SUR	6.247E-14	1.970E-11	2.764E-11	1.170E-15	-1.000E+00	1.481E-11	1.332E-11
BREAST	6.786E-14	2.143E-11	3.008E-11	1.272E-15	-1.000E+00	1.281E-11	2.560E-11
TESTES	7.515E-14	2.363E-11	3.315E-11	1.405E-15	-1.000E+00	5.415E-12	1.105E-11

OVARIES	5.137E-14	1.608E-11	2.255E-11	9.576E-16	-1.000E+00	2.148E-11	1.514E-10
EDEWBODY	6.528E-14	2.129E-11	2.998E-11	1.238E-15	-1.000E+00	1.740E-10	4.830E-10
THYROIDH	7.103E-14	2.233E-11	3.132E-11	1.329E-15	9.521E-12	9.720E-12	1.464E-12
TE-127							
STOMACH	1.639E-16	7.509E-14	1.679E-13	3.456E-18	4.321E-11	4.465E-11	2.425E-10
SMALL IN	1.462E-16	6.717E-14	1.502E-13	3.092E-18	6.822E-11	7.117E-11	3.896E-10
LUNGS	1.788E-16	8.198E-14	1.833E-13	3.773E-18	3.727E-10	4.258E-10	2.885E-12
RED MARR	1.836E-16	8.405E-14	1.879E-13	3.869E-18	3.342E-12	3.986E-12	6.413E-12
THYROID	2.245E-16	1.033E-13	2.310E-13	4.756E-18	-1.000E+00	1.844E-12	2.855E-12
LOWER LI	1.605E-16	7.371E-14	1.648E-13	3.393E-18	1.640E-10	2.275E-10	1.265E-09
BONE SUR	2.191E-16	1.006E-13	2.248E-13	4.630E-18	-1.000E+00	4.063E-12	6.424E-12
BREAST	2.312E-16	1.061E-13	2.372E-13	4.883E-18	-1.000E+00	1.878E-12	2.998E-12
TESTES	2.410E-16	1.109E-13	2.479E-13	5.105E-18	-1.000E+00	1.828E-12	2.940E-12
OVARIES	1.560E-16	7.165E-14	1.602E-13	3.298E-18	-1.000E+00	2.029E-12	4.040E-12
EDEWBODY	0.000E+00	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	8.597E-11	1.874E-10
THYROIDH	2.245E-16	1.033E-13	2.310E-13	4.756E-18	1.590E-12	1.844E-12	2.855E-12
TE-127M							
STOMACH	4.566E-17	7.804E-14	2.953E-12	1.884E-18	8.892E-11	2.302E-10	2.115E-10
SMALL IN	3.165E-17	5.837E-14	2.406E-12	1.287E-18	1.832E-10	3.690E-10	4.338E-10
LUNGS	6.247E-17	1.013E-13	3.555E-12	2.616E-18	1.799E-09	3.337E-08	9.597E-11
RED MARR	2.632E-17	5.643E-14	2.669E-12	1.034E-18	2.769E-10	5.309E-09	5.373E-09
THYROID	1.237E-16	1.852E-13	5.663E-12	5.296E-18	-1.000E+00	9.635E-11	9.411E-11
LOWER LI	4.059E-17	7.121E-14	2.788E-12	1.662E-18	2.309E-09	5.719E-09	1.109E-08
BONE SUR	1.069E-16	1.615E-13	5.126E-12	4.503E-18	-1.000E+00	2.055E-08	2.086E-08
BREAST	3.038E-16	4.141E-13	1.042E-11	1.322E-17	-1.000E+00	1.097E-10	9.733E-11
TESTES	1.877E-16	2.688E-13	7.518E-12	8.118E-18	-1.000E+00	9.225E-11	9.303E-11
OVARIES	4.503E-17	7.676E-14	2.865E-12	1.877E-18	-1.000E+00	1.100E-10	1.248E-10
EDEWBODY	1.412E-16	1.758E-13	3.615E-12	6.111E-18	-1.000E+00	5.801E-09	2.224E-09
THYROIDH	1.237E-16	1.852E-13	5.663E-12	5.296E-18	1.337E-11	9.635E-11	9.411E-11
TE-129							
STOMACH	1.842E-15	2.273E-13	2.293E-13	3.805E-17	1.553E-11	1.553E-11	3.970E-10
SMALL IN	1.652E-15	2.027E-13	2.044E-13	3.393E-17	1.083E-11	1.083E-11	2.730E-10
LUNGS	2.007E-15	2.482E-13	2.503E-13	4.154E-17	1.526E-10	1.526E-10	4.910E-13
RED MARR	2.042E-15	2.501E-13	2.522E-13	4.186E-17	6.131E-13	6.131E-13	7.610E-13
THYROID	2.527E-15	3.145E-13	3.172E-13	5.264E-17	-1.000E+00	5.088E-13	3.350E-13
LOWER LI	1.804E-15	2.217E-13	2.235E-13	3.710E-17	1.838E-12	1.839E-12	3.700E-11
BONE SUR	2.375E-15	2.956E-13	2.981E-13	4.947E-17	-1.000E+00	7.058E-13	5.990E-13
BREAST	2.610E-15	3.334E-13	3.363E-13	5.581E-17	-1.000E+00	5.381E-13	6.050E-13
TESTES	2.737E-15	3.429E-13	3.458E-13	5.740E-17	-1.000E+00	4.522E-13	3.750E-13
OVARIES	1.782E-15	2.198E-13	2.216E-13	3.678E-17	-1.000E+00	5.052E-13	1.580E-12
EDEWBODY	2.685E-15	5.525E-13	5.572E-13	9.248E-17	-1.000E+00	2.085E-11	5.430E-11
THYROIDH	2.527E-15	3.145E-13	3.172E-13	5.264E-17	5.088E-13	5.088E-13	3.350E-13
TE-129M							
STOMACH	1.157E-15	1.240E-12	2.709E-11	2.359E-17	2.603E-10	4.813E-10	6.262E-10
SMALL IN	1.040E-15	1.104E-12	2.413E-11	2.099E-17	5.055E-10	7.966E-10	1.470E-09
LUNGS	1.262E-15	1.358E-12	2.966E-11	2.591E-17	3.516E-09	4.028E-08	1.588E-10
RED MARR	1.259E-15	1.344E-12	2.940E-11	2.524E-17	4.854E-10	3.038E-09	3.432E-09
THYROID	1.617E-15	1.753E-12	3.820E-11	3.393E-17	-1.000E+00	1.555E-10	1.566E-10
LOWER LI	1.132E-15	1.208E-12	2.639E-11	2.296E-17	4.897E-09	1.100E-08	2.464E-08
BONE SUR	1.443E-15	1.599E-12	3.496E-11	3.022E-17	-1.000E+00	7.149E-09	8.103E-09
BREAST	1.687E-15	1.936E-12	4.203E-11	3.869E-17	-1.000E+00	1.684E-10	1.657E-10
TESTES	1.754E-15	1.932E-12	4.207E-11	3.773E-17	-1.000E+00	1.390E-10	1.604E-10

OVARIES	1.138E-15	1.209E-12	2.640E-11	2.318E-17	-1.000E+00	1.783E-10	2.405E-10
EDEWBODY	1.644E-15	2.813E-12	6.190E-11	5.035E-17	-1.000E+00	6.466E-09	2.885E-09
THYROIDH	1.617E-15	1.753E-12	3.820E-11	3.393E-17	3.040E-11	1.555E-10	1.566E-10
TE-131M							
STOMACH	5.525E-14	2.755E-11	1.751E-10	1.048E-15	2.208E-10	2.758E-10	6.627E-10
SMALL IN	5.016E-14	2.504E-11	1.589E-10	9.528E-16	3.920E-10	4.928E-10	1.600E-09
LUNGS	5.966E-14	2.979E-11	1.895E-10	1.133E-15	1.203E-09	2.231E-09	6.208E-11
RED MARR	6.028E-14	3.011E-11	1.918E-10	1.145E-15	9.441E-11	1.386E-10	2.393E-10
THYROID	7.492E-14	3.757E-11	2.390E-10	1.430E-15	-1.000E+00	3.280E-08	3.908E-08
LOWER LI	5.424E-14	2.710E-11	1.722E-10	1.031E-15	1.333E-09	2.367E-09	8.102E-09
BONE SUR	6.713E-14	3.366E-11	2.159E-10	1.281E-15	-1.000E+00	2.608E-10	3.698E-10
BREAST	7.245E-14	3.646E-11	2.332E-10	1.387E-15	-1.000E+00	9.204E-11	1.342E-10
TESTES	7.928E-14	3.970E-11	2.529E-10	1.511E-15	-1.000E+00	4.542E-11	9.816E-11
OVARIES	5.350E-14	2.671E-11	1.695E-10	1.016E-15	-1.000E+00	2.335E-10	7.370E-10
EDEWBODY	6.458E-14	3.240E-11	2.070E-10	1.227E-15	-1.000E+00	1.634E-09	2.355E-09
THYROIDH	7.492E-14	3.757E-11	2.390E-10	1.430E-15	6.429E-09	3.280E-08	3.908E-08
TE-132							
STOMACH	6.976E-15	3.219E-11	5.471E-10	1.551E-16	2.302E-10	4.076E-10	4.855E-10
SMALL IN	6.152E-15	2.912E-11	4.957E-10	1.364E-16	3.127E-10	5.081E-10	7.662E-10
LUNGS	7.706E-15	3.493E-11	5.930E-10	1.722E-16	5.309E-10	1.641E-09	2.937E-10
RED MARR	7.642E-15	3.531E-11	6.006E-10	1.681E-16	2.500E-10	3.951E-10	4.064E-10
THYROID	1.021E-14	4.414E-11	7.469E-10	2.308E-16	-1.000E+00	5.284E-08	4.695E-08
LOWER LI	6.849E-15	3.154E-11	5.362E-10	1.519E-16	8.207E-10	1.574E-09	3.764E-09
BONE SUR	1.075E-14	4.024E-11	6.752E-10	2.419E-16	-1.000E+00	7.249E-10	8.537E-10
BREAST	1.154E-14	4.369E-11	7.321E-10	2.686E-16	-1.000E+00	3.312E-10	3.126E-10
TESTES	1.078E-14	4.683E-11	7.922E-10	2.461E-16	-1.000E+00	3.374E-10	3.256E-10
OVARIES	6.247E-15	3.114E-11	5.313E-10	1.395E-16	-1.000E+00	3.866E-10	5.058E-10
EDEWBODY	9.502E-15	4.131E-11	6.992E-10	2.153E-16	-1.000E+00	2.229E-09	2.132E-09
THYROIDH	1.021E-14	4.414E-11	7.469E-10	2.308E-16	2.263E-08	5.284E-08	4.695E-08
I-131							
STOMACH	1.291E-14	7.742E-12	1.238E-10	2.727E-16	5.997E-11	7.516E-11	3.059E-10
SMALL IN	1.154E-14	6.914E-12	1.106E-10	2.435E-16	1.572E-11	2.742E-11	4.471E-11
LUNGS	1.408E-14	8.444E-12	1.351E-10	2.974E-16	4.539E-10	6.565E-10	1.016E-10
RED MARR	1.449E-14	8.678E-12	1.388E-10	3.057E-16	3.518E-11	6.260E-11	9.444E-11
THYROID	1.776E-14	1.062E-11	1.699E-10	3.742E-16	-1.000E+00	2.911E-07	4.753E-07
LOWER LI	1.265E-14	7.589E-12	1.214E-10	2.673E-16	1.465E-11	2.593E-11	4.239E-11
BONE SUR	1.731E-14	1.044E-11	1.671E-10	3.678E-16	-1.000E+00	5.718E-11	8.699E-11
BREAST	1.830E-14	1.098E-11	1.757E-10	3.869E-16	-1.000E+00	7.861E-11	1.209E-10
TESTES	1.899E-14	1.143E-11	1.829E-10	4.027E-16	-1.000E+00	2.322E-11	3.777E-11
OVARIES	1.224E-14	7.337E-12	1.174E-10	2.584E-16	-1.000E+00	2.533E-11	4.067E-11
EDEWBODY	1.667E-14	1.009E-11	1.614E-10	3.553E-16	-1.000E+00	8.872E-09	1.434E-08
THYROIDH	1.776E-14	1.062E-11	1.699E-10	3.742E-16	1.279E-08	9.694E-08	1.583E-07
I-132							
STOMACH	8.308E-14	1.738E-11	1.909E-11	1.598E-15	9.896E-11	9.896E-11	6.320E-10
SMALL IN	7.547E-14	1.579E-11	1.735E-11	1.452E-15	1.245E-11	1.245E-11	3.160E-11
LUNGS	8.974E-14	1.879E-11	2.065E-11	1.728E-15	2.702E-10	2.703E-10	2.640E-11
RED MARR	9.132E-14	1.910E-11	2.099E-11	1.757E-15	1.401E-11	1.401E-11	2.450E-11
THYROID	1.126E-13	2.352E-11	2.584E-11	2.163E-15	-1.000E+00	1.726E-09	3.842E-09
LOWER LI	8.149E-14	1.703E-11	1.871E-11	1.566E-15	1.126E-11	1.127E-11	2.750E-11
BONE SUR	9.989E-14	2.090E-11	2.296E-11	1.922E-15	-1.000E+00	1.242E-11	2.190E-11
BREAST	1.078E-13	2.259E-11	2.481E-11	2.077E-15	-1.000E+00	1.412E-11	2.511E-11
TESTES	1.192E-13	2.493E-11	2.739E-11	2.293E-15	-1.000E+00	9.901E-12	2.220E-11

OVARIES	8.118E-14	1.700E-11	1.868E-11	1.563E-15	-1.000E+00	9.960E-12	2.340E-11
EDEWBODY	1.032E-13	2.203E-11	2.420E-11	2.025E-15	-1.000E+00	1.026E-10	1.814E-10
THYROIDH	1.126E-13	2.352E-11	2.584E-11	2.163E-15	1.721E-09	1.726E-09	3.842E-09
I-133							
STOMACH	2.121E-14	1.076E-11	4.720E-11	4.249E-16	1.023E-10	1.046E-10	5.533E-10
SMALL IN	1.915E-14	9.713E-12	4.252E-11	3.837E-16	2.006E-11	2.150E-11	4.041E-11
LUNGS	2.305E-14	1.172E-11	5.158E-11	4.630E-16	7.085E-10	8.162E-10	4.518E-11
RED MARR	2.350E-14	1.196E-11	5.196E-11	4.725E-16	2.454E-11	2.717E-11	4.313E-11
THYROID	2.873E-14	1.462E-11	6.491E-11	5.771E-16	-1.000E+00	4.855E-08	9.102E-08
LOWER LI	2.077E-14	1.052E-11	4.605E-11	4.154E-16	1.910E-11	2.049E-11	3.883E-11
BONE SUR	2.645E-14	1.350E-11	6.041E-11	5.327E-16	-1.000E+00	2.518E-11	4.080E-11
BREAST	2.829E-14	1.439E-11	6.509E-11	5.676E-16	-1.000E+00	2.931E-11	4.688E-11
TESTES	3.079E-14	1.566E-11	6.965E-11	6.183E-16	-1.000E+00	1.947E-11	3.632E-11
OVARIES	2.071E-14	1.052E-11	4.602E-11	4.154E-16	-1.000E+00	1.934E-11	3.573E-11
EDEWBODY	2.685E-14	1.427E-11	6.312E-11	5.637E-16	-1.000E+00	1.583E-09	2.800E-09
THYROIDH	2.873E-14	1.462E-11	6.491E-11	5.771E-16	2.389E-08	4.855E-08	9.102E-08
I-134							
STOMACH	9.672E-14	8.230E-12	8.245E-12	1.811E-15	7.081E-11	7.081E-11	5.480E-10
SMALL IN	8.847E-14	7.524E-12	7.537E-12	1.655E-15	5.521E-12	5.521E-12	1.600E-11
LUNGS	1.043E-13	8.893E-12	8.909E-12	1.957E-15	1.429E-10	1.429E-10	1.260E-11
RED MARR	1.059E-13	9.008E-12	9.025E-12	1.982E-15	6.067E-12	6.067E-12	1.090E-11
THYROID	1.306E-13	1.114E-11	1.116E-11	2.451E-15	-1.000E+00	2.848E-10	6.160E-10
LOWER LI	9.513E-14	8.100E-12	8.115E-12	1.782E-15	4.800E-12	4.800E-12	1.290E-11
BONE SUR	1.148E-13	9.787E-12	9.804E-12	2.153E-15	-1.000E+00	5.296E-12	9.290E-12
BREAST	1.246E-13	1.061E-11	1.063E-11	2.334E-15	-1.000E+00	6.153E-12	1.160E-11
TESTES	1.379E-13	1.175E-11	1.177E-11	2.584E-15	-1.000E+00	4.001E-12	8.860E-12
OVARIES	9.418E-14	8.028E-12	8.043E-12	1.766E-15	-1.000E+00	4.235E-12	1.100E-11
EDEWBODY	1.204E-13	1.042E-11	1.044E-11	2.292E-15	-1.000E+00	3.548E-11	6.630E-11
THYROIDH	1.306E-13	1.114E-11	1.116E-11	2.451E-15	2.848E-10	2.848E-10	6.160E-10
I-135							
STOMACH	6.093E-14	2.170E-11	4.265E-11	1.065E-15	9.819E-11	9.855E-11	5.403E-10
SMALL IN	5.689E-14	2.020E-11	3.951E-11	9.932E-16	1.878E-11	1.899E-11	4.108E-11
LUNGS	6.589E-14	2.354E-11	4.632E-11	1.154E-15	4.291E-10	4.396E-10	3.737E-11
RED MARR	6.658E-14	2.377E-11	4.682E-11	1.165E-15	2.194E-11	2.231E-11	3.638E-11
THYROID	8.172E-14	2.917E-11	5.765E-11	1.427E-15	-1.000E+00	8.435E-09	1.778E-08
LOWER LI	6.056E-14	2.154E-11	4.231E-11	1.057E-15	1.765E-11	1.784E-11	3.937E-11
BONE SUR	7.106E-14	2.561E-11	5.157E-11	1.242E-15	-1.000E+00	1.997E-11	3.342E-11
BREAST	7.823E-14	2.817E-11	5.639E-11	1.370E-15	-1.000E+00	2.334E-11	3.844E-11
TESTES	8.672E-14	3.094E-11	6.113E-11	1.514E-15	-1.000E+00	1.521E-11	3.213E-11
OVARIES	5.897E-14	2.091E-11	4.088E-11	1.029E-15	-1.000E+00	1.699E-11	3.616E-11
EDEWBODY	7.257E-14	2.643E-11	5.277E-11	1.285E-15	-1.000E+00	3.308E-10	6.041E-10
THYROIDH	8.172E-14	2.917E-11	5.765E-11	1.427E-15	7.172E-09	8.435E-09	1.778E-08
XE-133							
STOMACH	9.450E-16	0.000E+00	0.000E+00	0.000E+00	1.312E-13	1.451E-13	0.000E+00
SMALL IN	7.991E-16	0.000E+00	0.000E+00	0.000E+00	1.368E-13	1.498E-13	0.000E+00
LUNGS	1.113E-15	0.000E+00	0.000E+00	0.000E+00	3.508E-13	3.716E-13	0.000E+00
RED MARR	7.293E-16	0.000E+00	0.000E+00	0.000E+00	1.558E-13	1.686E-13	0.000E+00
THYROID	1.719E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	1.381E-13	0.000E+00
LOWER LI	8.689E-16	0.000E+00	0.000E+00	0.000E+00	1.357E-13	1.486E-13	0.000E+00
BONE SUR	1.976E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	1.616E-13	0.000E+00
BREAST	2.255E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	1.415E-13	0.000E+00
TESTES	1.814E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	1.392E-13	0.000E+00

OVARIES	8.340E-16	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	1.464E-13	0.000E+00
EDEWBODY	1.551E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	1.762E-13	0.000E+00
THYROIDH	1.719E-15	0.000E+00	0.000E+00	0.000E+00	1.212E-13	1.381E-13	0.000E+00
XE-135							
STOMACH	8.213E-15	0.000E+00	0.000E+00	0.000E+00	2.546E-13	2.575E-13	0.000E+00
SMALL IN	7.293E-15	0.000E+00	0.000E+00	0.000E+00	2.560E-13	2.586E-13	0.000E+00
LUNGS	9.006E-15	0.000E+00	0.000E+00	0.000E+00	7.645E-13	7.685E-13	0.000E+00
RED MARR	9.228E-15	0.000E+00	0.000E+00	0.000E+00	2.532E-13	2.554E-13	0.000E+00
THYROID	1.167E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.341E-13	0.000E+00
LOWER LI	8.118E-15	0.000E+00	0.000E+00	0.000E+00	2.479E-13	2.504E-13	0.000E+00
BONE SUR	1.202E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.473E-13	0.000E+00
BREAST	1.253E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.392E-13	0.000E+00
TESTES	1.227E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.321E-13	0.000E+00
OVARIES	7.515E-15	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	2.525E-13	0.000E+00
EDEWBODY	1.103E-14	0.000E+00	0.000E+00	0.000E+00	-1.000E+00	3.151E-13	0.000E+00
THYROIDH	1.167E-14	0.000E+00	0.000E+00	0.000E+00	2.308E-13	2.341E-13	0.000E+00
CS-134							
STOMACH	5.581E-14	3.159E-11	6.615E-10	1.097E-15	3.462E-10	1.251E-08	2.009E-08
SMALL IN	5.042E-14	2.858E-11	5.984E-10	9.925E-16	3.382E-10	1.372E-08	2.178E-08
LUNGS	6.025E-14	3.424E-11	7.169E-10	1.189E-15	8.600E-10	1.173E-08	1.746E-08
RED MARR	6.152E-14	3.488E-11	7.303E-10	1.211E-15	9.057E-10	1.178E-08	1.868E-08
THYROID	7.579E-14	4.292E-11	8.986E-10	1.490E-15	-1.000E+00	1.113E-08	1.764E-08
LOWER LI	5.454E-14	3.095E-11	6.481E-10	1.075E-15	3.349E-10	1.372E-08	2.177E-08
BONE SUR	6.786E-14	3.844E-11	8.049E-10	1.335E-15	-1.000E+00	1.091E-08	1.731E-08
BREAST	7.293E-14	4.136E-11	8.661E-10	1.436E-15	-1.000E+00	1.082E-08	1.714E-08
TESTES	8.023E-14	4.556E-11	9.540E-10	1.582E-15	-1.000E+00	1.296E-08	2.058E-08
OVARIES	5.454E-14	3.105E-11	6.500E-10	1.078E-15	-1.000E+00	1.133E-08	1.798E-08
EDEWBODY	6.968E-14	3.966E-11	8.304E-10	1.377E-15	-1.000E+00	1.253E-08	1.975E-08
THYROIDH	7.579E-14	4.292E-11	8.986E-10	1.490E-15	4.736E-10	1.113E-08	1.764E-08
CS-136							
STOMACH	7.864E-14	4.255E-11	7.539E-10	1.490E-15	3.756E-10	1.965E-09	3.384E-09
SMALL IN	7.166E-14	3.884E-11	6.882E-10	1.360E-15	3.663E-10	2.114E-09	3.408E-09
LUNGS	8.498E-14	4.608E-11	8.165E-10	1.614E-15	6.540E-10	2.311E-09	2.617E-09
RED MARR	8.593E-14	4.653E-11	8.245E-10	1.630E-15	7.018E-10	1.855E-09	2.952E-09
THYROID	1.072E-13	5.830E-11	1.033E-09	2.042E-15	-1.000E+00	1.723E-09	2.736E-09
LOWER LI	7.737E-14	4.191E-11	7.427E-10	1.468E-15	3.617E-10	2.108E-09	3.404E-09
BONE SUR	9.481E-14	5.178E-11	9.176E-10	1.814E-15	-1.000E+00	1.691E-09	2.697E-09
BREAST	1.027E-13	5.604E-11	9.930E-10	1.963E-15	-1.000E+00	1.658E-09	2.636E-09
TESTES	1.126E-13	6.129E-11	1.086E-09	2.147E-15	-1.000E+00	1.881E-09	3.034E-09
OVARIES	7.642E-14	4.146E-11	7.347E-10	1.452E-15	-1.000E+00	1.673E-09	2.699E-09
EDEWBODY	9.792E-14	5.320E-11	9.427E-10	1.863E-15	-1.000E+00	1.990E-09	3.062E-09
THYROIDH	1.072E-13	5.830E-11	1.033E-09	2.042E-15	3.585E-10	1.723E-09	2.736E-09
CS-137							
STOMACH	2.010E-14	1.149E-11	2.430E-10	4.020E-16	2.251E-10	8.606E-09	1.390E-08
SMALL IN	1.812E-14	1.037E-11	2.194E-10	3.630E-16	1.956E-10	9.043E-09	1.436E-08
LUNGS	2.178E-14	1.243E-11	2.630E-10	4.350E-16	8.287E-10	8.799E-09	1.266E-08
RED MARR	2.217E-14	1.260E-11	2.666E-10	4.410E-16	5.625E-10	8.295E-09	1.316E-08
THYROID	2.730E-14	1.560E-11	3.301E-10	5.460E-16	-1.000E+00	7.919E-09	1.257E-08
LOWER LI	1.968E-14	1.123E-11	2.376E-10	3.930E-16	1.953E-10	9.063E-09	1.439E-08
BONE SUR	2.460E-14	1.406E-11	2.974E-10	4.920E-16	-1.000E+00	7.933E-09	1.258E-08
BREAST	2.643E-14	1.509E-11	3.192E-10	5.280E-16	-1.000E+00	7.823E-09	1.240E-08
TESTES	2.904E-14	1.655E-11	3.500E-10	5.790E-16	-1.000E+00	8.758E-09	1.390E-08

OVARIES	1.974E-14	1.123E-11	2.376E-10	3.930E-16	-1.000E+00	8.107E-09	1.286E-08
EDEWBODY	2.526E-14	1.459E-11	3.085E-10	5.104E-16	-1.000E+00	8.628E-09	1.355E-08
THYROIDH	2.730E-14	1.560E-11	3.301E-10	5.460E-16	2.960E-10	7.919E-09	1.257E-08
BA-139							
STOMACH	1.157E-15	1.742E-13	1.775E-13	2.467E-17	9.184E-11	9.184E-11	6.880E-10
SMALL IN	1.024E-15	1.539E-13	1.567E-13	2.178E-17	7.425E-11	7.425E-11	5.560E-10
LUNGS	1.278E-15	1.928E-13	1.964E-13	2.730E-17	2.529E-10	2.529E-10	4.450E-13
RED MARR	1.227E-15	1.841E-13	1.875E-13	2.607E-17	4.351E-12	4.351E-12	9.610E-13
THYROID	1.709E-15	2.598E-13	2.646E-13	3.678E-17	-1.000E+00	2.905E-12	3.210E-13
LOWER LI	1.138E-15	1.711E-13	1.743E-13	2.423E-17	1.573E-11	1.573E-11	1.000E-10
BONE SUR	1.826E-15	2.777E-13	2.829E-13	3.932E-17	-1.000E+00	4.354E-12	6.400E-13
BREAST	1.887E-15	2.911E-13	2.966E-13	4.122E-17	-1.000E+00	2.947E-12	5.700E-13
TESTES	1.763E-15	2.687E-13	2.737E-13	3.805E-17	-1.000E+00	2.870E-12	3.620E-13
OVARIES	1.034E-15	1.554E-13	1.583E-13	2.201E-17	-1.000E+00	3.054E-12	1.610E-12
EDEWBODY	2.164E-15	8.125E-13	8.276E-13	1.150E-16	-1.000E+00	4.686E-11	1.080E-10
THYROIDH	1.709E-15	2.598E-13	2.646E-13	3.678E-17	2.905E-12	2.905E-12	3.210E-13
BA-140							
STOMACH	6.405E-15	6.623E-12	5.941E-10	1.332E-16	1.416E-10	3.561E-10	5.836E-10
SMALL IN	5.708E-15	6.025E-12	5.512E-10	1.189E-16	2.874E-10	5.526E-10	1.691E-09
LUNGS	6.976E-15	7.209E-12	6.438E-10	1.455E-16	9.303E-10	1.678E-09	6.920E-11
RED MARR	7.071E-15	7.296E-12	6.525E-10	1.471E-16	4.739E-10	1.221E-09	4.219E-10
THYROID	8.752E-15	9.019E-12	7.951E-10	1.842E-16	-1.000E+00	2.721E-10	5.583E-11
LOWER LI	6.247E-15	6.515E-12	5.891E-10	1.300E-16	2.334E-09	4.364E-09	2.630E-08
BONE SUR	8.340E-15	8.317E-12	7.069E-10	1.754E-16	-1.000E+00	2.317E-09	5.331E-10
BREAST	8.942E-15	9.129E-12	7.788E-10	1.918E-16	-1.000E+00	3.023E-10	1.609E-10
TESTES	9.418E-15	9.696E-12	8.495E-10	1.991E-16	-1.000E+00	2.908E-10	1.467E-10
OVARIES	6.152E-15	6.374E-12	5.705E-10	1.284E-16	-1.000E+00	4.480E-10	9.877E-10
EDEWBODY	8.333E-15	8.930E-12	7.628E-10	1.875E-16	-1.000E+00	1.020E-09	2.545E-09
THYROIDH	8.752E-15	9.019E-12	7.951E-10	1.842E-16	6.819E-11	2.721E-10	5.583E-11
LA-140							
STOMACH	8.657E-14	4.027E-11	2.954E-10	1.497E-15	3.570E-10	4.664E-10	1.086E-09
SMALL IN	8.086E-14	3.754E-11	2.754E-10	1.395E-15	7.481E-10	9.753E-10	2.968E-09
LUNGS	9.354E-14	4.359E-11	3.198E-10	1.620E-15	1.958E-09	4.213E-09	4.000E-11
RED MARR	9.481E-14	4.419E-11	3.242E-10	1.643E-15	1.440E-10	2.124E-10	2.816E-10
THYROID	1.148E-13	5.366E-11	3.936E-10	1.995E-15	-1.000E+00	6.865E-11	6.386E-12
LOWER LI	8.593E-14	4.001E-11	2.935E-10	1.487E-15	2.946E-09	5.498E-09	1.750E-08
BONE SUR	1.008E-13	4.726E-11	3.467E-10	1.757E-15	-1.000E+00	1.406E-10	9.757E-11
BREAST	1.116E-13	5.212E-11	3.824E-10	1.937E-15	-1.000E+00	1.453E-10	1.800E-10
TESTES	1.227E-13	5.724E-11	4.199E-10	2.128E-15	-1.000E+00	5.875E-11	1.217E-10
OVARIES	8.276E-14	3.864E-11	2.835E-10	1.436E-15	-1.000E+00	4.534E-10	1.334E-09
EDEWBODY	1.071E-13	5.107E-11	3.746E-10	1.898E-15	-1.000E+00	1.315E-09	2.290E-09
THYROIDH	1.148E-13	5.366E-11	3.936E-10	1.995E-15	3.768E-11	6.865E-11	6.386E-12
LA-141							
STOMACH	1.566E-15	4.158E-13	6.939E-13	2.667E-17	9.818E-11	9.900E-11	9.310E-10
SMALL IN	1.475E-15	3.913E-13	6.421E-13	2.511E-17	1.430E-10	1.445E-10	1.370E-09
LUNGS	1.700E-15	4.510E-13	7.574E-13	2.892E-17	8.303E-10	8.904E-10	2.715E-13
RED MARR	1.712E-15	4.545E-13	7.461E-13	2.917E-17	5.104E-12	6.845E-12	1.073E-12
THYROID	2.099E-15	5.594E-13	9.643E-13	3.583E-17	-1.000E+00	2.447E-12	5.284E-14
LOWER LI	1.563E-15	4.152E-13	6.889E-13	2.664E-17	1.440E-10	1.672E-10	1.448E-09
BONE SUR	1.804E-15	4.812E-13	8.877E-13	3.073E-17	-1.000E+00	2.502E-11	6.220E-13
BREAST	2.001E-15	5.310E-13	9.646E-13	3.393E-17	-1.000E+00	2.669E-12	7.068E-13
TESTES	2.223E-15	5.890E-13	1.010E-12	3.773E-17	-1.000E+00	2.300E-12	3.183E-13

OVARIES	1.516E-15	4.021E-13	6.581E-13	2.581E-17	-1.000E+00	2.896E-12	3.757E-12
EDEWBODY	2.569E-15	1.848E-12	2.653E-12	1.192E-16	-1.000E+00	1.529E-10	3.750E-10
THYROIDH	2.099E-15	5.594E-13	9.643E-13	3.583E-17	2.195E-12	2.447E-12	5.284E-14
LA-142							
STOMACH	1.123E-13	1.396E-11	1.440E-11	1.744E-15	4.911E-11	4.911E-11	8.530E-10
SMALL IN	1.053E-13	1.307E-11	1.349E-11	1.633E-15	4.066E-11	4.066E-11	7.750E-10
LUNGS	1.195E-13	1.490E-11	1.537E-11	1.861E-15	3.508E-10	3.508E-10	8.370E-12
RED MARR	1.221E-13	1.521E-11	1.569E-11	1.899E-15	6.799E-12	6.799E-12	1.930E-11
THYROID	1.433E-13	1.792E-11	1.849E-11	2.239E-15	-1.000E+00	4.904E-12	1.160E-12
LOWER LI	1.113E-13	1.384E-11	1.427E-11	1.728E-15	1.143E-11	1.144E-11	1.901E-10
BONE SUR	1.262E-13	1.579E-11	1.629E-11	1.972E-15	-1.000E+00	5.372E-12	7.400E-12
BREAST	1.427E-13	1.780E-11	1.836E-11	2.223E-15	-1.000E+00	6.257E-12	1.540E-11
TESTES	1.560E-13	1.945E-11	2.006E-11	2.429E-15	-1.000E+00	2.103E-12	5.290E-12
OVARIES	1.037E-13	1.297E-11	1.338E-11	1.620E-15	-1.000E+00	5.887E-12	6.970E-11
EDEWBODY	1.366E-13	1.761E-11	1.816E-11	2.199E-15	-1.000E+00	5.587E-11	1.790E-10
THYROIDH	1.433E-13	1.792E-11	1.849E-11	2.239E-15	4.904E-12	4.904E-12	1.160E-12
CE-141							
STOMACH	2.388E-15	1.547E-12	3.029E-11	5.391E-17	9.040E-11	1.603E-10	2.240E-10
SMALL IN	2.074E-15	1.338E-12	2.619E-11	4.661E-17	2.167E-10	2.866E-10	5.893E-10
LUNGS	2.664E-15	1.729E-12	3.385E-11	6.025E-17	1.192E-09	1.669E-08	1.429E-12
RED MARR	2.419E-15	1.556E-12	3.047E-11	5.422E-17	2.434E-11	8.891E-11	3.396E-11
THYROID	3.678E-15	2.412E-12	4.721E-11	8.403E-17	-1.000E+00	2.543E-11	1.800E-13
LOWER LI	2.328E-15	1.502E-12	2.940E-11	5.232E-17	1.972E-09	4.100E-09	8.641E-09
BONE SUR	4.154E-15	2.703E-12	5.292E-11	9.418E-17	-1.000E+00	2.657E-10	2.375E-11
BREAST	4.249E-15	2.821E-12	5.523E-11	9.830E-17	-1.000E+00	4.456E-11	1.105E-11
TESTES	3.773E-15	2.484E-12	4.864E-11	8.657E-17	-1.000E+00	5.369E-12	7.580E-12
OVARIES	2.093E-15	1.356E-12	2.655E-11	4.725E-17	-1.000E+00	5.544E-11	1.076E-10
EDEWBODY	3.426E-15	2.229E-12	4.364E-11	7.766E-17	-1.000E+00	2.436E-09	7.850E-10
THYROIDH	3.678E-15	2.412E-12	4.721E-11	8.403E-17	3.186E-12	2.543E-11	1.800E-13
CE-143							
STOMACH	8.720E-15	4.926E-12	3.092E-11	1.858E-16	1.854E-10	2.121E-10	5.608E-10
SMALL IN	7.769E-15	4.380E-12	2.749E-11	1.652E-16	4.174E-10	4.914E-10	1.365E-09
LUNGS	9.545E-15	5.422E-12	3.403E-11	2.045E-16	1.429E-09	3.884E-09	3.829E-12
RED MARR	9.545E-15	5.330E-12	3.345E-11	2.010E-16	2.039E-11	2.953E-11	5.074E-11
THYROID	1.234E-14	7.087E-12	4.448E-11	2.673E-16	-1.000E+00	6.239E-12	4.351E-13
LOWER LI	8.498E-15	4.792E-12	3.007E-11	1.807E-16	2.311E-09	4.281E-09	1.167E-08
BONE SUR	1.195E-14	6.893E-12	4.326E-11	2.600E-16	-1.000E+00	1.647E-11	1.610E-11
BREAST	1.303E-14	7.675E-12	4.817E-11	2.895E-16	-1.000E+00	1.661E-11	2.327E-11
TESTES	1.319E-14	7.616E-12	4.780E-11	2.873E-16	-1.000E+00	5.816E-12	1.531E-11
OVARIES	8.245E-15	4.657E-12	2.923E-11	1.757E-16	-1.000E+00	7.556E-11	2.131E-10
EDEWBODY	1.169E-14	7.369E-12	4.697E-11	2.778E-16	-1.000E+00	9.190E-10	1.228E-09
THYROIDH	1.234E-14	7.087E-12	4.448E-11	2.673E-16	3.686E-12	6.239E-12	4.351E-13
CE-144							
STOMACH	1.793E-15	9.314E-13	2.002E-11	3.343E-17	6.003E-10	1.185E-09	1.110E-09
SMALL IN	1.636E-15	8.416E-13	1.811E-11	3.024E-17	1.461E-09	2.166E-09	3.711E-09
LUNGS	1.960E-15	1.025E-12	2.201E-11	3.675E-17	1.811E-08	7.896E-07	6.514E-12
RED MARR	1.882E-15	9.613E-13	2.070E-11	3.457E-17	4.025E-11	2.786E-09	8.660E-11
THYROID	2.505E-15	1.344E-12	2.880E-11	4.810E-17	-1.000E+00	2.908E-10	5.137E-12
LOWER LI	1.761E-15	9.113E-13	1.960E-11	3.272E-17	1.526E-08	3.410E-08	6.638E-08
BONE SUR	2.426E-15	1.328E-12	2.838E-11	4.738E-17	-1.000E+00	4.819E-09	1.304E-10
BREAST	2.649E-15	1.467E-12	3.136E-11	5.235E-17	-1.000E+00	3.478E-10	1.215E-11
TESTES	2.660E-15	1.426E-12	3.057E-11	5.105E-17	-1.000E+00	1.922E-10	1.013E-11

OVARIES	1.651E-15	8.577E-13	1.845E-11	3.081E-17	-1.000E+00	2.383E-10	6.961E-11
EDEWBODY	8.079E-16	5.398E-13	1.124E-11	1.875E-17	-1.000E+00	1.012E-07	5.710E-09
THYROIDH	2.505E-15	1.344E-12	2.880E-11	4.810E-17	3.907E-12	2.908E-10	5.137E-12
PR-143							
STOMACH	3.234E-22	1.802E-19	3.209E-18	6.310E-24	1.398E-10	1.661E-10	3.620E-10
SMALL IN	2.917E-22	1.630E-19	2.902E-18	5.708E-24	3.371E-10	4.126E-10	8.939E-10
LUNGS	3.488E-22	1.947E-19	3.467E-18	6.818E-24	1.631E-09	1.332E-08	6.518E-15
RED MARR	3.552E-22	1.983E-19	3.531E-18	6.944E-24	4.864E-12	1.497E-11	1.039E-12
THYROID	4.376E-22	2.454E-19	4.370E-18	8.593E-24	-1.000E+00	9.391E-14	6.518E-15
LOWER LI	3.158E-22	1.766E-19	3.144E-18	6.183E-24	3.304E-09	6.763E-09	1.466E-08
BONE SUR	3.900E-22	2.173E-19	3.870E-18	7.610E-24	-1.000E+00	1.495E-11	1.037E-12
BREAST	4.186E-22	2.345E-19	4.176E-18	8.213E-24	-1.000E+00	9.391E-14	6.519E-15
TESTES	4.630E-22	2.590E-19	4.611E-18	9.069E-24	-1.000E+00	9.390E-14	6.519E-15
OVARIES	3.168E-22	1.775E-19	3.160E-18	6.215E-24	-1.000E+00	9.390E-14	6.523E-15
EDEWBODY	1.771E-16	5.553E-13	9.887E-12	1.944E-17	-1.000E+00	2.190E-09	1.264E-09
THYROIDH	4.376E-22	2.454E-19	4.370E-18	8.593E-24	8.229E-14	9.391E-14	6.518E-15
ND-147							
STOMACH	4.313E-15	2.675E-12	4.589E-11	9.386E-17	1.419E-10	1.977E-10	3.571E-10
SMALL IN	3.805E-15	2.359E-12	4.046E-11	8.276E-17	3.388E-10	4.346E-10	9.403E-10
LUNGS	4.756E-15	2.982E-12	5.116E-11	1.046E-16	1.380E-09	1.060E-08	2.446E-12
RED MARR	4.471E-15	2.729E-12	4.682E-11	9.576E-17	3.426E-11	9.219E-11	5.042E-11
THYROID	6.279E-15	4.003E-12	6.868E-11	1.405E-16	-1.000E+00	1.825E-11	2.699E-13
LOWER LI	4.154E-15	2.567E-12	4.403E-11	9.006E-17	2.868E-09	5.843E-09	1.279E-08
BONE SUR	6.247E-15	4.003E-12	6.868E-11	1.405E-16	-1.000E+00	3.258E-10	2.219E-11
BREAST	6.818E-15	4.473E-12	7.674E-11	1.570E-16	-1.000E+00	3.465E-11	1.872E-11
TESTES	6.723E-15	4.302E-12	7.379E-11	1.509E-16	-1.000E+00	6.749E-12	1.364E-11
OVARIES	4.091E-15	2.539E-12	4.356E-11	8.911E-17	-1.000E+00	8.412E-11	1.790E-10
EDEWBODY	5.891E-15	3.991E-12	6.847E-11	1.400E-16	-1.000E+00	1.849E-09	1.184E-09
THYROIDH	6.279E-15	4.003E-12	6.868E-11	1.405E-16	4.598E-12	1.825E-11	2.699E-13
NP-239							
STOMACH	5.296E-15	3.236E-12	3.022E-11	1.180E-16	1.059E-10	1.291E-10	3.457E-10
SMALL IN	4.630E-15	2.818E-12	2.632E-11	1.027E-16	2.413E-10	2.988E-10	8.735E-10
LUNGS	5.898E-15	3.610E-12	3.371E-11	1.316E-16	9.014E-10	2.348E-09	2.402E-12
RED MARR	5.454E-15	3.314E-12	3.095E-11	1.208E-16	7.943E-11	2.075E-10	4.660E-11
THYROID	7.991E-15	4.915E-12	4.590E-11	1.792E-16	-1.000E+00	7.599E-12	2.063E-13
LOWER LI	5.137E-15	3.149E-12	2.941E-11	1.148E-16	1.509E-09	2.916E-09	8.684E-09
BONE SUR	8.815E-15	5.437E-12	5.077E-11	1.982E-16	-1.000E+00	2.027E-09	3.609E-11
BREAST	9.037E-15	6.028E-12	5.629E-11	2.198E-16	-1.000E+00	1.623E-11	1.714E-11
TESTES	8.245E-15	5.141E-12	4.801E-11	1.874E-16	-1.000E+00	2.296E-11	1.144E-11
OVARIES	4.725E-15	2.897E-12	2.705E-11	1.056E-16	-1.000E+00	7.449E-11	1.621E-10
EDEWBODY	7.350E-15	4.572E-12	4.270E-11	1.667E-16	-1.000E+00	6.760E-10	8.807E-10
THYROIDH	7.991E-15	4.915E-12	4.590E-11	1.792E-16	4.130E-12	7.599E-12	2.063E-13
PU-238							
STOMACH	6.723E-19	1.396E-15	2.935E-14	4.852E-20	2.725E-10	1.134E-09	1.277E-09
SMALL IN	4.566E-19	4.249E-16	8.939E-15	1.478E-20	6.381E-10	2.222E-09	3.186E-09
LUNGS	1.008E-18	3.021E-15	6.348E-14	1.050E-19	9.682E-07	3.186E-04	8.643E-14
RED MARR	4.535E-19	1.113E-15	2.340E-14	3.869E-20	2.552E-09	5.785E-05	1.266E-08
THYROID	1.465E-18	3.724E-15	7.825E-14	1.294E-19	-1.000E+00	3.852E-10	7.993E-14
LOWER LI	6.659E-19	1.780E-15	3.740E-14	6.183E-20	6.605E-09	3.294E-08	5.656E-08
BONE SUR	1.792E-18	5.057E-15	1.063E-13	1.757E-19	-1.000E+00	7.211E-04	1.576E-07
BREAST	1.547E-17	1.004E-13	2.110E-12	3.488E-18	-1.000E+00	4.394E-10	1.804E-13
TESTES	3.615E-18	1.862E-14	3.913E-13	6.469E-19	-1.000E+00	1.038E-05	2.318E-09

OVARIES	6.659E-19	1.716E-15	3.606E-14	5.961E-20	-1.000E+00	1.041E-05	2.325E-09
EDEWBODY	4.028E-18	2.290E-14	4.809E-13	7.951E-19	-1.000E+00	7.759E-05	1.337E-08
THYROIDH	1.465E-18	3.724E-15	7.825E-14	1.294E-19	1.480E-11	3.852E-10	7.993E-14
PU-239							
STOMACH	1.776E-18	1.489E-15	2.909E-14	5.169E-20	2.533E-10	1.069E-09	1.196E-09
SMALL IN	1.481E-18	9.863E-16	1.881E-14	3.425E-20	5.952E-10	2.097E-09	2.991E-09
LUNGS	2.074E-18	2.210E-15	4.401E-14	7.674E-20	9.116E-07	3.213E-04	7.881E-14
RED MARR	1.671E-18	1.379E-15	2.665E-14	4.788E-20	2.400E-09	6.568E-05	1.405E-08
THYROID	2.901E-18	2.877E-15	5.717E-14	9.989E-20	-1.000E+00	3.757E-10	7.495E-14
LOWER LI	1.735E-18	1.616E-15	3.182E-14	5.613E-20	6.175E-09	3.099E-08	5.316E-08
BONE SUR	3.425E-18	3.635E-15	7.276E-14	1.262E-19	-1.000E+00	8.167E-04	1.748E-07
BREAST	8.562E-18	3.991E-14	8.344E-13	1.386E-18	-1.000E+00	3.990E-10	1.207E-13
TESTES	3.710E-18	8.548E-15	1.762E-13	2.968E-19	-1.000E+00	1.197E-05	2.631E-09
OVARIES	1.573E-18	1.479E-15	2.915E-14	5.137E-20	-1.000E+00	1.194E-05	2.624E-09
EDEWBODY	3.646E-18	1.003E-14	2.107E-13	3.484E-19	-1.000E+00	8.299E-05	1.396E-08
THYROIDH	2.901E-18	2.877E-15	5.717E-14	9.989E-20	1.381E-11	3.757E-10	7.495E-14
PU-240							
STOMACH	6.976E-19	1.387E-15	2.914E-14	4.820E-20	2.553E-10	1.079E-09	1.201E-09
SMALL IN	4.820E-19	4.516E-16	9.487E-15	1.570E-20	6.007E-10	2.108E-09	3.005E-09
LUNGS	1.034E-18	2.949E-15	6.193E-14	1.024E-19	9.117E-07	3.213E-04	8.206E-14
RED MARR	4.661E-19	1.095E-15	2.301E-14	3.805E-20	2.400E-09	6.562E-05	1.405E-08
THYROID	1.522E-18	3.661E-15	7.689E-14	1.272E-19	-1.000E+00	3.758E-10	7.499E-14
LOWER LI	6.849E-19	1.744E-15	3.662E-14	6.057E-20	6.224E-09	3.112E-08	5.337E-08
BONE SUR	1.842E-18	4.948E-15	1.039E-13	1.719E-19	-1.000E+00	8.145E-04	1.746E-07
BREAST	1.490E-17	9.586E-14	2.013E-12	3.330E-18	-1.000E+00	4.333E-10	1.734E-13
TESTES	3.583E-18	1.789E-14	3.758E-13	6.215E-19	-1.000E+00	1.197E-05	2.631E-09
OVARIES	6.881E-19	1.689E-15	3.547E-14	5.866E-20	-1.000E+00	1.197E-05	2.632E-09
EDEWBODY	3.958E-18	2.190E-14	4.599E-13	7.604E-19	-1.000E+00	8.291E-05	1.397E-08
THYROIDH	1.522E-18	3.661E-15	7.689E-14	1.272E-19	1.381E-11	3.758E-10	7.499E-14
PU-241							
STOMACH	0.000E+00	8.927E-19	3.289E-16	0.000E+00	2.415E-12	2.455E-11	6.080E-12
SMALL IN	0.000E+00	7.733E-19	2.849E-16	0.000E+00	5.838E-12	2.436E-11	1.513E-11
LUNGS	0.000E+00	1.015E-18	3.739E-16	0.000E+00	5.369E-10	3.172E-06	4.468E-15
RED MARR	0.000E+00	8.539E-19	3.146E-16	0.000E+00	4.411E-13	1.426E-06	2.780E-10
THYROID	0.000E+00	1.430E-18	5.268E-16	0.000E+00	-1.000E+00	9.130E-12	1.011E-15
LOWER LI	0.000E+00	8.569E-19	3.157E-16	0.000E+00	6.199E-11	1.805E-10	2.694E-10
BONE SUR	0.000E+00	1.615E-18	5.950E-16	0.000E+00	-1.000E+00	1.776E-05	3.467E-09
BREAST	0.000E+00	1.860E-18	6.852E-16	0.000E+00	-1.000E+00	2.141E-11	2.780E-15
TESTES	0.000E+00	1.496E-18	5.510E-16	0.000E+00	-1.000E+00	2.753E-07	5.636E-11
OVARIES	0.000E+00	7.912E-19	2.915E-16	0.000E+00	-1.000E+00	2.755E-07	5.650E-11
EDEWBODY	7.153E-20	6.100E-17	1.281E-15	2.118E-21	-1.000E+00	1.334E-06	2.069E-10
THYROIDH	0.000E+00	1.430E-18	5.268E-16	0.000E+00	1.872E-15	9.130E-12	1.011E-15
AM-241							
STOMACH	4.883E-16	4.036E-13	8.475E-12	1.402E-17	5.091E-10	3.251E-09	1.345E-09
SMALL IN	4.122E-16	3.378E-13	7.095E-12	1.173E-17	8.464E-10	4.191E-09	3.330E-09
LUNGS	5.930E-16	4.958E-13	1.041E-11	1.722E-17	4.703E-07	1.837E-05	3.364E-11
RED MARR	3.203E-16	2.657E-13	5.580E-12	9.228E-18	4.847E-08	1.738E-04	1.448E-06
THYROID	9.418E-16	7.834E-13	1.645E-11	2.721E-17	-1.000E+00	1.596E-09	1.321E-11
LOWER LI	4.313E-16	3.588E-13	7.536E-12	1.246E-17	6.275E-09	3.161E-08	5.810E-08
BONE SUR	1.091E-15	9.112E-13	1.914E-11	3.165E-17	-1.000E+00	2.166E-03	1.802E-05
BREAST	1.259E-15	1.370E-12	2.876E-11	4.756E-17	-1.000E+00	2.666E-09	2.625E-11
TESTES	9.862E-16	8.738E-13	1.835E-11	3.035E-17	-1.000E+00	3.243E-05	2.693E-07

OVARIES	4.344E-16	3.606E-13	7.574E-12	1.253E-17	-1.000E+00	3.251E-05	2.706E-07
EDEWBODY	8.264E-16	7.533E-13	1.582E-11	2.616E-17	-1.000E+00	1.197E-04	9.819E-07
THYROIDH	9.418E-16	7.834E-13	1.645E-11	2.721E-17	2.761E-10	1.596E-09	1.321E-11
CM-242							
STOMACH	7.008E-19	1.652E-15	3.421E-14	5.740E-20	5.453E-10	1.627E-09	1.423E-09
SMALL IN	4.439E-19	4.317E-16	8.939E-15	1.500E-20	8.934E-10	2.656E-09	3.545E-09
LUNGS	1.081E-18	3.541E-15	7.333E-14	1.230E-19	4.630E-07	1.546E-05	8.833E-12
RED MARR	4.915E-19	1.296E-15	2.684E-14	4.503E-20	5.125E-08	3.908E-06	3.581E-08
THYROID	1.560E-18	4.581E-15	9.487E-14	1.592E-19	-1.000E+00	9.384E-10	8.805E-12
LOWER LI	7.135E-19	2.090E-15	4.328E-14	7.262E-20	6.546E-09	3.118E-08	6.234E-08
BONE SUR	1.899E-18	5.886E-15	1.219E-13	2.045E-19	-1.000E+00	4.862E-05	4.463E-07
BREAST	1.719E-17	1.059E-13	2.192E-12	3.678E-18	-1.000E+00	9.415E-10	8.935E-12
TESTES	4.186E-18	2.172E-14	4.498E-13	7.547E-19	-1.000E+00	5.695E-07	5.190E-09
OVARIES	7.040E-19	2.017E-15	4.177E-14	7.008E-20	-1.000E+00	5.699E-07	5.198E-09
EDEWBODY	4.502E-18	2.482E-14	5.139E-13	8.623E-19	-1.000E+00	4.663E-06	3.102E-08
THYROIDH	1.560E-18	4.581E-15	9.487E-14	1.592E-19	3.048E-10	9.384E-10	8.805E-12
CM-244							
STOMACH	5.105E-19	1.389E-15	2.914E-14	4.820E-20	5.191E-10	1.712E-09	1.356E-09
SMALL IN	3.000E-19	3.090E-16	6.480E-15	1.072E-20	8.501E-10	2.737E-09	3.362E-09
LUNGS	8.308E-19	3.052E-15	6.404E-14	1.059E-19	4.950E-07	1.925E-05	8.846E-12
RED MARR	3.583E-19	1.097E-15	2.301E-14	3.805E-20	5.102E-08	9.330E-05	7.766E-07
THYROID	1.186E-18	3.929E-15	8.244E-14	1.364E-19	-1.000E+00	1.015E-09	8.467E-12
LOWER LI	5.359E-19	1.791E-15	3.758E-14	6.215E-20	6.289E-09	3.147E-08	5.967E-08
BONE SUR	1.446E-18	5.072E-15	1.064E-13	1.760E-19	-1.000E+00	1.171E-03	9.748E-06
BREAST	1.509E-17	9.504E-14	1.994E-12	3.298E-18	-1.000E+00	1.052E-09	8.920E-12
TESTES	3.520E-18	1.919E-14	4.026E-13	6.659E-19	-1.000E+00	1.584E-05	1.319E-07
OVARIES	5.296E-19	1.727E-15	3.624E-14	5.993E-20	-1.000E+00	1.587E-05	1.324E-07
EDEWBODY	3.831E-18	2.208E-14	4.633E-13	7.662E-19	-1.000E+00	6.687E-05	5.429E-07
THYROIDH	1.186E-18	3.929E-15	8.244E-14	1.364E-19	2.909E-10	1.015E-09	8.467E-12

D.2 Site Data File For the Sample Problems - SURSIT

MACCS SITE DATA FILE FOR SURRY (JLS, 11/10/88)

SECPop POP DISTRIBUTION FROM 1980 CENSUS DATA ALTERED USING 0-10 MI NRC DATA

26 SPATIAL INTERVALS

16 WIND DIRECTIONS

7 CROP CATEGORIES

4 WATER PATHWAY ISOTOPES

2 WATERSHEDS

59 ECONOMIC REGIONS

SPATIAL DISTANCES

0.16	0.52	1.21	1.61	2.13	3.22	4.02	4.83
5.63	8.05	11.27	16.09	20.92	25.75	32.19	40.23
48.28	64.37	80.47	112.65	160.93	241.14	321.87	563.27
804.67	1609.34						

POPULATION

0.	0.	0.	0.	0.	0.	4.	5.
6.	25.	3341.	7107.	2173.	0.	1305.	474.
2252.	2945.	5403.	20169.	112004.	3431358.	1355700.	2742710.
2487346.	104331.						
0.	0.	0.	0.	1.	2.	9.	13.
15.	63.	1667.	3550.	1330.	1072.	3198.	2425.
515.	9469.	5317.	7120.	13586.	198785.	1058744.	20508438.
3290082.	830354.						
0.	0.	0.	0.	0.	0.	5.	6.
8.	31.	822.	1752.	4543.	1713.	1597.	2296.
6535.	1775.	0.	8555.	48596.	119411.	233382.	3003954.
7620063.	1169436.						
0.	0.	0.	0.	0.	0.	1.	1.
2.	11.	543.	1157.	3820.	1621.	3364.	0.
0.	129.	6679.	11858.	0.	0.	0.	0.
0.	0.						
0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	4798.	10202.	10348.	10480.	9570.	0.
0.	2317.	1756.	0.	0.	0.	0.	0.
0.	0.						
0.	0.	0.	0.	0.	0.	1.	1.
1.	7.	8316.	17684.	16340.	30419.	39474.	74998.
24195.	80412.	57477.	0.	0.	0.	0.	0.
0.	0.						
0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1722.	6433.	36763.	20632.
126203.	372471.	68327.	8599.	6339.	1057.	0.	0.
0.	0.						
0.	0.	0.	0.	0.	0.	2.	2.
3.	13.	127.	273.	1649.	4571.	3441.	7838.
11747.	19019.	3360.	36387.	10447.	12402.	0.	0.
0.	0.						
0.	0.	5.	4.	8.	23.	14.	20.
23.	93.	301.	650.	0.	0.	1264.	4065.
1106.	14665.	4071.	18006.	37417.	89072.	81626.	0.

0.	0.						
0.	0.	0.	0.	0.	0.	19.	25.
29.	117.	45.	105.	0.	510.	951.	1521.
1223.	17636.	4926.	30765.	53265.	289674.	216165.	479431.
280809.	8801784.						
0.	0.	0.	0.	1.	2.	14.	20.
23.	93.	155.	338.	125.	1079.	0.	1355.
2765.	154.	5296.	21409.	62228.	523803.	479588.	1538059.
1526840.	3099458.						
0.	0.	0.	0.	1.	2.	14.	20.
23.	93.	110.	240.	1056.	0.	50.	1396.
915.	3153.	4132.	16295.	35596.	239712.	709522.	2845970.
3957581.	0560254.						
0.	0.	0.	0.	0.	0.	25.	33.
38.	154.	30.	70.	450.	0.	980.	517.
155.	66531.	40902.	9557.	44818.	194801.	376828.	1492286.
2250273.	2145932.						
0.	0.	0.	0.	0.	0.	7.	9.
12.	47.	31.	69.	0.	380.	281.	445.
1986.	32459.	183133.	193630.	30369.	203275.	94113.	1328987.
5086913.	9537940.						
0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	223.	477.	0.	1026.	609.	2575.
2794.	6593.	96857.	107328.	47585.	156826.	101785.	4175263.
7535605.	9667977.						
0.	0.	0.	0.	0.	0.	15.	20.
23.	92.	2503.	5326.	3508.	1826.	1884.	275.
3965.	2084.	6270.	10765.	103787.	970659.	472558.	1396088.
1969210.	73968.						
LAND FRACTION							
1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.80
1.00	0.85	0.70	0.75	0.55	0.70	0.60	1.00
1.00	1.00	1.00	1.00	0.90	0.70	0.40	0.00
0.90	0.45	0.60	0.20	0.50	0.50	0.30	0.25
1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
0.85	0.20	0.00	0.20	0.00	0.00	0.00	0.00
1.00	1.00	1.00	1.00	1.00	0.80	0.10	0.00
0.15	0.00	0.45	0.30	0.00	0.00	0.00	0.00
1.00	1.00	1.00	1.00	1.00	0.60	0.00	0.00
0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00
1.00	1.00	1.00	1.00	1.00	0.70	0.00	0.80
0.15	0.25	0.25	0.00	0.00	0.00	0.00	0.00
1.00	1.00	1.00	1.00	1.00	1.00	0.55	0.50
0.85	1.00	1.00	0.40	0.40	0.05	0.00	0.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90
1.00	1.00	1.00	1.00	0.95	0.20	0.00	0.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	0.80	0.40	0.00
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1.00	1.00	1.00	1.00	1.00	1.00	0.75	0.50
1.00	1.00	0.70	0.40	0.20	0.75	0.95	1.00
1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.80

WATERSHED DEFINITION -- INITIAL AND ANNUAL WASHOFF AND INGESTION FACTORS

1 SR-89			5.0E-6	0.0
2 SR-90			5.0E-6	0.0
3 CS-134			5.0E-6	0.0
4 CS-137			5.0E-6	0.0

REGIONAL ECONOMIC DATA

1 ALA	.354	.040	459.	1824.	62000.
2 ARIZ	.516	.104	110.	682.	74000.
3 ARK	.483	.041	466.	2049.	61000.
4 CALIF	.330	.144	1022.	4394.	93000.
5 COLO	.522	.048	211.	971.	83000.
6 CONN	.160	.294	1605.	4980.	107000.
7 DEL	.534	.042	1723.	3428.	82000.
8 FLA	.375	.080	832.	3341.	80000.
9 GA	.363	.060	613.	1885.	73000.
10 IDAHO	.279	.144	343.	1562.	61000.
11 ILL	.806	.044	709.	3900.	86000.
12 IND	.713	.079	611.	3283.	72000.
13 IOWA	.938	.060	695.	3133.	73000.
14 KANS	.917	.035	281.	1204.	81000.
15 KY	.571	.112	482.	1838.	61000.
16 LA	.354	.074	459.	3284.	61000.
17 MAINE	.079	.260	662.	1133.	70000.
18 MD	.429	.216	956.	4489.	93000.
19 MASS	.136	.249	1349.	2563.	97000.
20 MICH	.313	.247	658.	2187.	81000.
21 MINN	.597	.223	516.	2111.	82000.
22 MISS	.470	.054	403.	2084.	53000.
23 MO	.703	.102	322.	1647.	76000.
24 MONT	.657	.030	61.	563.	65000.
25 NEBR	.962	.031	318.	1148.	75000.
26 NEV	.127	.139	63.	601.	84000.
27 N.H.	.096	.482	518.	2018.	87000.
28 N.J.	.203	.129	1399.	6477.	102000.
29 N.MEX	.590	.144	53.	473.	63000.
30 N.Y.	.310	.589	711.	1378.	94000.
31 N.C.	.352	.065	860.	2658.	68000.
32 N.DAK	.924	.048	164.	948.	69000.
33 OHIO	.602	.175	581.	2686.	76000.
34 OKLA	.751	.060	204.	1508.	67000.
35 OREG	.292	.111	236.	1203.	73000.
36 PA	.303	.447	855.	2534.	78000.
37 R.I.	.108	.213	1062.	6438.	80000.
38 S.C.	.290	.084	472.	1843.	62000.
39 S.DAK	.915	.091	145.	587.	65000.
40 TENN	.509	.153	360.	1850.	66000.
41 TEX	.816	.064	164.	1492.	74000.
42 UTAH	.225	.259	123.	1286.	60000.
43 VT	.286	.789	628.	1472.	73000.
44 VA	.382	.198	371.	2075.	84000.
45 WASH	.377	.154	476.	1948.	82000.
46 W.VA	.246	.224	150.	1728.	58000.

47 WIS	.517	.591	723.	1751.	76000.
48 WYO	.561	.028	43.	380.	70000.
49 BRIT COL	.377	.154	476.	1948.	60000.
50 OCEAN	.000	.000	0.	0.	0.
51 SASKAT	.657	.030	61.	563.	60000.
52 MANITOBA	.924	.048	164.	948.	60000.
53 ONTARIO	.597	.223	516.	2111.	60000.
54 QUEBEC	.310	.589	711.	1378.	60000.
55 NOVA SCOT	.079	.260	662.	1133.	60000.
56 BAJA CAL	.330	.144	1022.	4394.	10000.
57 SONORA	.516	.104	110.	682.	10000.
58 CHIHUAHUA	.590	.144	53.	473.	10000.
59 COAHUILA	.816	.064	164.	1492.	10000.

END

D.3 List Output File for Sample Problem A

MACCS11, ATMINP=IN1A, EARINP=IN2A, CHRINP IN3A, METFIL=METSUR, SITDAT=SURSIT, LISOUT=LISTA

USER INPUT IS READ FROM UNIT 24
 RECORD IDENTIFIER FIELDS 11 CHARACTERS LONG ARE EXPECTED
 THE FIRST 100 COLUMNS OF EACH INPUT RECORD ARE PROCESSED
 THE MAXIMUM NUMBER OF IDENTIFIER RECORDS THAT MAY BE SAVED AS THE BASE CASE IS 1000

RECORD NUMBER	RECORD	
	* GENERAL DESCRIPTIVE TITLE DESCRIBING THIS "ATMOS" INPUT	
1	RIATNAM1001 'IN1A INP, SURRY, SAMPLE PROBLEM A, ATMOS INPUT'	

	* GEOMETRY DATA BLOCK, LOADED BY INPGEO, STORED IN /GEOM/	
	* NUMBER OF RADIAL SPATIAL ELEMENTS	
2	GENUMKAD001 26	
	* SURRY	
3	GESPAEND001 16 52 1 21 1 61 2 13	
4	GESPAEND002 3 22 4 02 4 83 5 63 8 05	
5	GESPAEND003 11 27 16 09 20 92 25 75 32 19	
6	GESPAEND004 40 23 48 28 64 37 80 47 112 65	
7	GESPAEND005 160 93 241 14 321 87 563 27 804 67	
8	GESPAEND006 1609 34	

	* NUCLIDE DATA BLOCK, LOADED BY INPISO, STORED IN /ISOGRP/, /ISONAM/	
	* NUMBER OF NUCLIDES	
9	ISNUMISO001 60	
	* NUMBER OF NUCLIDE GROUPS	
10	ISMAGRP001 9	
	* WET AND DRY DEPOSITION FLAGS FOR EACH NUCLIDE GROUP	
	* WETDEP DRYDEP	
11	ISDEPFLA001 FALSE FALSE	
12	ISDEPFLA002 TRUE TRUE	
13	ISDEPFLA003 TRUE TRUE	
14	ISDEPFLA004 TRUE TRUE	
15	ISDEPFLA005 TRUE TRUE	
16	ISDEPFLA006 TRUE TRUE	
17	ISDEPFLA007 TRUE TRUE	
18	ISDEPFLA008 TRUE TRUE	
19	ISDEPFLA009 TRUE TRUE	
	* NUCLIDE GROUP DATA FOR 9 NUCLIDE GROUPS	
	* NUCNAM PARENT IGROUP HAFLIF	
20	ISOTPGRP001 CO-58 NONE 6 6 160E+06	
21	ISOTPGRP002 CO-60 NONE 6 1 660E+08	
22	ISOTPGRP003 KR 85 NONE 1 3 386E+08	
23	ISOTPGRP004 KR-85M NONE 1 1 613E+04	
24	ISOTPGRP005 KR 87 NONE 1 4 560E+03	
25	ISOTPGRP006 KR-88 NONE 1 1 008E+04	
26	ISOTPGRP007 RB-86 NONE 3 1 611E+06	
27	ISOTPGRP008 SR-89 NONE 5 4 493E+06	

28	ISOTPGRP009	SR 90	NONE	5	8 865F+08	
29	ISOTPGRP010	SR 91	NONE	5	3 413F+04	
30	ISOTPGRP011	SR 92	NONE	5	9 756F+03	NEW
31	ISOTPGRP012	Y 90	SR 90	7	2 307E+05	
32	ISOTPGRP013	Y 91	SR 91	7	5 080E+06	
33	ISOTPGRP014	Y 92	SR 92	7	1 274F+04	
34	ISOTPGRP015	Y 93	NONE	7	3 635E+04	NEW
35	ISOTPGRP016	ZR 95	NONE	7	5 659E+06	NEW
36	ISOTPGRP017	ZR 97	NONE	7	9 019E+04	
37	ISOTPGRP018	NB 95	ZR 95	7	3 013E+06	
38	ISOTPGRP019	MO 99	NONE	6	2 377E+05	
39	ISOTPGRP020	TC-99H	MO 99	6	2 167E+04	
40	ISOTPGRP021	RU-103	NONE	6	3 421E+06	
41	ISOTPGRP022	RU-105	NONE	6	1 598E+04	
42	ISOTPGRP023	RU-106	NONE	6	3 188E+07	
43	ISOTPGRP024	RU 105	RU 105	6	1 278E+05	
44	ISOTPGRP025	SB-127	NONE	4	3 283E+05	
45	ISOTPGRP026	SB-129	NONE	4	1 562E+04	
46	ISOTPGRP027	TE-127	NONE	4	3 366E+04	
47	ISOTPGRP028	TE-127H	NONE	4	9 418E+06	
48	ISOTPGRP029	TE-129	NONE	4	4 200E+03	
49	ISOTPGRP030	TE-129H	NONE	4	2 886E+06	
50	ISOTPGRP031	TE 131H	NONE	4	1 080E+05	
51	ISOTPGRP032	TE 132	NONE	4	2 808E+05	
52	ISOTPGRP033	I-131	TE-131H	2	6 947E+05	
53	ISOTPGRP034	I 132	TE 132	2	8 226E+03	
54	ISOTPGRP035	I-133	NONE	2	7 488E+04	
55	ISOTPGRP036	I-134	NONE	2	3 156E+03	
56	ISOTPGRP037	I 135	NONE	2	2 371E+04	
57	ISOTPGRP038	XE 133	I 133	1	4 571F+05	
58	ISOTPGRP039	XE-135	I 135	1	3 301L+04	
59	ISOTPGRP040	CS 136	NONE	3	6 501E+07	
60	ISOTPGRP041	CS 136	NONE	3	1 123F+06	
61	ISOTPGRP042	CS-137	NONE	3	9 495L+08	
62	ISOTPGRP043	BA-139	NONE	9	4 986E+03	NEW
63	ISOTPGRP044	BA 140	NONE	9	1 105E+06	
64	ISOTPGRP045	LA 140	BA 140	7	1 448E+05	
65	ISOTPGRP046	LA 141	NONE	7	1 418E+04	
66	ISOTPGRP047	CE 141	NONE	7	5 724F+03	NEW
67	ISOTPGRP048	CE-143	LA-141	8	2 811E+06	
68	ISOTPGRP049	PR-143	NONE	8	1 188E+05	PARENT ADDED
69	ISOTPGRP050	PR-143	NONE	8	2 457E+07	
70	ISOTPGRP051	ND-143	CE-143	7	1 173E+06	
71	ISOTPGRP052	ND-239	NONE	7	9 495E+05	
72	ISOTPGRP053	RU-238	NONE	8	2 030E+05	
73	ISOTPGRP054	RU-239	CH-242	8	2 809E+09	
74	ISOTPGRP055	RU-240	NP-239	8	7 700E+11	
75	ISOTPGRP056	RU-241	CH-244	8	2 133E+11	
76	ISOTPGRP057	AM-241	NONE	8	4 608F+08	
77	ISOTPGRP058	CH 242	PU-241	7	1 368E+10	
78	ISOTPGRP059	CH 244	NONE	7	1 308E+07	
79	ISOTPGRP060	CH 244	NONE	7	5 712E+08	

 * WET DEPOSITION DATA BLOCK, LOADED BY INPWET, STORED IN /NETCON/

* * WASHOUT COEFFICIENT NUMBER ONE, LINEAR FACTOR
 * * WDCWASH1001 9 5E-5 (JON HELTON AFTER JONES, 1986)

* * WASHOUT COEFFICIENT NUMBER TWO, EXPONENTIAL FACTOR
 * * WDCWASH2001 0 8 (JON HELTON AFTER JONES, 1986)

 * DRY DEPOSITION DATA BLOCK, LOADED BY INPDY, STORED IN /DRYCON/

 * * NUMBER OF PARTICLE SIZE GROUPS

```

*
* DPMPS4 R1 001 1
*
* DI POSITION VLOCITY OF EACH PARTICLE SIZE GROUP (M/S)
*
* INVD10.001 0 01 (VALUE SELECTED BY S. ACHARYA, NRC)
* *****
* DISPERSION PARAMETER DATA BLOCK, LOADED BY INPDIS, STORED IN /DISPY/, /DISPZ/
* *****
* SIGMA A X ** B WHERE A AND B VALUES ARE FROM TADMOR AND GUR (1969)
*
* LINEAR TERM OF THE EXPRESSION FOR SIGMA Y, 6 STABILITY CLASSES
*
* STABILITY CLASS A B C D E F
*
84 DPCYSIGA001 0 3658 0 2751 0 2089 0 1474 0 1046 0 0722
*
* EXPONENTIAL TERM OF THE EXPRESSION FOR SIGMA Y, 6 STABILITY CLASSES
*
* STABILITY CLASS A B C D E F
*
85 DPCYSIGB001 9031 9031 9031 9031 9031 9031 9031
*
* LINEAR TERM OF THE EXPRESSION FOR SIGMA-Z, 6 STABILITY CLASSES
*
* STABILITY CLASS A B C D E F
*
86 DPCZSIGA001 2 5E-4 1 9E 3 2 2 3 4 2
*
* EXPONENTIAL TERM OF THE EXPRESSION FOR SIGMA-Z, 6 STABILITY CLASSES
*
* STABILITY CLASS, A B C D E F
*
87 DPCZSIGB001 2 125 1 6021 8543 6532 6021 6020
*
* LINEAR SCALING FACTOR FOR SIGMA-Y FUNCTION, NORMALLY 1
*
88 DPYSCALE001 1
*
* LINEAR SCALING FACTOR FOR SIGMA-Z FUNCTION.
*
* NORMALLY USED FOR SURFACE ROUGHNESS LENGTH CORRECTION
*
* (Z1 / Z0) ** 0 2, FROM CRAC2 WE HAVE (10 CM / 3 CM) ** 0 2 - 1 27
*
89 DPZSCALE001 1 27
* *****
* EXPANSION FACTOR DATA BLOCK, LOADED BY INPEXP, STORED IN /EXPAND/
* *****
*
* TIME BASE FOR EXPANSION FACTOR (SECONDS)
*
90 PHTMBAS001 600 (10 MINUTES)
*
* BREAK POINT FOR FORMULA CHANGE (SECONDS)
*
91 PMBRKPT001 3600 (1 HOUR)
*
* EXPONENTIAL EXPANSION FACTOR NUMBER 1
*
92 PMXPFFAC1001 0 2
*
* EXPONENTIAL EXPANSION FACTOR NUMBER 2
*
93 PMXPFFAC2001 0 25
* *****
* PLUME RISE DATA BLOCK, LOADED BY INPLRS, STORED IN /PLUMRS/
* *****
*
* SCALING FACTOR FOR THE CRITICAL WIND SPEED FOR ENTRAINMENT OF A BOUVANT PLUME

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```

* (USED BY FUNCTION CAUGHT)
*
94 PRSCLCRW001 1.
*
* SCALING FACTOR FOR THE A-D STABILITY PLUME RISE FORMULA
* (USED BY FUNCTION PLMRIS)
*
95 PRSCLADP001 1.
*
* SCALING FACTOR FOR THE E-F STABILITY PLUME RISE FORMULA
* (USED BY FUNCTION PLMRIS)
*
96 PRSCLFPP001 1.
*****
* WAKE EFFECTS DATA BLOCK, LOADED BY INPWAK, STORED IN /BILWAK/
*
* BUILDING WIDTH (METERS)
*
97 WEBUILDW001 40. * SURRY
*
* BUILDING HEIGHT (METERS)
*
98 WEBUILDH001 50. * SURRY
*****
* RELEASE DATA BLOCK, LOADED BY INPREL, STORED IN /ATNAM2/, /MULREL/
*
99 RDATNAM2001 'SECOND DRAFT 1150, WORST CASE SOURCE TERM FOR EARLY FATALITIES'
*
* TIME AFTER ACCIDENT INITIATION WHEN THE ACCIDENT REACHES GENERAL EMERGENCY
* CONDITIONS (AS DEFINED IN NUREG-0654), OR WHEN PLANT PERSONNEL CAN RELIABLY
* PREDICT THAT GENERAL EMERGENCY CONDITIONS WILL BE ATTAINED
*
100 RDOALARM001 1300.
*
* NUMBER OF PLUME SEGMENTS THAT ARE RELEASED
*
101 RDNUMREL001 2
*
* SELECTION OF RISK DOMINANT PLUME
*
102 RDMAXRIS001 1
*
* REFERENCE TIME FOR DISPERSION AND RADIOACTIVE DECAY
*
103 RDREFTIM001 0.00 0.50
*
* HEAT CONTENT OF THE RELEASE SEGMENTS (W)
* A VALUE SPECIFIED FOR EACH OF THE RELEASE SEGMENTS
*
104 RDPLHEAT001 3.7E+6 1.7E5
*
* HEIGHT OF THE PLUME SEGMENTS AT RELEASE (M)
* A VALUE SPECIFIED FOR EACH OF THE RELEASE SEGMENTS
*
105 RDPLHITE001 0. 0.
*
* DURATION OF THE PLUME SEGMENTS (S)
* A VALUE SPECIFIED FOR EACH OF THE RELEASE SEGMENTS
*
106 RDPLUDUR001 1800. 22000.
*
* TIME OF RELEASE FOR EACH PLUME (S AFTER SCRAM)
* A VALUE SPECIFIED FOR EACH OF THE RELEASE SEGMENTS
*
107 RDPDELAY001 3700. 10000.
*

```


* PARTICLE SIZE DISTRIBUTION OF EACH NUCLIDE GROUP
 * YOU MUST SPECIFY A COLUMN OF DATA FOR EACH OF THE PARTICLE SIZE GROUPS
 *

108	RDPDIST001	1
109	RDPDIST002	1
110	RDPDIST003	1
111	RDPDIST004	1
112	RDPDIST005	1
113	RDPDIST006	1
114	RDPDIST007	1
115	RDPDIST008	1
116	RDPDIST009	1

*
 * 3412 MWTH PWR CORE INVENTORY, END-OF-CYCLE
 * SUPPLIED BY D E BENNETT, 5/14/86
 *

	NUCNAM	CORINV(BQ)	
117	RDCORINV001	CO-58	3 223E+16
118	RDCORINV002	CO 60	2 465E+16
119	RDCORINV003	KR-85	2 475E+16
120	RDCORINV004	KR-85M	1 159E+18
121	RDCORINV005	KR-87	2 118E+18
122	RDCORINV006	KR-88	2 864E+18
123	RDCORINV007	RB-86	1 888E+15
124	RDCORINV008	SR-89	3 590E+18
125	RDCORINV009	SR-90	1 938E+17
126	RDCORINV010	SR-91	4 616E+18
127	RDCORINV011	SR-92	4 803E+18
128	RDCORINV012	Y-90	2 079E+17
129	RDCORINV013	Y-91	4 374E+18
130	RDCORINV014	Y-92	4 821E+18
131	RDCORINV015	Y-93	5 454E+18
132	RDCORINV016	ZR-95	5 526E+18
133	RDCORINV017	ZR-97	5 759E+18
134	RDCORINV018	NB-95	5 224E+18
135	RDCORINV019	MO-99	6 098E+18
136	RDCORINV020	TC-99M	5 263E+18
137	RDCORINV021	RU-103	4 542E+18
138	RDCORINV022	RU-105	2.954E+18
139	RDCORINV023	RU-106	1 032E+18
140	RDCORINV024	RH-105	2 046E+18
141	RDCORINV025	SB-127	2 787E+17
142	RDCORINV026	SB-129	9 872E+17
143	RDCORINV027	TE-127	2 692E+17
144	RDCORINV028	TE-127M	3 564E+16
145	RDCORINV029	TE-129	9 267E+17
146	RDCORINV030	TE-129M	2 443E+17
147	RDCORINV031	TE-131M	4.680E+17
148	RDCORINV032	TE-132	4 658E+18
149	RDCORINV033	I-131	3 206E+18
150	RDCORINV034	I-132	4 725E+18
151	RDCORINV035	I-133	6 779E+18
152	RDCORINV036	I-134	7 440E+18
153	RDCORINV037	I-135	6.392E+18
154	RDCORINV038	XE-133	6 782E+18
155	RDCORINV039	XE-135	1 273E+18
156	RDCORINV040	CS-134	4 324E+17
157	RDCORINV041	CS-136	1 316E+17
158	RDCORINV042	CS-137	2 417E+17
159	RDCORINV043	BA-139	6 282E+18
160	RDCORINV044	BA-140	6 216E+18
161	RDCORINV045	LA-140	6 352E+18
162	RDCORINV046	LA-141	5 826E+18
163	RDCORINV047	LA-142	5 616E+18
164	RDCORINV048	CE-141	5 651E+18

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165 RDCORINV049 CE 143 5 494E+18
166 RDCORINV050 CE 144 3 405E+18
167 RDCORINV051 PR 143 5 395E+18
168 RDCORINV052 ND 147 2 412E+18
169 RDCORINV053 NP-239 6 464E+19
170 RDCORINV054 PU-238 3 664E+15
171 RDCORINV055 PU 239 8 263E+14
172 RDCORINV056 PU 240 1 042E+15
173 RDCORINV057 PU-241 1 755E+17
174 RDCORINV058 AM-241 1 159E+14
175 RDCORINV059 CM-242 4 436E+16
176 RDCORINV060 CM-244 2 596E+15
*
* SCALING FACTOR TO ADJUST THE CORE INVENTORY FOR POWER LEVEL
*
177 RDCORSCA001 0 715 * SURRY
*
* RELEASE FRACTIONS FOR ISOTOPE GROUPS IN RELEASE
*
* ISOTOPE GROUPS
*
* XE/KR I CS TE SR RU LA CE BA
*
178 RDRCIFRC001 1 0E+0 6 8E 1 6 4E-1 1 7E-1 4 2E-3 2 3E-3 1 6E-4 4 0E 4 6 3E-3
179 RDRCIFRC002 4 3E-3 9 5E-3 2 4E 3 1 4E 1 6 0E-2 4 7E 4 6 8E-3 7 1E-3 5 4E-2
*****
* OUTPUT CONTROL DATA BLOCK, LOADED BY INPOPT, STORED IN /STOPME/, /ATMOPT/
*
* FLAG TO INDICATE THAT THIS IS THE LAST PROGRAM IN THE SERIES TO BE RUN
*
180 OCENDAT1001 FALSE (SET THIS VALUE TO TRUE TO SKIP EARLY AND CHRONC)
*
181 OCIDEBUG001 0
*
* NAME OF THE NUCLIDE TO BE LISTED ON THE DISPERSION LISTINGS
*
*OCNUCOUT001 CS-137
*****
* METEOROLOGICAL SAMPLING DATA BLOCK
*
* METEOROLOGICAL SAMPLING OPTION CODE
*
* METCOD = 1, USER SPECIFIED DAY AND HOUR IN THE YEAR (FROM MET FILE),
*           2, WEATHER CATEGORY BIN SAMPLING,
*           3, 120 HOURS OF WEATHER SPECIFIED ON THE ATMOS USER INPUT FILE,
*           4, CONSTANT MET (BOUNDARY WEATHER USED FROM THE START),
*           5, STRATIFIED RANDOM SAMPLES FOR EACH DAY OF THE YEAR
*
182 M1METCOD001 2
*
* LAST SPATIAL INTERVAL FOR MEASURED WEATHER
*
183 M2LIMSPA001 25
*
* BOUNDARY WEATHER MIXING LAYER HEIGHT
*
184 M2BNDMXH001 1000 (METERS)
*
* BOUNDARY WEATHER STABILITY CLASS INDEX
*
185 M2IBDSFB001 4 (D STABILITY)
*
* BOUNDARY WEATHER RAIN RATE
*
186 M2BNDRAN001 5 (MM/HR)
*

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```

      * BOUNDARY WEATHER WIND SPEED
      *
187 M2BNOWND001 5      (M/S)
      *
      * NUMBER OF RAIN DISTANCE INTERVALS FOR BINNING
      *
188 M4NRHINT001 5
      *
      * ENDPOINTS OF THE RAIN DISTANCE INTERVALS (KILOMETERS)
      *
      * NOTE THESE MUST BE CHOSEN TO MATCH THE SPATIAL ENDPOINT DISTANCES
      * SPECIFIED FOR THE ARRAY SPAEND (10 % ERROR IS ALLOWED)
      *
189 M4RNDSTS001 3 22 5 63 11 27 20 92 32 19
      *
      * NUMBER OF RAIN INTENSITIY BREAKPOINTS
      *
190 M4NRINTN001 3
      *
      * RAIN INTENSITY BREAKPOINTS FOR WEATHER BINNING (MILLIMETERS PER HOUR)
      *
191 M4RRRATE001 2 4 6
      *
      * NUMBER OF SAMPLES PER BIN
      *
192 M4NSMPLS001 4 (THIS NUMBER SHOULD BE SET TO 4 FOR RISK ASSESSMENT)
      *
      * INITIAL SEED FOR RANDOM NUMBER GENERATOR
      *
193 M4IRSEED001 79

```

***** TERMINATOR RECORD ENCOUNTERED -- END OF BASE CASE USER INPUT *****

USER INPUT PROCESSING SUMMARY - BASE CASE

```

NUMBER OF RECORDS READ          = 416
NUMBER OF BLANK OR COMMENT RECORDS READ = 222
NUMBER OF TERMINATOR RECORDS    = 1
NUMBER OF RECORDS PROCESSED     = 193
      NUMBER OF PROCESSED RECORDS DUPLICATED = 0
      NUMBER OF PROCESSED RECORDS SORTED   = 193
*****

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RELEASED INVENTORY OF ALL PLUMES

CO-58	5 30E+13	1 08E+13
CO 60	4 05E+13	8 28E+12
NR 85	1 77E+16	7 61E+13
NR 85M	7 07E+17	2 32E+15
NR 87	8 63E+17	1 42E+15
NR 88	1 59E+18	4 43E+15
NR 86	8 63E+14	3 23E+12
SR 89	1 08E+16	1 74E+17
SR 90	5 82E+14	9 42E+15
SR-91	1 29E+16	1 83E+17
SR 92	1 11E+16	1 15E+17
Y-90	3 00E+13	1 26E+15
Y-91	5 07E+14	2 15E+16
Y-92	2 75E+15	8 15E+16
Y-93	5 81E+14	2 19E+16
ZR-95	6 32E+14	2 68E+16
ZR-97	6 31E+14	2 50E+16
NB-95	5 98E+14	2 54E+16
MO-99	9 92E+15	1 99E+15
TC-99M	8 80E+15	1 84E+15
RU-103	7 46E+15	1 52E+15
RU-105	4 14E+15	6 43E+14
RU-106	1 70E+15	3 47E+14
RU-105	3 39E+15	6 94E+14
SB-127	3 36E+16	2 73E+16
SB-129	1 02E+17	6 34E+16
TE-127	3 28E+16	2 71E+16
TE-127M	4 33E+15	3 56E+15
TE 129	1 11E+17	7 86E+16
TE-129M	2 97E+16	2 44E+16
TE 131M	5 56E+16	4 39E+16
TE-132	5 61E+17	4 55E+17
I-131	1 55E+18	2 20E+16
I-132	1 83E+18	2 76E+17
I-133	3 18E+18	4 20E+16
I 134	1 60E+18	5 62E+15
I-135	2 79E+18	3 24E+16
XE 133	4 84E+18	2 12E+16
XE-135	1 06E+18	1 03E+16
CS-134	1 98E+17	7 42E+14
CS-136	6 01E+16	2 24E+14
CS 137	1 11E+17	4 15E+14
BA-139	1 69E+16	6 04E+16
BA-140	2 79E+16	2 38E+17
LA 140	1 20E+15	4 06E+16
LA-141	5 56E+14	1 74E+16
LA-142	4 10E+14	8 13E+15
CE-141	1 62E+15	2 87E+16
CE-143	1 54E+15	2 63E+16
CE-144	9 74E+14	1 73E+16
PR-143	6 19E+14	2 62E+16
ND-147	2 75E+14	1 16E+16
NP-239	1 83E+16	3 17E+17
PU-238	1 05E+12	1 86E+13
PU-239	2 36E+11	4 20E+12
PU-240	2 98E+11	5 29E+12
PU-241	5 02E+13	8 91E+14
AM-241	1 33E+10	5 64E+11
CM-242	5 07E+12	2 16E+14
CM-244	2 97E+11	1 26E+13

READING FROM A WEATHER FILE WITH THE FOLLOWING HEADER:

SURRY MET, NRC-12/12/88, CREATED 12/22/88

MACCS FORMAT--NUREG-1150

METEOROLOGICAL DATA FILE CONTAINS 451 HOURS OF OBSERVED RAIN DATA

ACCUMULATED RAIN MEASUREMENTS TOTALED 29 21 INCHES FOR THE YEAR
 CONSTANT LID HEIGHTS (M) FOR 4 SEASONS - 1054 1090 1924 1412
 NON ZERO WINDSPEEDS LESS THAN 0 5 M/S ARE SET TO 0 5 M/S

* * * * METEOROLOGICAL BIN SUMMARY * * * *

BIN PRIORITIES

R1 XX RAIN INTENSITY I WITHIN THE INTERVAL ENDING AT XX
 INTERVAL ENDPOINTS ARE IN KILOMETERS FROM THE ACCIDENT SITE, THE 5 INTERVAL ENDPOINTS ARE 3 6 11 21 32
 RAIN INTENSITIES ARE IN MILLIMETERS OF RAIN PER HOUR THE 3 INTENSITY BREAKPOINTS ARE 2 0 4 0 6 0
 S V INITIAL WEATHER CONDITIONS WITH STABILITY CLASS S AND WIND SPEED INTERVAL V
 STABILITY CLASSES ARE B = A/B, D = C/D, E = E, AND F = F
 WIND SPEED INTERVALS ARE IN METERS PER SECOND, 1 (0 1), 2 (1-2), 3 (2 3), 4 (3 5), 5 (5-7), 6 (GT 7)

	METBIN	WIND DIRECTION																TOTAL	PER CENT
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
1 B	3	0 032	0 041	0 037	0 029	0 077	0 088	0 080	0 055	0 060	0 046	0 039	0 069	0 089	0 090	0 130	0 039	957	10 9247
2 B	4	0 008	0 075	0 122	0 080	0 042	0 093	0 088	0 094	0 094	0 067	0 053	0 091	0 066	0 011	0 013	0 004	946	10 7991
3 D	1	0 058	0 093	0 047	0 047	0 116	0 047	0 023	0 058	0 081	0 047	0 047	0 035	0 047	0 070	0 128	0 058	86	0 9817
4 D	2	0 035	0 040	0 054	0 063	0 052	0 080	0 052	0 072	0 070	0 072	0 075	0 059	0 084	0 096	0 052	0 042	572	6 5297
5 D	3	0 015	0 063	0 066	0 037	0 059	0 066	0 057	0 063	0 083	0 083	0 131	0 079	0 114	0 050	0 031	0 006	544	6 2100
6 D	4	0 011	0 088	0 103	0 074	0 036	0 020	0 030	0 149	0 120	0 109	0 093	0 094	0 056	0 003	0 008	0 005	658	7 5114
7 D	5	0 014	0 110	0 076	0 076	0 034	0 021	0 083	0 241	0 145	0 028	0 083	0 062	0 028	0 000	0 000	0 000	145	1 6553
8 D	6	0 000	0 364	0 000	0 000	0 091	0 000	0 000	0 000	0 000	0 000	0 000	0 545	0 000	0 000	0 000	0 000	11	0 1256
9 E	1	0 101	0 081	0 054	0 041	0 108	0 041	0 041	0 041	0 020	0 034	0 034	0 054	0 054	0 095	0 095	0 108	148	1 6895
10 E	2	0 060	0 063	0 063	0 063	0 081	0 058	0 037	0 028	0 057	0 069	0 046	0 031	0 100	0 156	0 048	0 039	668	7 6256
11 E	3	0 063	0 135	0 080	0 057	0 036	0 036	0 040	0 078	0 135	0 077	0 090	0 018	0 063	0 053	0 015	0 026	758	8 6530
12 E	4	0 055	0 240	0 130	0 088	0 052	0 037	0 065	0 120	0 073	0 052	0 035	0 020	0 013	0 002	0 010	0 007	599	6 8379
13 F	1	0 138	0 101	0 071	0 039	0 041	0 049	0 056	0 039	0 037	0 028	0 018	0 031	0 027	0 079	0 090	0 155	774	8 8356
14 F	2	0 163	0 149	0 065	0 071	0 069	0 049	0 058	0 046	0 082	0 034	0 013	0 013	0 008	0 022	0 053	0 105	759	8 6644
15 F	3	0 207	0 290	0 124	0 103	0 076	0 069	0 007	0 014	0 028	0 007	0 007	0 014	0 000	0 007	0 007	0 041	145	1 6553
16 F	4	0 167	0 333	0 167	0 000	0 083	0 000	0 000	0 167	0 083	0 000	0 000	0 000	0 000	0 000	0 000	0 000	12	0 1370
17 R1	3	0 074	0 031	0 037	0 026	0 034	0 074	0 085	0 097	0 071	0 040	0 060	0 105	0 111	0 043	0 063	0 051	352	4 0183
18 R1	6	0 171	0 024	0 073	0 049	0 024	0 073	0 073	0 049	0 024	0 049	0 024	0 024	0 122	0 049	0 098	0 073	41	0 4680
19 R1	11	0 097	0 049	0 049	0 010	0 010	0 058	0 039	0 039	0 049	0 029	0 087	0 068	0 165	0 010	0 097	0 146	103	1 1758
20 R1	21	0 098	0 076	0 045	0 015	0 008	0 053	0 068	0 053	0 030	0 038	0 045	0 098	0 144	0 038	0 106	0 083	132	1 5068
21 R1	32	0 110	0 055	0 039	0 008	0 031	0 031	0 047	0 071	0 039	0 031	0 047	0 126	0 142	0 063	0 071	0 087	127	1 4498
22 R2	3	0 108	0 041	0 027	0 068	0 041	0 000	0 014	0 068	0 068	0 068	0 108	0 135	0 081	0 081	0 068	0 027	74	0 8447
23 R2	6	0 333	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 333	0 000	0 000	0 000	0 000	0 000	0 333	3	0 0342
24 R2	11	0 125	0 000	0 125	0 000	0 000	0 000	0 000	0 063	0 125	0 063	0 063	0 000	0 063	0 063	0 250	0 063	16	0 1826
25 R2	21	0 125	0 042	0 167	0 000	0 083	0 000	0 042	0 042	0 083	0 042	0 000	0 042	0 083	0 000	0 125	0 125	24	0 2740
26 R2	32	0 148	0 000	0 074	0 037	0 074	0 037	0 000	0 000	0 000	0 000	0 037	0 037	0 185	0 037	0 074	0 259	27	0 3082
27 R3	3	0 059	0 059	0 059	0 059	0 118	0 000	0 059	0 059	0 000	0 059	0 059	0 118	0 000	0 118	0 059	0 118	17	0 1941
29 R3	11	0 333	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 333	0 000	0 333	3	0 0342
30 R3	21	0 200	0 000	0 200	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 200	0 200	5	0 0571
31 R3	32	0 571	0 000	0 000	0 143	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 143	0 143	7	0 0799
32 R4	3	0 211	0 000	0 000	0 000	0 053	0 053	0 000	0 000	0 000	0 053	0 105	0 000	0 211	0 105	0 053	0 158	19	0 2169
33 R4	6	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	1 000	1	0 0114
34 R4	11	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 000	0 400	0 000	0 400	5	0 0571
35 R4	21	0 071	0 071	0 000	0 000	0 000	0 071	0 143	0 000	0 071	0 000	0 000	0 000	0 143	0 071	0 143	0 214	14	0 1598
36 R4	32	0 125	0 000	0 000	0 000	0 125	0 000	0 125	0 000	0 000	0 125	0 000	0 000	0 125	0 250	0 000	0 000	8	0 0913
37 ALL		0 066	0 095	0 075	0 056	0 054	0 057	0 057	0 074	0 077	0 057	0 055	0 056	0 066	0 054	0 052	0 050	8760	

* * * * METEOROLOGICAL BIN SUMMARY * * * *

BIN PRIORITIES

RI XX RAIN INTENSITY I WITHIN THE INTERVAL ENDING AT XX
 INTERVAL ENDPOINTS ARE IN KILOMETERS FROM THE ACCIDENT SITE, THE 5 INTERVAL ENDPOINTS ARE 3 6 11 21 32
 RAIN INTENSITIES ARE IN MILLIMETERS OF RAIN PER HOUR, THE 3 INTENSITY BREAKPOINTS ARE 2 0 4 0 6 0
 S V INITIAL WEATHER CONDITIONS WITH STABILITY CLASS S AND WIND SPEED INTERVAL V
 STABILITY CLASSES ARE B - A/B, D - C/D, F - E, AND F F
 WIND SPEED INTERVALS ARE IN METERS PER SECOND (M/S), 1 (0-1), 2 (1-2), 3 (2-3), 4 (3-5), 5 (5-7), 6 (GT 7)

METBIN	WIND DIRECTION																TOTAL	PER CENT
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
1 B 3	31	39	35	28	74	84	77	53	57	44	37	66	85	86	124	37	957	10 9247
2 B 4	8	71	115	76	40	88	83	89	89	63	50	86	62	10	12	4	946	10 7991
3 D 1	5	8	4	4	10	4	2	5	7	4	4	3	4	6	11	5	86	0 9817
4 D 2	20	23	31	36	30	46	30	41	40	41	43	34	48	55	30	24	572	6 5297
5 D 3	8	34	36	20	32	36	31	34	45	45	71	41	62	27	17	3	544	6 2100
6 D 4	7	58	68	49	24	13	20	98	79	72	61	62	37	2	5	3	658	7 5114
7 D 5	2	16	11	11	5	3	12	35	21	4	12	9	4	0	0	0	145	1 6553
8 D 6	0	4	0	0	1	0	0	0	0	0	0	6	0	0	0	0	11	0 1256
9 E 1	15	12	8	6	16	6	6	6	3	5	5	8	8	14	14	16	148	1 6895
10 E 2	40	42	42	42	54	39	25	19	38	46	31	21	67	104	32	26	668	7 6256
11 E 3	48	102	61	43	27	27	30	59	102	58	68	14	48	40	11	20	758	8 6530
12 E 4	33	144	78	53	31	22	39	72	44	31	21	12	8	1	6	4	599	6 8379
13 F 1	107	78	55	30	32	38	43	30	29	22	14	24	21	61	70	120	774	8 8356
14 F 2	124	113	49	54	52	37	44	35	62	26	10	10	6	17	40	80	759	8 6644
15 F 3	30	42	18	15	11	10	1	2	4	1	1	2	0	1	1	6	145	1 6553
16 F 4	2	4	2	0	1	0	0	2	1	0	0	0	0	0	0	0	12	0 1370
17 R1 3	26	11	13	9	12	26	30	34	25	14	21	37	39	15	22	18	352	4 0183
18 R1 6	7	1	3	2	1	3	3	2	1	2	1	1	5	2	4	3	41	0 4680
19 R1 11	10	5	5	1	1	6	4	4	5	3	9	7	17	1	10	15	103	1 1758
20 R1 21	13	10	6	2	1	7	9	7	4	5	6	13	19	5	14	11	132	1 5068
21 R1 32	14	7	5	1	4	4	6	9	5	4	6	16	18	8	9	11	127	1 4498
22 R2 3	8	3	2	5	3	0	1	5	5	5	8	10	6	6	5	2	74	0 8447
23 R2 6	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	3	0 0342
24 R2 11	2	0	2	0	0	0	0	1	2	1	1	0	1	1	4	1	16	0 1826
25 R2 21	3	1	4	0	2	0	1	1	2	1	0	1	2	0	3	3	24	0 2740
26 R2 32	4	0	2	1	2	1	0	0	0	0	1	1	5	1	2	7	27	0 3082
27 R3 3	1	1	1	1	2	0	1	1	0	1	1	2	0	2	1	2	17	0 1941
28 R3 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0 0000
29 R3 11	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3	0 0342
30 R3 21	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1	1	5	0 0571
31 R3 32	4	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	7	0 0799
32 R4 3	4	0	0	0	1	1	0	0	0	1	2	0	4	2	1	3	19	0 2169
33 R4 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0 0114
34 R4 11	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	2	5	0 0571
35 R4 21	1	1	0	0	0	1	2	0	1	0	0	0	2	1	2	3	14	0 1598
36 R4 32	1	0	0	0	1	0	1	0	0	1	0	0	1	1	2	0	8	0 0913

* * * * SUMMARIES * * * *

R	101	40	44	23	30	49	58	64	50	39	56	89	121	46	82	86	978	11 1644
B	39	110	150	104	114	172	160	142	146	107	87	152	147	96	136	41	1903	21 7237
D	42	143	150	120	102	102	95	213	192	166	191	157	155	90	63	35	2016	23 0137
E	136	300	189	144	128	94	100	156	187	140	125	55	131	159	63	66	2173	24 8059
F	263	237	124	99	96	85	88	69	96	49	25	36	27	79	111	206	1690	19 2922
1	127	98	67	40	58	48	51	42	39	31	23	35	34	81	95	141	1010	11 5297
2	199	186	127	138	156	141	122	108	154	124	89	82	143	198	132	146	2245	25 6279
3	102	209	145	100	124	138	116	134	194	137	172	108	172	132	123	50	2156	24 6119
4	45	255	228	166	82	112	126	242	204	165	128	156	100	13	23	11	2056	23 4703
5	/	37	45	23	19	14	28	54	30	5	16	13	11	0	0	0	302	3 4475
6	0	5	1	0	1	0	0	0	0	0	0	6	0	0	0	0	13	0 1484

***** BIN WINDROSE SUMMARY *****

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	TOTAL
BIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
DIRECTION	0.012	0.041	0.017	0.029	0.077	0.088	0.080	0.055	0.060	0.046	0.039	0.069	0.089	0.090	0.130	0.039	1.000000
1	0.008	0.075	0.122	0.080	0.042	0.093	0.088	0.094	0.094	0.067	0.053	0.091	0.086	0.090	0.104	0.004	1.000000
2	0.008	0.093	0.116	0.047	0.116	0.047	0.073	0.058	0.041	0.047	0.073	0.091	0.086	0.090	0.104	0.004	1.000000
3	0.015	0.040	0.054	0.063	0.052	0.080	0.052	0.072	0.070	0.072	0.075	0.059	0.084	0.096	0.052	0.042	1.000000
4	0.015	0.063	0.066	0.037	0.039	0.066	0.057	0.063	0.083	0.083	0.131	0.079	0.094	0.050	0.031	0.006	1.000000
5	0.011	0.088	0.103	0.074	0.036	0.020	0.030	0.149	0.120	0.109	0.093	0.062	0.056	0.000	0.000	0.000	1.000000
6	0.014	0.110	0.076	0.076	0.036	0.021	0.000	0.241	0.145	0.108	0.083	0.062	0.056	0.000	0.000	0.000	1.000000
7	0.000	0.364	0.000	0.000	0.091	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000000
8	0.101	0.081	0.054	0.041	0.108	0.041	0.041	0.041	0.020	0.034	0.034	0.054	0.054	0.095	0.095	0.108	1.000000
9	0.060	0.063	0.063	0.063	0.063	0.058	0.037	0.028	0.077	0.069	0.046	0.031	0.100	0.156	0.048	0.039	1.000000
10	0.063	0.135	0.080	0.057	0.036	0.036	0.065	0.120	0.135	0.052	0.035	0.020	0.013	0.002	0.010	0.007	1.000000
11	0.055	0.240	0.130	0.088	0.052	0.037	0.056	0.039	0.037	0.028	0.018	0.031	0.008	0.022	0.053	0.105	1.000000
12	0.055	0.240	0.130	0.088	0.052	0.037	0.056	0.039	0.037	0.028	0.018	0.031	0.008	0.022	0.053	0.105	1.000000
13	0.138	0.101	0.071	0.039	0.041	0.049	0.058	0.039	0.037	0.028	0.018	0.031	0.008	0.022	0.053	0.105	1.000000
14	0.163	0.149	0.065	0.071	0.069	0.069	0.007	0.014	0.028	0.034	0.013	0.014	0.000	0.007	0.007	0.007	1.000000
15	0.207	0.290	0.124	0.103	0.076	0.069	0.000	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
16	0.167	0.333	0.167	0.000	0.083	0.000	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
17	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
18	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
19	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
20	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
21	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
22	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
23	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
24	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
25	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
26	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
27	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
28	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
29	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
30	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
31	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
32	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
33	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
34	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
35	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
36	0.103	0.041	0.045	0.024	0.031	0.050	0.059	0.065	0.051	0.040	0.057	0.091	0.124	0.047	0.084	0.088	1.000000
37	0.066	0.095	0.075	0.056	0.054	0.057	0.057	0.074	0.077	0.057	0.055	0.056	0.066	0.054	0.052	0.050	1.000000

***** BEGINNING OF CHANGE CASE 1 USER INPUT *****

***** SOURCE TERM NUMBER 2 OF 2 *****

194 RDTNAM2001 'RELEASE FRACTIONS OF SOURCE TERM 1 REDUCED BY A FACTOR OF TEN'

***** RECORD NUMBER 194 REPLACES RECORD NUMBER 99 *****

* XE/RR 1 CS TE SR RU LA CE BA
 195 RORLEPRC001 1.0E-1 6.8E-2 6.4E-2 1.7E-2 4.2E-4 2.3E-4 1.6E-5 4.0E-5 6.3E-4
 ***** RECORD NUMBER 195 REPLACES RECORD NUMBER 176 *****
 196 RORLEPRC002 4.3E-4 9.5E-4 2.4E-4 1.4E-2 6.8E-3 4.7E-5 6.8E-4 7.1E-4 5.4E-3
 ***** RECORD NUMBER 196 REPLACES RECORD NUMBER 179 *****

***** TERMINATOR RECORD ENCOUNTERED -- END OF CHANGE CASE 1 USER INPUT *****

USER INPUT PROCESSING SUMMARY - CHANGE CASE 1
 NUMBER OF RECORDS CHANGED - 3
 NUMBER OF RECORDS ADDED - 0

RELEASED INVENTORY OF ALL PLUMES

CO 58	5 30E+12	1 08E+12
CO 60	4 05E+12	8 28E+11
AR 85	1 77E+15	7 61E+12
KR 85M	7 07E+16	2 32E+14
KR 87	8 63E+16	1 42E+14
KR 88	1 59E+17	4 43E+14
RB 86	8 63E+13	3 23E+11
SR 89	1 08E+15	1 74E+16
SR 90	5 82E+13	9 42E+14
SR-91	1 29E+15	1 83E+16
SN 92	1 11E+15	1 15E+16
Y 90	3 00E+12	1 26E+14
Y 91	5 07E+13	2 15E+15
Y-92	2 75E+14	8 15E+15
Y-93	5 81E+13	2 19E+15
ZR 95	6 32E+13	2 68E+15
ZR-97	6 31E+13	2 50E+15
NB 95	5 98E+13	2 54E+15
MO 99	9 82E+14	1 99E+14
JC-99M	8 80E+14	1 84E+14
RU 103	7 46E+14	1 52E+14
RU 105	4 14E+14	6 43E+13
RU-106	1 70E+14	3 47E+13
RH 105	3 39E+14	6 94E+13
SD 127	3 36E+15	2 73E+15
SB 129	1 02E+16	6 34E+15
TC 127	3 28E+15	2 71E+15
TE 127M	4 33E+14	3 56E+14
TE-129	1 11E+16	7 86E+15
TE-129M	2 97E+15	2 44E+15
TE-131M	5 66E+15	4 39E+15
TE-132	5 85E+15	4 55E+15
I 131	1 55E+17	2 50E+15
I 132	1 83E+17	2 76E+16
I 133	3 16E+17	4 20E+15
I 134	1 60E+17	5 62E+14
I 135	2 79E+17	3 24E+15
XE-133	4 84E+17	2 12E+15
XE-135	1 06E+17	1 03E+15
CS-134	1 98E+16	7 42E+13
CS-136	6 01E+15	2 24E+13
CS-137	1 11E+16	4 15E+13
BA-139	1 69E+15	6 04E+15
BA 140	2 79E+15	2 38E+16
LA 140	1 20E+14	4 06E+15
LA-141	5 56E+13	1 74E+15
LA-142	4 10E+13	8 13E+14
CE 141	1 62E+14	2 87E+15
CE 143	1 54E+14	2 63E+15
CE 144	9 74E+13	1 73E+15
PR 143	6 19E+13	2 62E+15
ND 147	2 75E+13	1 16E+15
NP 239	1 83E+15	3 17E+16
PU 238	1 05E+11	1 86E+12
PU 239	2 36E+10	4 20E+11
PU 240	2 98E+10	5 29E+11
PU 241	5 02E+12	8 91E+13
AM 241	1 33E+09	5 64E+10
CM 242	5 07E+11	2 16E+13
CM 244	2 97E+10	1 26E+12

USER INPUT IS READ FROM UNIT 25
RECORD IDENTIFIER FIELDS 11 CHARACTERS LONG ARE EXPECTED
THE FIRST 100 COLUMNS OF EACH INPUT RECORD ARE PROCESSED

THE MAXIMUM NUMBER OF IDENTIFIER RECORDS THAT MAY BE SAVED AS THE BASE CASE IS 1000.

RECORD
NUMBER

RECORD

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* GENERAL DESCRIPTIVE TITLE DESCRIBING THIS "EARLY" INPUT FILE
*
1 MIENAM1001 'IN2A.INP, SURRY, SAMPLE PROBLEM A, EARLY INPUT'
*
* FLAG TO INDICATE THAT THIS IS THE LAST PROGRAM IN THE SERIES TO BE RUN
*
2 MIENDAT2001 .FALSE. (SET THIS VALUE TO .TRUE. TO SKIP CHRONC)
*
* DISPERSION MODEL OPTION CODE:  1 * STRAIGHT LINE
*                                2 * WIND-SHIFT WITH ROTATION
*                                3 * WIND-SHIFT WITHOUT ROTATION
*
3 MIPLUME001 2
*
* NUMBER OF FINE GRID SUBDIVISIONS USED BY THE MODEL
*
4 MINUMFIN001 7 (3, 5 OR 7 ALLOWED)
*
* LEVEL OF DEBUG OUTPUT REQUIRED, NORMAL RUNS SHOULD SPECIFY ZERO
*
5 MIIPRINT001 0
*
* LOGICAL FLAG SIGNIFYING THAT THE BREAKDOWN OF RISK BY WEATHER CATEGORY
* BIN ARE TO BE PRESENTED TO SHOW THEIR RELATIVE CONTRIBUTION TO THE MEAN
*
* RISBIN
*
6 MIRISCAT001 .FALSE.
*
* FLAG INDICATING IF WIND-ROSES FROM ATMOS ARE TO BE OVERRIDDEN
*
7 MIOVRRID001 .FALSE. (USE THE WIND ROSE CALCULATED FOR EACH WEATHER BIN)
*****
* POPULATION DISTRIBUTION DATA BLOCK, LOADED BY INOPU, STORED IN /POPDAT/
*
8 PDPOPFLG001 FILE
*
* PDPOPFLG001 UNIFORM
* PDIBEGIN001 1 (SPATIAL INTERVAL AT WHICH POPULATION BEGINS)
* PDPOPUEN001 50. (POPULATION DENSITY (PEOPLE PER SQUARE KILOMETER))
*****
* ORGAN DEFINITION DATA BLOCK, LOADED BY INORGA, STORED IN /EARDIH/ AND /ORGNAM/
*
* NUMBER OF ORGANS DEFINED FOR HEALTH EFFECTS
*
9 ODNUMORG001 9
*
* NAMES OF THE ORGANS DEFINED FOR HEALTH EFFECTS
*
10 ODORGNAM001 'SKIN', 'EDEWBODY', 'LUNGS', 'RED MARR', 'LOWER LI', 'STOMACH',
11 ODORGNAM002 'THYROIDH', 'BONE SUR', 'BREAST'
*****
* SHIELDING AND EXPOSURE FACTORS, LOADED BY INDFAC, STORED IN /EADFAC/
*
* THREE VALUES OF EACH PROTECTION FACTOR ARE SUPPLIED,
* ONE FOR EACH TYPE OF ACTIVITY:
*
* ACTIVITY TYPE:
* 1 - EVACUEES WHILE MOVING
* 2 - NORMAL ACTIVITY IN SHELTERING AND EVACUATION ZONE
* 3 - SHELTERED ACTIVITY

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*
* CLOUD SHIELDING FACTOR
*
*   SITE      GG   PB   SEQ  SUR  ZION
*   SHELTERING 0 7   0 5   0 65 0 6   0 5
*
*   EVACUEES  NORMAL  SHELTER
*
12  SICSHACT001      1      0 75      0 6   * SURRY SHELTERING VALUE
*
* PROTECTION FACTOR FOR INHALATION
*
13  SEPROTIN001      1.      0 41      0 33   * VALUES FOR NORMAL ACTIVITY AND
*                                           SHELTERING SELECTED BY NRC STAFF
*
* BREATHING RATE (CUBIC METERS PER SECOND)
*
14  SLBRRATE001  2 66E-4  2 66E-4  2 66E-4
*
* SKIN PROTECTION FACTOR
*
15  SESKPFAC001  1 0      0 41      0 33   * VALUES FOR NORMAL ACTIVITY AND
*                                           SHELTERING SELECTED BY NRC STAFF
*
* GROUND SHIELDING FACTOR
*
*   SITE      GG   PB   SEQ  SUR  ZION
*   SHELTERING 0 25 0 1   0 2   0 2   0 1
*
16  SEGSHFAC001      0 5      0.33      0 2   * VALUE FOR NORMAL ACTIVITY SELECTED BY
*                                           NRC STAFF
*
* RESUSPENSION INHALATION MODEL CONCENTRATION COEFFICIENT (/METER)
*
* RESCON = 1 E-4 IS APPROPRIATE FOR MECHANICAL RESUSPENSION BY VEHICLES
* RESHAP = 2.11 DAYS CAUSES 1 E-4 TO DECAY IN ONE WEEK TO 1 E-5, THE VALUE
* OF RESCON USED IN THE FIRST TERM OF THE LONG-TERM RESUSPENSION EQUATION
* USED IN CHRONC
*
17  SERESCON001  1 E-4      (RESUSPENSION IS TURNED ON)
*
* RESUSPENSION CONCENTRATION COEFFICIENT HALF-LIFE (SEC)
*
18  SFRESHAF001  1.82E5      (2 11 DAYS)
*****
* EVACUATION ZONE DATA BLOCK, LOADED BY EVNETW, STORED IN /NETWORK/, /BOPTIO/
*
* SPECIFIC DESCRIPTION OF THE EMERGENCY RESPONSE SCENARIO BEING USED
*
19  EZEANAM2001  'EVACUATION WITHIN 10 MILES, RELOCATION MODELS APPLY ELSEWHERE'
*
* THE TYPE OF WEIGHTING TO BE APPLIED TO THE EMERGENCY RESPONSE SCENARIOS
* YOU MUST SUPPLY A VALUE OF 'TIME' OR 'PEOPLE'
*
20  EZWTNAME001  'PEOPLE'
*
* WEIGHTING FRACTION APPLICABLE TO THIS SCENARIO
*
21  EZWTFRAC001  0.95
*
* LAST RING IN THE MOVEMENT ZONE
*
22  EZLASMOV001      15      (EVACUEES DISAPPEAR AFTER TRAVELING TO 20 MILES)
*
* FIRST SPATIAL INTERVAL IN THE EVACUATION ZONE
*

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23 EZINIEVA001      1      (NO INNER SHELTER ZONE)
*
* * OUTER BOUNDS ON 3 EVACUATION ZONES (ZERO MEANS THE ZONE IS NOT DEFINED)
*
24 EZLASEVA001      0      0      12 (SINGLE EVACUATION ZONE OUT TO 10 MILES)
*
* * EVACUATION DELAY TIMES FOR THE 3 EVACUATION ZONES
* * THIS IS THE DELAY TIME FROM OALARM (ATMOS) TO WHEN PEOPLE START MOVING
*
25 EZEDELAY001      0.      0.      7200. (SURRY)      ?
*
* * RADIAL EVACUATION SPEED (M/S)
*
26 EZFSPEED001      1.8      (SURRY)
*****
* * SHELTER AND RELOCATION ZONE DATA BLOCK, LOADED BY INPEMR,
* *                               STORED IN /INPSRZ/, /RELOCA/
*
* * TIME TO TAKE SHELTER IN THE INNER SHELTER ZONE (SECONDS FROM OALARM)
*
27 SRTTOSH1001      0.      (THERE IS NO INNER SHELTER ZONE)
*
* * SHELTER DURATION IN THE INNER SHELTER ZONE (SECONDS FROM TAKING SHELTER)
*
28 SRSHELT1001      0.      (THERE IS NO INNER SHELTER ZONE)
*
* * LAST RING OF THE OUTER SHELTER ZONE
*
29 SRIASHE2001      0      (THERE IS NO OUTER SHELTER ZONE)
*
* * TIME TO TAKE SHELTER IN THE OUTER SHELTER ZONE (SECONDS FROM OALARM)
*
30 SRTTOSH2001      0.      (THERE IS NO OUTER SHELTER ZONE)
*
* * SHELTER DURATION IN THE OUTER SHELTER ZONE (SECONDS FROM TAKING SHELTER)
*
31 SRSHELT2001      0.      (THERE IS NO OUTER SHELTER ZONE)
*
* * DURATION OF THE EMERGENCY PHASE (SECONDS FROM PLUME ARRIVAL)
*
32 SRENDEMP001      604800. (ONE WEEK)
*
* * CRITICAL ORGAN FOR RELOCATION DECISIONS
*
33 SRCHIORG001 'EDEWBODY'
*
* * HOT SPOT RELOCATION TIME (SECONDS FROM PLUME ARRIVAL)
*
34 SRTIMHOT001      43200. (ONE-HALF DAY)
*
* * NORMAL RELOCATION TIME (SECONDS FROM PLUME ARRIVAL)
*
35 SRTIMNRM001      86400. (ONE DAY)
*
* * HOT SPOT RELOCATION DOSE CRITERION THRESHOLD (SIEVERTS)
*
36 SRDOSHOT001      0.5      (50 REM DOSE TO WHOLE BODY IN 1 WEEK TRIGGERS RELOCATION)
*
* * NORMAL RELOCATION DOSE CRITERION THRESHOLD (SIEVERTS)
*
37 SRDOSNRM001      0.25      (25 REM DOSE TO WHOLE BODY IN 1 WEEK TRIGGERS RELOCATION)
*****
* * EARLY FATALITY MODEL PARAMETERS, LOADED BY INEPAT, STORED IN /EFATAL/
*
* * NUMBER OF EARLY FATALITY EFFECTS
*

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```

38 EFNUMEFA001 3
*
*          ORGNAM      EFFACA  EFFACB  EFFTHR
*
39 EFATAGRP001 'RED MARR'      3.8      5.0      1.5
40 EFATAGRP002 'LUNGS'        10.0      7.0      5.0
41 EFATAGRP003 'LOWER LI'      15.0      10.0     8.0
*****
* EARLY INJURY MODEL PARAMETERS, LOADED BY INEINJ, STORED IN /EINJUR/
*
* NUMBER OF EARLY INJURY EFFECTS
*
42 EINUMEIN001 7
*
*          EINAME          ORGNAM  EISUSC EITHRE EIPACA EIFACB
*
43 EINJUGRP001 'PRODROMAL VOMIT' 'STOMACH' 1.      .5      2.      3.
44 EINJUGRP002 'DIARRHEA'        'STOMACH' 1.      1.      3.      2.5
45 EINJUGRP003 'PNEUMONITIS'     'LUNGS'   1.      5.      10.     7.
46 EINJUGRP004 'SKIN ERYTHEMA'    'SKIN'    1.      3.      6.      5.
47 EINJUGRP005 'TRANSEPIDERMAL'    'SKIN'    1.      10.     20.     5.
48 EINJUGRP006 'THYROIDITIS'      'THYROIDH' 1.      40.     240.    2.
49 EINJUGRP007 'HYPOTHYROIDISM'    'THYROIDH' 1.      2.      60.     1.3
*****
* ACUTE EXPOSURE CANCER PARAMETERS, LOADED BY INACAN STORED IN /ACANCR/.
*
* NUMBER OF ACUTE EXPOSURE CANCER EFFECTS
*
50 LCNUMACA001 7
*
* DOSE THRESHOLD FOR LINEAR DOSE RESPONSE (SV)
*
51 LCACTHRE001 1.5
*
*          ACNAME          ORGNAM  ACSUSC DOSEFA DOSEFB CFRISK CIRISK
*
52 LCANCERS001 'LEUKEMIA'        'RED MARR' 1.      .39     .61 3.7E-3 3.7E-3
53 LCANCERS002 'BONE'            'BONE SUR' 1.      .39     .61 1.5E-4 1.5E-4
54 LCANCERS003 'BREAST'          'BREAST'   1.      1.      0. 6.0E-3 1.7E-2
55 LCANCERS004 'LUNG'            'LUNGS'    1.      .39     .61 5.1E-3 5.7E-3
56 LCANCERS005 'THYROID'         'THYROIDH' 1.      1.      0. 7.2E-4 7.2E-3
57 LCANCERS006 'GI'              'LOWER LI' 1.      .39     .61 1.5E-2 2.5E-2
58 LCANCERS007 'OTHER'           'LOWER LI' 1.      .39     .61 7.5E-3 1.3E-2
*****
* RESULT 1 OPTIONS BLOCK, LOADED BY INOUT1, STORED IN /INOUT1/
* TOTAL NUMBER OF A GIVEN EFFECT (LATENT CANCER, EARLY DEATH, EARLY INJURY)
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
59 TYPEINUMBER 27
*
60 TYPEIOUT001 'ERL FAT/TOTAL'      1 26  CCDF (0 TO 1000 MILES)
61 TYPEIOUT002 'ERL INJ/PRODROMAL VOMIT' 1 26  CCDF
62 TYPEIOUT003 'ERL INJ/DIARRHEA'        1 26
63 TYPEIOUT004 'ERL INJ/PNEUMONITIS'      1 26
64 TYPEIOUT005 'ERL INJ/THYROIDITIS'      1 26
65 TYPEIOUT006 'ERL INJ/HYPOTHYROIDISM'    1 26
66 TYPEIOUT007 'ERL INJ/SKIN ERYTHEMA'    1 26
67 TYPEIOUT008 'ERL INJ/TRANSEPIDERMAL'    1 26
68 TYPEIOUT009 'CAN FAT/TOTAL'            1 26  CCDF
69 TYPEIOUT010 'CAN FAT/LUNG'              1 26
70 TYPEIOUT011 'CAN FAT/THYROID'           1 26
71 TYPEIOUT012 'CAN FAT/BREAST'            1 26
72 TYPEIOUT013 'CAN FAT/GI'                1 26
73 TYPEIOUT014 'CAN FAT/LEUKEMIA'         1 26
74 TYPEIOUT015 'CAN FAT/BONE'              1 26

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75 TYPE1OUT016 'CAN FAT/OTHER' 1 26
76 TYPE1OUT017 'CAN INJ/TOTAL' 1 26
77 TYPE1OUT018 'CAN FAT/TOTAL' 1 19
78 TYPE1OUT019 'ERL FAT/TOTAL' 1 12 (0 TO 10 MILES)
79 TYPE1OUT020 'ERL INJ/PRODROMAL VOMIT' 1 12
80 TYPE1OUT021 'ERL INJ/DIARRHEA' 1 12
81 TYPE1OUT022 'ERL INJ/PNEUMONITIS' 1 12
82 TYPE1OUT023 'ERL INJ/THYROIDITIS' 1 12
83 TYPE1OUT024 'ERL INJ/HYPOTHYROIDISM' 1 12
84 TYPE1OUT025 'ERL INJ/SKIN ERYTHEMA' 1 12
85 TYPE1OUT026 'ERL INJ/TRANSEPIDERMAL' 1 12
86 TYPE1OUT027 'CAN FAT/TOTAL' 1 12
*****
* RESULT 2 OPTIONS BLOCK, LOADED BY INOUT2, STORED IN /INOUT2/
* FURTHEST DISTANCE AT WHICH A GIVEN RISK OF EARLY DEATH IS EXCEEDED.
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
87 TYPE2NUMBER 1
*
* FATALITY RISK THRESHOLD
*
88 TYPE2OUT001 0.
*****
* RESULT 3 OPTIONS BLOCK, LOADED BY INOUT3, STORED IN /INOUT3/
* NUMBER OF PEOPLE WHOSE DOSE TO A GIVEN ORGAN EXCEEDS A GIVEN THRESHOLD.
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
89 TYPE3NUMBER 3
*
* ORGAN NAME DOSE THRESHOLD (SV) DOSE FLAG
*
90 TYPE3OUT001 'RED MARR' 1.5 ACUTE
91 TYPE3OUT002 'LUNGS' 5.0 ACUTE
92 TYPE3OUT003 'EDEWBODY' 0.05 LIFETIME
*****
* RESULT 4 OPTIONS BLOCK, LOADED BY INOUT4, STORED IN /INOUT4/
* 360 DEGREE AVERAGE RISK OF A GIVEN EFFECT AT A GIVEN DISTANCE.
*
* POSSIBLE TYPES OF EFFECTS ARE:
*
* 'ERL FAT/TOTAL'
* 'ERL INJ/INJURY NAME'
* 'CAN FAT/CANCER NAME'
* 'CAN FAT/TOTAL'
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
93 TYPE4NUMBER 5
*
* RADIAL INDEX TYPE OF EFFECT
*
94 TYPE4OUT001 1 'ERL FAT/TOTAL'
95 TYPE4OUT002 2 'ERL FAT/TOTAL'
96 TYPE4OUT003 3 'ERL FAT/TOTAL'
97 TYPE4OUT004 4 'ERL FAT/TOTAL'
98 TYPE4OUT005 5 'ERL FAT/TOTAL'
*****
* RESULT 5 OPTIONS BLOCK, LOADED BY INOUT5, STORED IN /INOUT5/
*
* TOTAL POPULATION DOSE TO A GIVEN ORGAN BETWEEN TWO DISTANCES.
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
99 TYPE5NUMBER 3

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*
*          ORGAN      I1DIS5      I2DIS5
*
100 TYPE5OUT001 'EDEWBODY'      1      12      (0-10 MILES)
101 TYPE5OUT002 'EDEWBODY'      1      19      CCDF (0-50 MILES)
102 TYPE5OUT003 'EDEWBODY'      1      26      CCDF (0-1000 MILES)
*****
* RESULT 6 OPTIONS BLOCK, LOADED BY INOUT6, STORED IN /INOUT6/
*
* CENTERLINE DOSE TO AN ORGAN VS DIST BY PATHWAY, PATHWAY NAMES ARE AS FOLLOWS
*
* PATHWAY NAME
* 'CLD' - CLOUDSHINE
* 'GRD' - GROUNDSHINE
* 'INH ACU' - "ACUTE DOSE EQUIVALENT" FROM DIRECT INHALATION OF THE CLOUD
* 'INH LIF' - "LIFETIME DOSE COMMITMENT" FROM DIRECT INHALATION OF THE CLOUD
* 'RES ACU' - "ACUTE DOSE EQUIVALENT" FROM RESUSPENSION INHALATION
* 'RES LIF' - "LIFETIME DOSE COMMITMENT" FROM RESUSPENSION INHALATION
* 'TOT ACU' - "ACUTE DOSE EQUIVALENT" FROM ALL PATHWAYS
* 'TOT LIF' - "LIFETIME DOSE COMMITMENT" FROM ALL PATHWAYS
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
103 TYPE6NUMBER      0
*
*          ORGNAM      PATHNM      I1DIS6      I2DIS6
*
*TYPE6OUT001 'RED MARR'      'TOT ACU'      1      19      (0-50 MILES)
*TYPE6OUT002 'LUNGS'      'TOT ACU'      1      19      (0-50 MILES)
*TYPE6OUT003 'EDEWBODY'      'TOT LIF'      1      26      (0-1000 MILES)
*****
* RESULT 7 OPTIONS BLOCK, LOADED BY INOUT7, STORED IN /INOUT7/
*
* CENTERLINE RISK OF A GIVEN EFFECT VS DISTANCE
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
104 TYPE7NUMBER      0
*
*          NAME          I1DIS7      I2DIS7
*
*TYPE7OUT001 'ERL FAT/TOTAL'      1      19      (0-50 MILES)
*TYPE7OUT002 'CAN FAT/TOTAL'      1      26      (0-1000 MILES)
*****
* RESULT 8 OPTIONS BLOCK, LOADED BY INOUT8, STORED IN /INOUT8/
*
* POPULATION WEIGHTED FATALITY RISK BETWEEN 2 DISTANCES
*
* NUMBER OF DESIRED RESULTS OF THIS TYPE
*
105 TYPE8NUMBER      2
*
*          NAME          I1DIS8      I2DIS8
*
106 TYPE8OUT001 'ERL FAT/TOTAL'      1      5      CCDF (0-EXCL ZONE + 1 MI)
107 TYPE8OUT002 'CAN FAT/TOTAL'      1      12      CCDF (0-10 MILES)
***** TERMINATOR RECORD ENCOUNTERED -- END OF BASE CASE USER INPUT *****

USIR INPUT PROCESSING SUMMARY - BASE CASE

NUMBER OF RECORDS READ          = 382
NUMBER OF BLANK OR COMMENT RECORDS READ = 274
NUMBER OF TERMINATOR RECORDS    = 1
NUMBER OF RECORDS PROCESSED     = 107

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NUMBER OF PROCESSED RECORDS DUPLICATED - 0
NUMBER OF PROCESSED RECORDS FORMED = 107

READING FROM A DOSE CONVERSION LIST WITH THE FOLLOWING HEADER
MAY (5 DOSE) CONVERSION FACTOR CHANGED BY D CHANIN 1 NOV 89, 15 18 00
APPLY THE HYDROD REDUCTION FACTORS TO ONLY 1-131

MACCS SITE DATA FILE FOR SURRY (JLS, 11/10/88)
SECP01 POP DISTRIBUTION FROM 1980 CENSUS DATA ALTERED USING 0-10 MI NRC DATAMACCS SITE DATA FILE FOR SURRY (JLS, 11/10/88)
SECP01 POP DISTRIBUTION FROM 1980 CENSUS DATA ALTERED USING 0-10 MI NRC DATA

SECTION FOR DISTRIBUTION FROM 1980 CENSUS DATA ADTERED USING 0-10 MI NRC DATA
26 SPATIAL INTERVALS
16 WIND DIRECTIONS

10 WIND DIRECTIONS
7 CROP CATEGORIES
4 WATER PATHWAY ISOTOPES

59 ECONOMIC REGIONS

59 ECONOMIC REGIONS			
SPATIAL DISTANCES			
	0.16	0.52	
	1.21	1.61	2.13
			3.22
			4.02
			4.1

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2
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804.67	1609.34	100.33	241.14	324.67
POPULATION				

POPULATION	0.	0.	0.	0.	0.	4.
	6.	25.	3341.	7107.	2173.	1305.

[illegible]

246/346.	0.	0.	1.	2.	9.
104331.	0.	0.	1330.	1072.	3198.
	15.	63.	3550.		242.

3290082. 830354.
515. 9469.
5317. 7120.
13586. 198785. 1058744. 2050843.
1330. 1072.
1667. 3350.
13. 63.
242. 2198.

	0.	0.	0.	0.	5.
3290062.	830354.				229
	0.	0.	0.	0.	
	31.	822.	1752.	4543.	1597.
8.				1713.	

8.	228.	300395.	3003382.
51.	1597.		
1775.	1713.		
6535.	4343.		
7620063.	1724.		
	622.		
	0.		
	8555.		
	48596.		
	119411.		

7620063.	1169436.				
0.	0.	0.	0.	0.	1.
2.	11.	543.	1157.	3820.	3364.

2.	0.	11.	343.	1137.	3020.	1641.	3364.
0.	129.	6679.	11858.	0.	0.	0.	0.

[illegible]

0.	0.	4756.	10202.	10348.	10480.	9570.
0.	2317.	1756.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.

0.	0.	0.	0.	0.	0.	1.
0.	0.	0.	0.	0.	0.	1.
0.	0.	0.	0.	0.	0.	1.
1.	7.	8316.	17684.	16340.	30419.	39474.
						74999.

[illegible]

0.	0.	0.	0.
0.	0.	0.	0.
0.	0.	6433.	0.
0.	0.	1722.	0.
0.	0.	36763.	0.
0.	0.	2063	

	0.	U.	U.	0.	0.
	126203.	372471.	68327.	8599.	U.
	U.	U.	U.	U.	0.
	1724.	6339.	1057.	56763.	2063
	0433.				

0.	0.	0.	0.	0.	2.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
3.	13.	127.	273.	1649.	3441.
				4571.	783.

5.	127.	275.	1049.	4571.	3441.	7653.
13.	3360.	36387.	10447.	12402.	0.	
11747.	19019.	0.	0.			

0.	0.	5.	4.	8.	23.	14.
0.	0.	301.	650.	0.	0.	1264.
23.	93.					406.

0.	0.	301.	0.	0.
1106.	14665.	4071.	37417.	89072.
23.	33.	350.	0.	0.
408.	408.	1204.	81626.	

	0.	0.	0.	0.	19.
	0.	0.	0.	0.	0.
	0.	0.	0.	0.	510.
	0.	0.	0.	0.	951.
	0.	0.	0.	0.	152.

280809.	8801784.	216165.	47943.
223.	117.	405.	310.
1223.	17636.	30765.	53265.
4926.		289674.	
223.			
132.			

2000000.	0001784.	0.	0.	0.	0.	1.	2.	2.
		23.	93.	155.	338.	125.	1079.	135.
								14.
								0.

42.	33.	155.	125.	1079.	0.	153.
2765.	154.	5296.	21409.	62228.	479588.	153805.
1526840.	3099450.			523803.		

1526616:	3677150:	2.	1.	2.	14.
0.	0.	0.	0.	0.	2.
23.	93.	110.	240.	1056.	50.
					139.

25.	23.	4132.	16295.	35596.	239712.	709522.	284597.
915.	3153.	4132.	16295.	35596.	239712.	709522.	284597.
3957581.	10560254.						

[illegible]

300.
3.
9.
9.
100.
9.

D-44

D-45

1526840	3099458							
0	0	0	0	1	2	14	20	
23	93	110	240	1056	0	50	1396	
915	1153	4132	16295	35596	239712	709522	2845970	
3957581	10560254							
0	0	0	0	0	0	25	33	
38	154	30	70	450	0	980	517	
155	66331	40902	9557	44818	194801	376828	1492286	
2250273	12145932							
0	0	0	0	0	0	7	9	
12	47	31	69	0	380	281	445	
1986	32459	183133	193630	30369	203275	94113	1328987	
5086913	19537940							
0	0	0	0	0	0	0	0	
0	0	223	477	0	1026	609	2575	
2794	6593	96857	107328	47585	156826	101785	4175263	
7535605	9667977							
0	0	0	0	0	0	15	20	
23	92	2503	5326	3508	1826	1884	275	
3965	2084	6270	10765	103787	970659	472558	1396088	
1969210	73968							

```

***** BEGINNING OF CHANGE CASE 1 USER INPUT *****
*****
* EMERGENCY RESPONSE SCENARIO NUMBER 2
*****
* EVACUATION ZONE DATA BLOCK, LOADED BY EVNETW, STORED IN /NETWOR/, /EOPTIO/
*
* SPECIFIC DESCRIPTION OF THE EMERGENCY RESPONSE SCENARIO BEING USED
*
108 EZEANAM2001 'NO EVACUATION, RELOCATION MODELS APPLY EVERYWHERE'
***** RECORD NUMBER 108 REPLACES RECORD NUMBER 19 *****
*
* WEIGHTING FRACTION APPLICABLE TO THIS SCENARIO
*
109 EZWTFRAC001 0 05
***** RECORD NUMBER 109 REPLACES RECORD NUMBER 21 *****
*
* LAST RING IN THE MOVEMENT ZONE
*
110 EZLASHOV001 0 (A ZERO TURNS OFF THE EVACUATION MODEL)
***** RECORD NUMBER 110 REPLACES RECORD NUMBER 22 *****

***** TERMINATOR RECORD ENCOUNTERED -- END OF CHANGE CASE 1 USER INPUT *****

USER INPUT PROCESSING SUMMARY - CHANGE CASE 1
NUMBER OF RECORDS CHANGED = 3
NUMBER OF RECORDS ADDED = 0
*****

```

NO EVACUATION REQUESTED

```

***** BEGINNING OF CHANGE CASE 2 USER INPUT *****
*****
* EMERGENCY RESPONSE SCENARIO NUMBER 3
*****
* EVACUATION ZONE DATA BLOCK, LOADED BY EVNETW, STORED IN /NETWOR/, /EOPTIO/
*
* SPECIFIC DESCRIPTION OF THE EMERGENCY RESPONSE SCENARIO BEING USED
*
111 EZEANAM2001 'SHELTERING WITHIN 10 MILES, RELOCATION MODELS APPLY ELSEWHERE'
***** RECORD NUMBER 111 REPLACES RECORD NUMBER 19 *****
*

```

```

      * WEIGHTING FRACTION APPLICABLE TO THIS SCENARIO
      *
112 EZWTFRAC001 0.0 (THIS CASE IS NOT BEING COMBINED WITH SCENARIOS 1 AND 2)
***** RECORD NUMBER 112 REPLACES RECORD NUMBER 21 *****
      *
      * TIME TO TAKE SHELTER IN THE OUTER SHELTER ZONE (SECONDS FROM OALARM)
      *
113 SRTTOSH2001 2700. (45 MINUTES TO TAKE SHELTER)
***** RECORD NUMBER 113 REPLACES RECORD NUMBER 30 *****
      *
      * SHELTER DURATION IN THE OUTER SHELTER ZONE (SECONDS FROM TAKING SHELTER)
      *
114 SRSHLT2001 43200. (12 HOUR SHELTER DURATION)
***** RECORD NUMBER 114 REPLACES RECORD NUMBER 31 *****
      *
      * LAST RING OF THE OUTER SHELTER ZONE
      *
115 SRLASHE2001 12 (OUTER SHELTER ZONE EXTENDS FROM 0 TO 10 MILES)
***** RECORD NUMBER 115 REPLACES RECORD NUMBER 29 *****
***** TERMINATOR RECORD ENCOUNTERED -- END OF CHANGE CASE 2 USER INPUT *****

USER INPUT PROCESSING SUMMARY - CHANGE CASE 2
NUMBER OF RECORDS CHANGED = 5
NUMBER OF RECORDS ADDED = 0
*****

```

NO EVACUATION REQUESTED

USER INPUT IS READ FROM UNIT 26
 RECORD IDENTIFIER FIELDS 11 CHARACTERS LONG ARE EXPECTED.
 THE FIRST 100 COLUMNS OF EACH INPUT RECORD ARE PROCESSED.
 THE MAXIMUM NUMBER OF IDENTIFIER RECORDS THAT MAY BE SAVED AS THE BASE CASE IS 1000.

RECORD NUMBER	RECORD
	* GENERAL DESCRIPTIVE TITLE DESCRIBING THIS "CHRONC" INPUT FILE
	*
1	CHCHNAME001 'IN3A.INP, SURRY, SAMPLE PROBLEM A, CHRONC'

	* EMERGENCY RESPONSE COST DATA BLOCK
	*
	* DAILY COST FOR A PERSON WHO IS EVACUATED (DOLLARS/PERSON-DAY)
	*
2	CHEVACST001 27.00 (INCLUDES FOOD AND HOUSING COSTS BUT NOT LOST INCOME)
	*
	* DAILY COST FOR A PERSON WHO IS RELOCATED (DOLLARS/PERSON-DAY)
	*
3	CHRELCST001 27.00 (INCLUDES FOOD AND HOUSING COSTS BUT NOT LOST INCOME)

	* LONG TERM PROTECTIVE ACTION DATA BLOCK
	*
	* END OF THE INTERMEDIATE PHASE PERIOD (SECONDS FROM ACCIDENT INITIATION)
	*
4	CHTMIPND001 604800. (7 DAYS, NO INTERMEDIATE PHASE)
	*
	* LONG-TERM PHASE DOSE PROJECTION PERIOD, THE DURATION OF THE EXPOSURE
	* PERIOD OVER WHICH THE LONG-TERM DOSE CRITERION IS EVALUATED (SECONDS)
	*
5	CHTMPACT001 1.58E8 (5 YEARS)
	*
	* DOSE CRITERION FOR INTERMEDIATE PHASE RELOCATION (SV)
	*

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6 CHDSCRTI001 1 0E5 (NO INTERMEDIATE PHASE RELOCATION)
*
* DOSE CRITERION FOR LONG-TERM PHASE RELOCATION (SV)
*
7 CHDSCRLT001 0 04
*
* CRITICAL ORGAN NAME FOR LONG-TERM ACTIONS
*
8 CHCRTOCR001 'EDEWBODY'
*****
* DECONTAMINATION PLAN DATA BLOCK
*
* NUMBER OF LEVELS OF DECONTAMINATION
*
9 CHLVLDEC001 2
*
* DECONTAMINATION TIMES CORRESPONDING TO THE LVLDEC LEVELS OF DECONTAMINATION
* (SECONDS)
*
10 CHTIMDEC001 5 184E6 1 0368E7 (60, 120 DAYS)
*
* DOSE REDUCTION FACTORS CORRESPONDING TO THE LVLDEC LEVELS OF DECONTAMINATION
*
11 CHDSRFACT001 3 15
*
* COST OF FARM DECONTAMINATION PER FARMLAND UNIT AREA (DOLLARS/HECTARE)
* FOR THE VARIOUS LEVELS OF DECONTAMINATION
*
12 CHCDPRM0001 562 5 1250
*
* COST OF NONFARM DECONTAMINATION PER RESIDENT PERSON (DOLLARS/PERSON)
* FOR THE VARIOUS LEVELS OF DECONTAMINATION
*
13 CHCDNPRM001 3000 8000
*
* FRACTION OF FARMLAND DECONTAMINATION COST DUE TO LABOR
* FOR THE VARIOUS DECONTAMINATION LEVELS
*
14 CHFRFDL0001 3 35
*
* FRACTION OF NON-FARM DECONTAMINATION COST DUE TO LABOR
* FOR THE VARIOUS DECONTAMINATION LEVELS
*
15 CHFRNFDL001 7 5
*
* FRACTION OF TIME WORKERS IN FARM AREAS SPEND IN CONTAMINATED AREAS
* FOR THE VARIOUS DECONTAMINATION LEVELS
*
16 CHTIWKPF0001 10 33
*
* FRACTION OF TIME WORKERS IN NON FARM AREAS SPEND IN CONTAMINATED AREAS
* FOR THE VARIOUS DECONTAMINATION LEVELS
*
17 CHTFWANF001 33 33
*
* AVERAGE COST OF DECONTAMINATION LABOR (DOLLARS/MAN-YEAR)
*
18 CHDLBCST001 35000
*****
* INTERDICTION COST DATA BLOCK
*
* DEPRECIATION (DETERIORATION) RATE DURING INTERDICTION PERIOD (PER YEAR)
*
19 CHDPRATE001 20 (VALUE OBTAINED FROM WASH 1400, APPENDIX 6)
*
* INVESTMENT INCOME RETURN (DISCOUNT RATE) DURING INTERDICTION PERIOD (PER YEAR)

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* THIS VALUE SHOULD BE DERIVED AS A REAL RETURN RATE ADJUSTED FOR INFLATION
*
20 CHDSKAT1001 12 (VALUE OBTAINED FROM WASH 1400, APPENDIX 6)
*
* POPULATION RELOCATION COST (DOLLARS/PERSON)
* ALTERNATIVE HOUSING, MOVING COSTS, AND LOST INCOME FOR PEOPLE IN
* AREAS WHICH REQUIRE DECONTAMINATION, INTERDICTION, OR CONDEMNATION
*
21 CHGOWCS1001 5000
*****
* GROUNDSHINE WEATHERING DEFINITION DATA BLOCK
*
* NUMBER OF TERMS IN THE GROUNDSHINE WEATHERING RELATIONSHIP (EITHER 1 OR 2)
*
22 CHNGWTRM001 2
*
* GROUNDSHINE WEATHERING COEFFICIENTS
*
23 CHGWCDEF001 0 5 0 5 (JON HELTON)
*
* HALF LIVES CORRESPONDING TO THE GROUNDSHINE WEATHERING COEFFICIENTS (S)
*
24 CHTGWHILF001 1 6E7 2 8E9 (JON HELTON)
*****
* RESUSPENSION WEATHERING DEFINITION DATA BLOCK
*
* NUMBER OF TERMS IN THE RESUSPENSION WEATHERING RELATIONSHIP
*
25 CHNRWTRM001 3
*
* RESUSPENSION CONCENTRATION COEFFICIENTS (/ METER)
* RELATIONSHIP BETWEEN GROUND CONCENTRATION AND INSTANTANEOUS AIR CONC
*
26 CHRWCOEF001 1 0E 5 1 0E-7 1 0E-9 (VALUES HERE SELECTED BY JON HELTON)
*
* HALF-LIVES CORRESPONDING TO THE RESUSPENSION CONCENTRATION COEFFICIENTS (S)
*
27 CHTRWHILF001 1 6E7 1 6E8 1 6E9 (6 MONTHS, 5 YEARS, 50 YEARS)
*****
* SITE REGION DESCRIPTION DATA BLOCK
*
* FRACTION OF AREA THAT IS LAND IN THE REGION
*
28 CHFRACLD001 0 95 (ROUGH GUESS VALUE, SITE FILE OVERRIDES THIS VALUE)
*
* FRACTION OF LAND DEVOTED TO FARMING IN THE REGION
*
29 CHFRCPRM001 0 382 (VIRGINIA STATE VALUE, SITE FILE OVERRIDES THIS VALUE)
*
* AVERAGE VALUE OF ANNUAL FARM PRODUCTION IN THE REGION (DOLLARS/HECTARE)
* (CASH RECEIPTS FROM FARMING PLUS VALUE OF HOME CONSUMPTION)/(LAND IN FARMS)
*
30 CHFRMPRD001 371 0 (VIRGINIA STATE VALUE, SITE FILE OVERRIDES THIS VALUE)
*
* FRACTION OF FARM PRODUCTION RESULTING FROM DAIRY PRODUCTION IN THE REGION
* (VALUE OF MILK PRODUCED)/(CASH RECEIPTS FROM FARMING PLUS HOME CONSUMPTION)
*
31 CHDPFRCT001 0 198 (VIRGINIA STATE VALUE, SITE FILE OVERRIDES THIS VALUE)
*
* VALUE OF FARM WEALTH (DOLLARS/HECTARE)
* (AVERAGE VALUE PER HECTARE OF FARM LAND AND BUILDINGS TO 100 MILES)
*
32 CHVALWF0001 2613 * SURRY
*
* FRACTION OF FARM WEALTH IN IMPROVEMENTS FOR THE REGION
*

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47 CHWTRISO002 SR 90 0 01 0 004 5 OF 6
48 CHWTRISO003 CS 134 0 005 0 001 5 OF 6
49 CHWTRISO004 CS 137 0 005 0 001 5 OF 6
*****
* FOOD PATHWAY DEFINITION DATA
*
* NUMBER OF NUCLIDES IN THE CHRONC FOOD INGESTION MODEL
*
50 CHNTRISO001 6 (UP TO 10 ALLOWED, BEWARE THAT DAUGHTER BUILDUP IS NOT TREATED)
*
* TABLE OF NUCLIDE DEFINITIONS IN THE CHRONC INGESTION PATHWAY MODEL
*
* NUCLIDES THAT WERE DEFINED IN THE WATER PATHWAY DATA ABOVE MUST BE
* A SUBSET OF THE CHRONC INGESTION FOOD PATHWAY NUCLIDES THE WATER
* PATHWAY NUCLIDES MUST BE LISTED FIRST IN THIS DATA BLOCK AND IN THE
* SAME ORDER AS THEY WERE LISTED IN THE WATER PATHWAY DATA BLOCK
*
*
* INGESTION RETENTION FACTORS TRANSFER FACTORS
* NUCLIDE PROCESSING AND DECAY [(BQ TRANSFERED)/
* MILK/MAN MEAT/MAN (BQ INGESTED)]
* MILK MEAT
*
51 CHISODEF001 NAMIPI DCYPMH DCYPBH TFMLK TFBF
52 CHISODEF002 SR-89 0 66 0 77 0 022 0 00022
53 CHISODEF003 SR-90 1 0 1 0 0 022 0 00022
54 CHISODEF004 CS-134 1 0 1 0 0 11 0 023
55 CHISODEF005 CS-137 1 0 1 0 0 11 0 024
56 CHISODEF006 I-131 0 28 0 18 0 13 0 0024
57 CHISODEF006 I 133 0 002 0 0 0 062 0 0011
*****
* TRANSFER FACTOR FROM SOIL TO PLANT BY ROOT UPTAKE (AND BY SOIL INGESTION FOR
* GRAZING ON PASTURE) INTEGRATED OVER ALL TIME [(BQ TRANSFERED)/(BQ DEPOSITED)]
*
*
* NUCLIDE PASTURE STORED GREEN OTHER LEGUMES ROOTS
* FORAGE FORAGE VEG FOOD AND AND
* CROPS SEEDS TUBERS
*
57 CHTCROOT001 NAMIPI TCROOT TCROOT TCROOT TCROOT TCROOT TCROOT TCROOT
58 CHTCROOT002 SR-89 4 1E-4 1 3E-3 4 3E-5 1 7E-4 8 6E-6 3 7E-4 1 1E-4
59 CHTCROOT003 SR-90 2 6E-2 9 0E-2 3 3E-3 1 3E-2 6 6E-4 2 8E-2 8 4E-3
60 CHTCROOT004 CS-134 1 3E-3 7 1E-4 3 5E-5 1 4E-5 1 1E-4 9 3E-5 5 6E-5
61 CHTCROOT005 CS-137 6 9E-3 1 5E-3 7 6E-5 3 0E-5 2 3E-4 2 0E-4 1 2E-4
62 CHTCROOT006 I-131 1 6E-4 0 0 0 0 0 0 0 0 0 0
63 CHTCROOT006 I-133 1 7E-6 0 0 0 0 0 0 0 0 0 0
*****
* RADIOACTIVE DECAY RETENTION FACTORS (I E, 1 - F WHERE F = FRACTION OF
* RADIOACTIVITY LOST BY DECAY) FOR NUCLIDES IN CROPS FROM TIME OF HARVEST
* TO TIME OF CONSUMPTION BY HUMANS (FRACTION RETAINED)
*
*
* NUCLIDE PASTURE STORED GREEN OTHER LEGUMES ROOTS
* FORAGE FORAGE VEG CROPS SEEDS TUBERS
*
63 CHDCYPCH001 NAMIPI DCYPCH DCYPCH DCYPCH DCYPCH DCYPCH DCYPCH DCYPCH
64 CHDCYPCH002 SR-89 0 0 0 0 0 18 0 67 0 21 0 18 0 18
65 CHDCYPCH003 SR-90 0 0 0 0 0 99 1 0 0 99 0 99 0 99
66 CHDCYPCH004 CS-134 0 0 0 0 0 84 0 96 0 85 0 84 0 84
67 CHDCYPCH005 CS-137 0 0 0 0 0 99 1 0 0 99 0 99 0 99
68 CHDCYPCH006 I-131 0 0 0 0 0 0099 0 21 0 024 0 0099 0 0099
69 CHDCYPCH006 I-133 0 0 0 0 0 0 0 0 0 0 0 0 0
*****
* RETENTION FACTORS FOR NUCLIDES IN CROPS FROM TIME OF HARVEST TO TIME OF
* CONSUMPTION BY MILK PRODUCING ANIMALS (FRACTION RETAINED) FACTOR REFLECTS
* LOSSES DUE TO RADIOACTIVE DECAY
*
*
* GREEN OTHER LEGUMES ROOTS

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* OF CTCEP1.
*
* TWO TIME PERIODS ARE USED FOR WEATHERING, THE FIRST IS 14 DAYS LONG (1.21E6
* SECONDS) AND THE SECOND IS 50 DAYS LONG (4.32E6 SECONDS).
*
* DIRECT DEPOSITION TRANSFER COEFFICIENTS BY CHRONC INGESTION MODEL NUCLIDE
* ((BQ TRANSFERED)/(BQ DEPOSITED))
*
*
*   * TERM 1   NUCLIDE  PASTURE  STORED  GREEN  OTHER  LEGUMES  ROOTS
*   *          *        *        *        *        *        *        *
*   *          *        *        *        *        *        *        *
88  CHCTCOEF101  SR-89   0.3      0.2      0.01   0.24   0.2      0.005  0.0006
89  CHCTCOEF102  SR-90   0.3      0.2      0.01   0.24   0.2      0.005  0.0006
90  CHCTCOEF103  CS-134  0.3      0.2      0.05   0.24   0.2      0.01   0.025
91  CHCTCOEF104  CS-137  0.3      0.2      0.05   0.24   0.2      0.01   0.025
92  CHCTCOEF105  I-131   0.3      0.2      0.0     0.24   0.2      0.0     0.0
93  CHCTCOEF106  I-133   0.3      0.2      0.0     0.24   0.2      0.0     0.0
*   * TERM 2
94  CHCTCOEF201  SR-89   0.076   0.05   0.0     0.06   0.05   0.0     0.0
95  CHCTCOEF202  SR-90   0.076   0.05   0.0     0.06   0.05   0.0     0.0
96  CHCTCOEF203  CS-134  0.076   0.05   0.0     0.06   0.05   0.0     0.0
97  CHCTCOEF204  CS-137  0.076   0.05   0.0     0.06   0.05   0.0     0.0
98  CHCTCOEF205  I-131   0.076   0.05   0.0     0.06   0.05   0.0     0.0
99  CHCTCOEF206  I-133   0.076   0.05   0.0     0.06   0.05   0.0     0.0
*
*   * CROP TRANSFER HALF-LIVES BY CHRONC INGESTION MODEL NUCLIDE (SECONDS)
*
*   *
*   *   * TERM 1   NUCLIDE  PASTURE  STORED  GREEN  OTHER  LEGUMES  ROOTS
*   *   *          *        *        *        *        *        *        *
100  CHCTHALF101  SR-89   1.21E6  1.21E6  1E13   1.21E6  1.21E6  1E13  1E13
101  CHCTHALF102  SR-90   1.21E6  1.21E6  1E13   1.21E6  1.21E6  1E13  1E13
102  CHCTHALF103  CS-134  1.21E6  1.21E6  1E13   1.21E6  1.21E6  1E13  1E13
103  CHCTHALF104  CS-137  1.21E6  1.21E6  1E13   1.21E6  1.21E6  1E13  1E13
104  CHCTHALF105  I-131   1.21E6  1.21E6  1.0    1.21E6  1.21E6  1.0    1.0
105  CHCTHALF106  I-133   1.21E6  1.21E6  1.0    1.21E6  1.21E6  1.0    1.0
*   * TERM2
106  CHCTHALF201  SR-89   4.32E6  4.32E6  1.0    4.32E6  4.32E6  1.0    1.0
107  CHCTHALF202  SR-90   4.32E6  4.32E6  1.0    4.32E6  4.32E6  1.0    1.0
108  CHCTHALF203  CS-134  4.32E6  4.32E6  1.0    4.32E6  4.32E6  1.0    1.0
109  CHCTHALF204  CS-137  4.32E6  4.32E6  1.0    4.32E6  4.32E6  1.0    1.0
110  CHCTHALF205  I-131   4.32E6  4.32E6  1.0    4.32E6  4.32E6  1.0    1.0
111  CHCTHALF206  I-133   4.32E6  4.32E6  1.0    4.32E6  4.32E6  1.0    1.0
*****
*   * TABLE OF CROP DATA (GROWING SEASON AND FARMLAND SHARE) IN THE REGION.
*
*   * IF A SITE DATA FILE IS BEING USED (AS SPECIFIED ON THE EARLY USER INPUT FILE),
*   * THEN DATA FROM THE SITE FILE (AND NOT THE DATA BELOW) IS USED FOR THE
*   * CALCULATION OF DOSES AND COSTS FROM THE AGRICULTURE MODEL AND THE NUMBERS
*   * BELOW ARE NOT UTILIZED IN THE CALCULATIONS.
*
*   * IF A SITE DATA FILE IS NOT BEING USED, THE DATA BELOW IS USED IN ITS STEAD.
*
*   * IN ALL CASES, THE USER MUST SUPPLY VALID VALUES FOR THE PARAMETERS BELOW.
*
*   *
*   *           GROWING
*   *           SEASON (DAYS)  FARMLAND
*   *           START  END    SHARE
*   *
*   *   * NAMCRP      TGSBEG  TGSEND  PRCTFL
112  CHCRPRGN001 'PASTURE      ' 90.  270.  0.41
113  CHCRPRGN002 'STORED FORAGE  ' 150. 240.  0.13
114  CHCRPRGN003 'GRAINS        ' 150. 240.  0.21
115  CHCRPRGN004 'GRN LEAFY VEGETABLES' 150. 240.  0.002
116  CHCRPRGN005 'OTHER FOOD CROPS ' 150. 240.  0.004
117  CHCRPRGN006 'LEGUMES AND SEEDS ' 150. 240.  0.15
118  CHCRPRGN007 'ROOTS AND TUBERS ' 150. 240.  0.003

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*****
* FLAG DETERMINING WHETHER OR NOT THE FOOD ACTIONS ARE COUPLED
*
119 CHCOUPLD001 .FALSE. (GROWING-SEASON ACTIONS INDEPENDENT OF LONG-TERM ACTIONS)
*
* PROTECTIVE ACTION GUIDES FOR THE GROWING-SEASON PATHWAY FOR BOTH MILK
* AND NON-MILK CROPS, DEFINED SEPARATELY AS PSCMLK AND PSCOTH.
*
* THESE VALUES ARE CALCULATED OUTSIDE OF THE CODE BY ASSUMING THAT THE
* ACCIDENT OCCURED IN THE MIDDLE OF THE GROWING SEASON. THESE VALUES
* ARE THE GROUND CONCENTRATION OF EACH NUCLIDE (ASSUMING A SINGLE NUCLIDE
* RELEASE) WHICH WOULD RESULT IN A MAXIMALLY EXPOSED INDIVIDUAL RECEIVING
* A DOSE NOT EXCEEDING 0.05 SIEVERT EFFECTIVE-WHOLE-BODY-DOSE-EQUIVALENT
* OR 0.15 SIEVERT TO THE THYROID. THE UNITS ARE (BECQUERELS / SQUARE-METER).
*
*
*          NUCLIDE      MILK AND      OTHER CROPS
*                        PRODUCTS      AND PRODUCTS
*
120 CHPAGMCP001  SR-89      2.2E07      2.2E07
121 CHPAGMCP002  SR-90      2.4E05      2.4E05
122 CHPAGMCP003  CS-134     2.2E05      2.2E05
123 CHPAGMCP004  CS-137     2.7E05      2.7E05
124 CHPAGMCP005  I-131      1.3E06      8.0E06
125 CHPAGMCP006  I-133      1.1E10      1.0E20
*****
* PROTECTIVE ACTION GUIDES FOR LONG-TERM AGRICULTURAL PRODUCTION, GCMAXR, AND
* THE RATE AT WHICH EACH RADIONUCLIDE BECOMES UNAVAILABLE FOR UPTAKE, QROOT.
*
* GCMAXR VALUES ARE CALCULATED OUTSIDE OF THE CODE BY ASSUMING THAT THE ACCIDENT
* IS EQUALLY LIKELY THROUGHOUT THE YEAR. THESE VALUES ARE THE GROUND
* CONCENTRATION OF EACH NUCLIDE (ASSUMING A SINGLE NUCLIDE RELEASE) WHICH
* WOULD RESULT IN A MAXIMALLY EXPOSED INDIVIDUAL RECEIVING A DOSE COMMITMENT
* NO GREATER THAN 0.005 SIEVERT EFFECTIVE-WHOLE-BODY-DOSE-EQUIVALENT OR
* 0.015 SIEVERT TO THE THYROID AS A RESULT OF AN EXPOSURE INTEGRATED
* FROM T=0 TO T-INFINITY. THE DECISION TO CALCULATE GCMAXR VALUES
* BASED ON AN INFINITE EXPOSURE DURATION WAS MADE BY NRC STAFF.
* THE UNITS ARE (BQ/SQUARE-METER).
*
* QROOT VALUES ARE DERIVED TO TAKE ACCOUNT OF THE COMBINED EFFECT OF
* PERCOLATION, CHEMICAL BINDING AND RADIOACTIVE DECAY IN REDUCING THE AMOUNT
* OF MATERIAL AVAILABLE FOR LONG-TERM UPTAKE INTO FOOD IN UNITS OF (PER YEAR).
*
*
126 CHPAGLTS001  SR-89      1.8E8      4.9
127 CHPAGLTS002  SR-90      3.7E4      0.065
128 CHPAGLTS003  CS-134     4.1E6      0.59
129 CHPAGLTS004  CS-137     1.8E6      0.28
130 CHPAGLTS005  I-131      1.E20      32.0
131 CHPAGLTS006  I-133      1.E20      290.0
*
* AN ALTERNATIVE METHOD FOR DERIVING VALUES FOR GCMAXR IS TO BASE THEM
* ON A ONE YEAR EXPOSURE PERIOD INSTEAD OF AN INFINITE EXPOSURE PERIOD.
* IF THE USER WOULD LIKE TO ADOPT THIS APPROACH, A SET OF APPROPRIATE
* VALUES CAN BE FOUND IN THE FOLLOWING COMMENT CARDS. THE VALUES BELOW
* CORRESPOND TO A MAXIMALLY EXPOSED INDIVIDUAL RECEIVING A DOSE COMMITMENT
* NO GREATER THAN 0.005 SIEVERT EFFECTIVE-WHOLE-BODY-DOSE-EQUIVALENT OR
* 0.015 SIEVERT TO THE THYROID AS A RESULT OF CONSUMING CONTAMINATED FOOD
* OVER A ONE YEAR EXPOSURE PERIOD.
* IN ORDER TO USE A DIFFERENT DOSE LIMIT, RATIO THE VALUE OF GCMAXR.
*
*
*          NAMIFI      GCMAXR      QROOT
*CHPAGLTS001  SR-89      1.8E8      4.9
*CHPAGLTS002  SR-90      5.9E5      0.065
*CHPAGLTS003  CS-134     9.2E6      0.59
*CHPAGLTS004  CS-137     7.4E6      0.28

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*CHPAGLTS005  I-131      1 E20      32 0
*CHPAGLTS006  I 133      1 I20      290 0
*****
* DEFINE THE TYPE 9 RESULTS
*
* LONG TERM POPULATION DOSE IN A GIVEN REGION BROKEN DOWN BY THE 12 PATHWAYS
*
* NUMBER OF RESULTS OF THIS TYPE THAT ARE BEING REQUESTED
* FOR EACH RESULT YOU REQUEST, THE CODE WILL PRODUCE A SET OF 12
*
132 TYP9NUMBER  2      (UP TO 10 ALLOWED)
*
*          ORGNAM      INNER      OUTER
*
133 TYPE9OUT001  'EDEWBODY'      1      26      (0-1000 MILES)
134 TYPE9OUT002  'EDEWBODY'      1      19      (0-50 MILES)
*****
* ECONOMIC COST RESULTS IN A REGION BROKEN DOWN BY 12 TYPES OF COSTS
*
* NUMBER OF RESULTS OF THIS TYPE THAT ARE BEING REQUESTED
* FOR EACH RESULT YOU REQUEST, THE CODE WILL PRODUCE A SET OF 12
*
135 TYP10NUMBER 2      (UP TO 10 ALLOWED)
*
*          INNER      OUTER
*
136 TYP10OUT001  1      26      (0-1000 MILES)
137 TYP10OUT002  1      19      (0-50 MILES)
*****
* DEFINE A FLAG THAT CONTROLS THE PRODUCTION OF THE ACTION DISTANCE RESULTS
*
* SPECIFYING A VALUE OF TRUE TURNS ON ALL 8 OF THE ACTION DISTANCE RESULTS,
* A VALUE OF FALSE WILL ELIMINATE THE ACTION DISTANCE RESULTS FROM THE OUTPUT
*
138 TYP11FLAG11 TRUE
*****
* IMPACTED AREA/POPULATION RESULTS IN A REGION BROKEN DOWN BY 6 TYPES OF IMPACTS
*
* NUMBER OF RESULTS OF THIS TYPE THAT ARE BEING REQUESTED
* FOR EACH RESULT YOU REQUEST, THE CODE WILL PRODUCE A SET OF 8
*
139 TYP12NUMBER 2      (UP TO 10 ALLOWED)
*
*          INNER      OUTER
*
140 TYP12OUT001  1      26      (0-1000 MILES)
141 TYP12OUT002  1      19      (0-50 MILES)
*****
***** TERMINATOR RECORD ENCOUNTERED -- END OF BASE CASE USER INPUT *****

USLR INPUT PROCESSING SUMMARY  BASE CASE

NUMBER OF RECORDS READ              = 537
NUMBER OF BLANK OR COMMENT RECORDS READ = 395
NUMBER OF TERMINATOR RECORDS        = 1
NUMBER OF RECORDS PROCESSED          = 141
NUMBER OF PROCESSED RECORDS DUPLICATED = 0
NUMBER OF PROCESSED RECORDS SORTED   = 141
*****

A SITE DATA FILE IS BEING USED FOR BOTH "EARLY" AND "CHRONC"

9 ORGANS ARE DEFINED IN THE "EARLY" MODEL

```

1 KIN
 2 IDIWHODY
 3 LUNG
 4 KID MARR
 5 LOWER LI
 6 STOMACH
 7 THYROIDH
 8 BONE SUR
 9 BREAST

6 ORGAN ARI UTILIZED IN THE CHRONIC MODEL
 1 SKIN
 2 IDIWHODY
 3 KID MARR
 4 BONE SUR
 5 BREAST
 6 LUNG
 7 THYROIDH
 8 LOWER LI

THE CRITICAL ORGAN FOR EARLY WAS EDEWHODY
 THE CRITICAL ORGAN FOR LONG TERM ACTION IS EDEWHODY

/ CANCER EFFECTS ARE DEFINED IN THE MODEL
 INDEX CANCER EFFECT ORGAN ALPHA BETA CPMKISK CIRISK
 1 LEUKEMIA RED MARR 3 900E 01 6 100F 01 3 700E 03 3 700E 03
 2 BONE BONE SUR 3 900E 01 6 100F 01 1 500E 04 1 500E 04
 3 BREAST BONE SUR 1 000F+00 0 000+00 6 000F 03 1 700E 02
 4 LUNG LUNG 3 900F 01 6 100F 01 5 100L 03 5 700E 03
 5 THYROID THYROIDH 1 000L+00 0 000+00 7 200L 04 7 200E 03
 6 GI LOWER LI 3 900E 01 6 100F 01 1 700E 02 2 500E 02
 7 OTHER LOWER LI 3 900E 01 6 100F 01 7 500E 03 1 100E-02

TIME OF HOTSPOT RELOCATION IS 4 3200E+04
 TIME OF NORMAL RETURN IS 8 640E+04 AND THE EMERGENCY PHASE ENDS AT 6 048E+04

GROUNDSHINE SHIELDING FACTOR = 0 330
 RESUSPLSION PROTECTION FACTOR = 0 410
 BREATHING RATE (CUBIC M/S) = 2 660E-04

DISPERSION MODEL FLAG IS 2, EVACUATION MODEL FLAG IS 1
 WINDROSE PROBABILITIES BY WIND DIRECTION AND MET BIN NUMBER
 BIN 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
 1 0 0324 0 0408 0 0366 0 0293 0 0773 0 0878 0 0805 0 0554 0 0596 0 0460 0 0387 0 0690 0 0888 0 0899 0 1396 0 0387
 2 0 0085 0 0753 0 1216 0 0803 0 0423 0 0930 0 0877 0 0941 0 0941 0 0666 0 0529 0 0909 0 0655 0 0106 0 0127 0 0042
 3 0 0581 0 0930 0 0465 0 0465 0 1163 0 0465 0 0533 0 0581 0 0814 0 0465 0 0465 0 0349 0 0465 0 0698 0 1379 0 0581
 4 0 0350 0 0402 0 0542 0 0629 0 0524 0 0804 0 0574 0 0717 0 0699 0 0717 0 0752 0 0590 0 0838 0 0962 0 0524 0 0420
 5 0 0147 0 0625 0 0662 0 0368 0 0588 0 0662 0 0570 0 0625 0 0627 0 0827 0 1305 0 0780 0 1140 0 0436 0 0313 0 0055
 6 0 0106 0 0881 0 1033 0 0745 0 0365 0 0198 0 0304 0 1459 0 1201 0 1074 0 0927 0 0942 0 0562 0 0030 0 0076 0 0046
 7 0 0138 0 1103 0 0759 0 0759 0 0345 0 0207 0 0828 0 2414 0 1448 0 0276 0 0828 0 0621 0 0276 0 0000 0 0000 0 0000
 8 0 0000 0 3636 0 0000 0 0000 0 0000 0 0000 0 0000 0 0000 0 0000 0 0000 0 0000 0 0000 0 0000 0 0000 0 0000
 9 0 1014 0 0811 0 0541 0 0405 0 1081 0 0405 0 0405 0 0405 0 0203 0 0338 0 0338 0 0341 0 0541 0 0946 0 0946 0 1081
 10 0 0599 0 0629 0 0629 0 0629 0 0808 0 0584 0 0374 0 0284 0 0569 0 0689 0 0464 0 0314 0 1003 0 1557 0 0479 0 0389
 11 0 0633 0 1346 0 0805 0 0567 0 0356 0 0356 0 0396 0 0778 0 1346 0 0765 0 0897 0 0851 0 0633 0 0528 0 0145 0 0264
 12 0 0551 0 2404 0 1302 0 0885 0 0518 0 0367 0 0651 0 1202 0 0735 0 0518 0 0351 0 0200 0 0134 0 0017 0 0100 0 0067
 13 0 1382 0 1008 0 0711 0 0388 0 0413 0 0491 0 0556 0 0388 0 0375 0 0284 0 0181 0 0310 0 0271 0 0788 0 0904 0 1550
 14 0 1634 0 1489 0 0646 0 0711 0 0685 0 0487 0 0580 0 0461 0 0817 0 0343 0 0132 0 0132 0 0079 0 0224 0 0527 0 1054
 15 0 2069 0 2897 0 1241 0 1034 0 0759 0 0690 0 0000 0 138 0 0276 0 0669 0 0069 0 0000 0 0069 0 0069 0 0000
 16 0 1667 0 3333 0 1667 0 0000 0 0833 0 0000 0 0000 0 1667 0 0833 0 0000 0 0000 0 0000 0 0000 0 0000 0 0000
 17 0 1033 0 0409 0 0450 0 0235 0 0307 0 0501 0 0593 0 0654 0 0511 0 0399 0 0573 0 0910 0 1237 0 0470 0 0838 0 0879
 18 0 1033 0 0409 0 0450 0 0235 0 0307 0 0501 0 0593 0 0654 0 0511 0 0399 0 0573 0 0910 0 1237 0 0470 0 0838 0 0879
 19 0 1033 0 0409 0 0450 0 0235 0 0307 0 0501 0 0593 0 0654 0 0511 0 0399 0 0573 0 0910 0 1237 0 0470 0 0838 0 0879
 20 0 1033 0 0409 0 0450 0 0235 0 0307 0 0501 0 0593 0 0654 0 0511 0 0399 0 0573 0 0910 0 1237 0 0470 0 0838 0 0879

21	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
22	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
23	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
24	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
25	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
26	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
27	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
28	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
29	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
30	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
31	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
32	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
33	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
34	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
35	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
36	0	1033	0	0409	0	0450	0	0235	0	0307	0	0501	0	0593	0	0654	0	0511	0	0399	0	0573	0	0910	0	1237	0	0470	0	0838	0	0879
37	0	0663	0	0947	0	0750	0	0559	0	0537	0	0573	0	0572	0	0735	0	0766	0	0572	0	0553	0	0558	0	0663	0	0537	0	0519	0	0495
38	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000
39	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000
40	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000
41	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000	0	0000

MACCS SITE DATA FILE FOR SURRY (JLS, 11/10/88)
 SECPPOP POP DISTRIBUTION FROM 1980 CENSUS DATA ALTERED USING 0-10 MI NRC DATA
 MACCS DOSE CONVERSION FILE CHANGED BY D. CHANIN 1-NOV-89, 15 18 00
 APPLY THE THYROID REDUCTION FACTORS TO ONLY 1-131

THIS PROGRAM CURRENTLY ALLOWS THE GENERATION OF UP TO 600 RESULTS

YOU HAVE REQUESTED 41 RESULTS FROM "EARLY" COMPOSED OF

27 RESULTS OF TYPE 1
1 RESULTS OF TYPE 2
3 RESULTS OF TYPE 3
5 RESULTS OF TYPE 4
3 RESULTS OF TYPE 5
0 RESULTS OF TYPE 6
0 RESULTS OF TYPE 7
2 RESULTS OF TYPE 8

YOU HAVE REQUESTED 72 RESULTS FROM "CHRONC" COMPOSED OF:

24 RESULTS OF TYPE 9
24 RESULTS OF TYPE 10
8 RESULTS OF TYPE 11
16 RESULTS OF TYPE 12

TRIAL	DAY	HOOR	BIN	PRBMET
1	153	15	24	4 57E-04
2	157	10	1	2 73E-02
3	163	14	21	3 62E-03
4	166	7	9	4 22E-03
5	167	17	2	2 70E-02
6	168	4	12	1 71E-02
7	171	7	6	1 88E-02
8	171	13	36	2 28E-04
9	171	15	35	4 00E-04
10	171	16	32	5 42E-04
11	179	24	31	2 00E-04
12	180	2	30	1 43E-04
13	180	23	10	1 91E-02
14	181	15	25	6 85E-04
15	188	8	4	1 63E-02
16	193	3	18	1 17E-03
17	195	22	15	4 14E-03
18	200	14	36	2 28E-04
19	201	21	34	1 43E-04
20	203	6	31	2 00E-04
21	203	8	31	2 00E-04
22	203	9	31	2 00E-04
23	203	10	30	1 43E-04
24	203	11	29	1 14E-04
25	204	9	36	2 28E-04
26	204	11	35	4 00E-04
27	204	12	34	1 43E-04
28	204	14	32	5 42E-04
29	205	24	11	2 16E-02
30	215	18	3	2 45E-03
31	220	5	5	1 55E-02
32	222	21	16	3 42E-04
33	224	4	27	4 85E-04
34	228	5	13	2 21E-02
35	229	24	7	4 14E-03
36	231	2	20	3 77E-03
37	232	14	30	1 43E-04
38	232	16	22	2 11E-03
39	232	22	35	4 00E-04
40	232	23	34	1 43E-04
41	235	19	14	2 17E-02
42	240	3	26	7 71E-04
43	244	21	19	2 94E-03
44	248	20	9	4 22E-03
45	250	22	26	7 71E-04
46	251	2	25	6 85E-04
47	253	2	13	2 21E-02
48	263	16	17	1 00E-02
49	268	8	4	1 63E-02
50	270	3	14	2 17E-02

TRIAL	DAY	HOUR	BIN	PRBMET
51	271	20	10	1 91E-02
52	272	10	1	2 73E-02
53	282	6	10	1 17E-03
54	286	22	24	4 57E-04
55	288	10	2	2 70E-02
56	299	10	32	5 42E-04
57	299	11	27	4 85E-04
58	301	2	11	2 16E-02
59	301	15	5	1 55E-02
60	307	5	6	1 88E-02
61	309	11	21	3 62E-03
62	309	14	19	2 94E-03
63	309	20	9	4 22E-03
64	311	18	3	2 45E-03
65	315	21	20	3 77E-03
66	319	5	10	1 91E-02
67	321	9	4	1 63E-02
68	330	9	19	2 94E-03
69	330	10	18	1 17E-03
70	330	18	36	2 28E-04
71	335	23	8	3 14E-04
72	335	24	8	3 14E-04
73	336	7	22	2 11E-03
74	336	21	23	1 14E-04
75	342	16	3	2 45E-03
76	346	13	1	2 73E-02
77	347	22	11	2 16E-02
78	348	9	9	4 22E-03
79	357	21	17	1 00E-02
80	358	12	22	2 11E-03
81	358	14	27	4 85E-04
82	358	17	32	5 42E-04
83	365	16	3	2 45E-03
84		16	5	1 55E-02
85	9	6	15	4 14E-03
86	12	23	12	1 71E-02
87	12	24	16	3 42E-04
88	13	5	14	2 17E-02
89	15	10	2	2 70E-02
90	23	9	7	4 14E-03
91	25	6	20	3 77E-03
92	25	10	18	1 17E-03
93	29	14	17	1 00E-02
94	32	5	13	2 21E-02
95	37	18	8	3 14E-04
96	47	11	4	1 63E-02
97	48	12	16	3 42E-04
98	49	10	26	7 71E-04
99	50	18	24	4 57E-04
100	51	19	5	1 55E-02

TRIAL	DAY	HOUR	BIN	PRBNET
101	53	1	6	1.88E-02
102	53	13	21	3.62E-03
103	57	22	17	1.00E-02
104	59	20	13	2.21E-02
105	65	14	7	4.14E-03
106	69	2	12	1.71E-02
107	71	24	25	6.85E-04
108	72	3	25	6.85E-04
109	72	4	23	1.14E-04
110	72	14	20	3.77E-03
111	74	20	23	1.14E-04
112	78	9	8	3.14E-04
113	83	17	6	1.88E-02
114	84	19	10	1.91E-02
115	85	2	14	2.17E-02
116	87	21	15	4.14E-03
117	101	4	16	3.42E-04
118	107	14	19	2.94E-03
119	107	20	21	3.62E-03
120	112	22	7	4.14E-03
121	115	13	2	2.70E-02
122	122	19	11	2.16E-02
123	124	23	15	4.14E-03
124	125	6	12	1.71E-02
125	127	18	26	7.71E-04
126	131	24	24	4.57E-04
127	131	1	22	2.11E-03
128	139	22	35	1.00E-04
129	139	23	34	1.43E-04
130	139	24	33	1.14E-04
131	140	2	30	1.43E-04
132	140	3	29	1.14E-04
133	140	7	27	4.85E-04
134	140	19	29	1.14E-04
135	151	9	1	2.73E-02

DATE AND TIME OF RUN = MACCS 2 NOV 89 14 25 06 VERSION 1 5 11, 10/16/89, D CHANIN
 ATMOS DESCRIPTION = IN1A INP, SURRY SAMPLE PROBLEM A, ATMOS INPUT
 EARLY DESCRIPTION = IN2A INP, SURRY SAMPLE PROBLEM A, EARLY INPUT
 CHRONC DESCRIPTION = IN3A INP, SURRY SAMPLE PROBLEM A, CHRONC

SOURCE FROM 1 OF 2
 SECOND DRAFT 1150 WORST CASE SOURCE TERM FOR EARLY FATALITIES

OVERALL RESULTS OBTAINED BY COMBINING 3 EMERGENCY RESPONSE COHORTS FROM "EARLY" WITH THE WEIGHTING FRACTIONS BELOW APPLIED TO THEM

	FRACTION OF THE PEOPLE

COHORT 1 = EVACUATION WITHIN 10 MILES, RELOCATION MODELS APPLY ELSEWHERE	0 950
COHORT 2 = NO EVACUATION, RELOCATION MODELS APPLY EVERYWHERE	0 050
COHORT 3 = SHELTERING WITHIN 10 MILES, RELOCATION MODELS APPLY ELSEWHERE	0 000

AND THEN MERGING THE 3 RESULTS ABOVE WITH THE SINGLE SET OF RESULTS FROM "CHRONC" DESCRIBED BELOW

COHORT 4 = IN3A INP, SURRY, SAMPLE PROBLEM A, CHRONC

RESULTS WHICH ARE PRODUCED ONLY BY "EARLY" OR ONLY BY "CHRONC" ARE PRESENTED IN LATER SECTIONS

2 NOV 89 14 25 06 PAGE 1	PROB NON ZERO	MEAN	50TH	QUANTILES 90TH 95TH 99TH 99 9TH	PEAK CONS	PEAK PROB	PEAK TRIAL
HEALTH EFFECTS CASES							
ERL FAT/TOTAL	0 1609 KM	0 6828	1 34E+01	2 34E 01 2 80E+01 5 35E+01 1 57E+02 1 17E+03	3 14E+03	2 85E 04	85
ERL INJ/PRODRROMAL VOMIT	0 1609 KM	0 8222	8 88E+01	5 51E+00 1 57E+02 3 14E+02 1 52E+03 4 78E+03	8 05E+03	2 85E 04	85
ERL INJ/DIARRHEA	0-1609 KM	0 7452	4 04E+01	1 39E+00 7 79E+01 1 47E+02 6 54E+02 2 87E+03	5 28E+03	2 85E-04	85
ERL INJ/PNEUMONITIS	0 1609 KM	0 5958	5 58E+00	6 77E 03 1 14E+01 2 55E+01 9 41E+01 3 37E+02	8 63E+02	2 85E 04	85
ERL INJ/THYROIDITIS	0-1609 KM	0 5741	9 92E+00	2 82E 02 1 87E+01 4 50E+01 1 85E+02 6 11E+02	1 22E+03	2 85E 04	85
ERL INJ/HYPOTHYROIDISM	0 1609 KM	0 9600	2 00E+02	4 16E+01 3 97E+02 9 07E+02 3 10E+03 6 06E+03	9 29E+03	5 71E 04	123
ERL INJ/SKIN ERYTHEMA	0-1609 KM	0 9971	3 62E+03	9 52E+02 8 84E+03 1 62E+04 4 05E+04 6 21E+04	1 66E+05	5 71E 05	83
ERL INJ/TRANSEPIDERMAL	0-1609 KM	0 9541	1 11E+03	2 01E+02 2 78E+03 5 51E+03 1 71E+04 2 53E+04	5 20E+04	1 14E 04	75
CAN FAT/TOTAL	0 1609 KM	1 0000	4 95E+03	2 80E+03 1 15E+04 1 60E+04 2 97E+04 3 77E+04	4 37E+04	2 28E 04	4
CAN FAT/LUNG	0 1609 KM	1 0000	5 21E+02	3 07E+02 1 17E+03 1 62E+03 3 02E+03	NOT-FOUND	4 08E+03	1 11E-03 135
CAN FAT/THYROID	0 1609 KM	1 0000	3 27E+02	2 20E+02 7 57E+02 1 01E+03 1 25E+03 1 70E+03	2 48E+03	2 85E-04	123
CAN FAT/BREAST	0 1609 KM	1 0000	1 53E+03	8 09E+02 3 69E+03 5 44E+03 9 23E+03	NOT-FOUND	1 41E+04	1 11E-03 135
CAN FAT/GI	0-1609 KM	1 0000	1 39E+03	7 66E+02 3 36E+03 4 88E+03 8 32E+03 1 22E+04	1 44E+04	2 28E-04	4
CAN FAT/LEUKEMIA	0 1609 KM	1 0000	4 54E+02	2 78E+02 1 07E+03 1 34E+03 2 25E+03 3 43E+03	4 01E+03	2 28E 04	4
CAN FAT/BONE	0-1609 KM	1 0000	2 86E+01	1 90E+01 6 92E+01 8 38E+01 1 18E+02 1 75E+02	2 11E+02	2 28E-04	4
CAN FAT/OTHER	0 1609 KM	1 0000	6 96E+02	3 71E+02 1 61E+03 2 36E+03 4 33E+03 6 03E+03	7 19E+03	2 28E 04	4
CAN INJ/TOTAL	0-1609 KM	1 0000	1 22E+04	7 39E+03 2 82E+04 3 97E+04 7 04E+04 8 51E+04	9 61E+04	2 28E-04	4
CAN FAT/TOTAL	0-80 5 KM	1 0000	6 16E+02	3 29E+02 1 47E+03 2 18E+03 3 37E+03 5 51E+03	8 05E+03	2 85E-04	123
ERL FAT/TOTAL	0-16 1 KM	0 6815	1 33E+01	2 26E-01 2 76E+01 5 29E+01 1 57E+02 1 17E+03	3 14E+03	2 85E-04	85
ERL INJ/PRODRROMAL VOMIT	0-16 1 KM	0 8172	7 97E+01	4 59E+00 1 29E+02 2 19E+02 1 49E+03 4 78E+03	7 84E+03	2 85E-04	85
ERL INJ/DIARRHEA	0-16 1 KM	0 7431	3 83E+01	1 33E+00 7 02E+01 1 27E+02 6 54E+02 2 54E+03	5 18E+03	2 85E-04	85
ERL INJ/PNEUMONITIS	0-16 1 KM	0 5958	5 58E+00	6 77E-03 1 14E+01 2 55E+01 9 41E+01 3 37E+02	8 63E+02	2 85E-04	85
ERL INJ/THYROIDITIS	0 16 1 KM	0 5741	9 92E+00	2 82E-02 1 87E+01 4 50E+01 1 85E+02 6 11E+02	1 22E+03	2 85E-04	85
ERL INJ/HYPOTHYROIDISM	0-16 1 KM	0 9515	1 64E+02	2 31E+01 2 77E+02 8 13E+02 2 88E+03 6 06E+03	9 09E+03	5 71E-04	123
ERL INJ/SKIN ERYTHEMA	0 16 1 KM	0 9929	1 67E+03	3 01E+02 4 78E+03 9 55E+03 2 06E+04	NOT-FOUND	2 56E+04	1 03E-03 100
ERL INJ/TRANSEPIDERMAL	0-16 1 KM	0 9475	8 54E+02	1 15E+02 2 00E+03 4 66E+03 1 48E+04 2 29E+04	2 52E+04	2 85E-04	85
CAN FAT/TOTAL	0-16 1 KM	1 0000	1 43E+02	5 06E+01 2 75E+02 5 91E+02 1 94E+03 3 61E+03	6 17E+03	2 85E-04	123

EARLY FATALITY DISTANCE (KM)
 ERL FAT/TOTAL RISK > 0 000

1 0000	4 41E+00	3 61E+00	8 75E+00	1 15E+01	NOT-FOUND	NOT-FOUND	2 09E+01	2 17E-02	50
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D-64

TABLE 1000 OF 1000 MACC 1 NOV 89 14 25 DE VERSION 1.0 11, 10/16/89, D CHANIN
 NAME DO ORIGIN INIA INI HRRY SAMPLE PROBLEM A, ALMO INPUT
 TABLE OF ORIGIN INJA INI HRRY SAMPLE PROBLEM A, EARLY INPUT

CORRECTED FROM 1 OF 2 WORK CASE SOURCE TERM FOR EARLY FATALITIES
 SECOND DEGREE 1120, WORK CASE SOURCE TERM FOR EARLY FATALITIES

RESULTS FOR A SINGLE EMERGENCY RESPONSE COHORT WITHOUT ANY WEIGHTING FRACTIONS BEING APPLIED

COHORT 1 EVALUATION WITHIN 10 MILES, RADIATION MODELS APPLY ELSEWHERE

2 NOV 89	14 25 06	PAGE 3	PROB NON ZERO	MEAN	50TH	QUANTILES 90TH 95TH	99TH	99 9TH	PEAK CONS	PEAK PROB	PEAK TRIAL
HEALTH EFFECTS CASES											
ERL INJ/TOTAL	0 1609 KM	0 4924	1 22E+01	0 00E+00	2 08E+01	4 60E+01	1 57E+02	1 21E+03	3 27E+03	2 85E-04	85
ERL INJ/PROXIMAL VOMIT	0 1609 KM	0 6225	8 51E+01	1 54E+00	1 47E+02	2 08E+01	1 63E+02	1 83E+03	8 32E+03	2 85E-04	85
ERL INJ/DIARRHEA	0 1609 KM	0 5277	3 84E+01	8 62E-02	7 09E+01	1 33E+02	1 70E+02	2 87E+03	5 48E+03	2 85E-04	85
ERL INJ/PNEUMONITIS	0 1609 KM	0 3925	5 64E+00	0 00E+00	1 14E+01	3 06E+01	9 55E+01	3 72E+02	9 08E+02	2 85E-04	85
ERL INJ/HYPOHYDRODISM	0 1609 KM	0 4799	1 03E+01	0 00E+00	2 03E+01	4 58E+01	1 98E+02	6 67E+02	1 29E+03	2 85E-04	85
ERL INJ/SKIN ERYTHEMA	0 1609 KM	0 8480	2 02E+02	3 84E+01	3 99E+02	8 91E+02	3 15E+03	NOT-FOUND	9 71E+03	1 34E-03	123
ERL INJ/TRANSEPIDERMAL	0 1609 KM	0 9436	3 60E+03	9 23E+02	8 79E+03	1 59E+04	4 05E+04	6 21E+04	1 65E+05	5 71E-05	83
CAN INJ/TOTAL	0 1609 KM	0 8362	1 11E+02	1 67E+02	2 70E+03	5 51E+03	1 71E+04	2 53E+04	5 14E+04	1 14E-04	75
CAN INJ/PROXIMAL VOMIT	0 1609 KM	1 0000	5 26E+02	3 49E+01	1 08E+03	1 36E+03	2 63E+03	5 36E+03	7 54E+03	2 85E-04	123
CAN INJ/DIARRHEA	0 1609 KM	1 0000	8 57E+01	5 75E+01	1 69E+02	2 27E+02	4 36E+02	7 94E+02	1 29E+03	2 85E-04	123
CAN INJ/PNEUMONITIS	0 1609 KM	1 0000	1 35E+02	7 72E+01	3 00E+02	4 17E+02	3 74E+02	2 02E+03	2 55E+03	2 85E-04	123
CAN INJ/HYPOHYDRODISM	0 1609 KM	1 0000	9 85E+01	7 33E+01	2 07E+02	2 51E+02	3 74E+02	4 47E+02	7 40E+02	1 14E-04	112
CAN INJ/SKIN ERYTHEMA	0 1609 KM	1 0000	1 16E+02	7 83E+01	3 32E+02	5 03E+02	5 69E+02	1 23E+03	1 79E+03	2 85E-04	123
CAN INJ/TRANSEPIDERMAL	0 1609 KM	1 0000	3 04E+01	2 16E+01	6 19E+01	7 67E+01	1 20E+02	2 31E+02	3 95E+02	2 85E-04	123
CAN INJ/TOTAL	0 1609 KM	1 0000	5 78E+01	2 26E+01	7 29E+01	9 56E+01	1 31E+02	2 31E+02	3 95E+02	2 85E-04	123
CAN INJ/PROXIMAL VOMIT	0 1609 KM	1 0000	2 05E+02	1 45E+02	4 16E+03	5 70E+03	1 10E+04	2 25E+04	3 36E+04	2 85E-04	123
CAN INJ/DIARRHEA	0 1609 KM	1 0000	3 11E+02	1 24E+01	6 30E+02	1 16E+03	2 19E+03	5 36E+03	7 54E+03	2 85E-04	123
CAN INJ/PNEUMONITIS	0 1609 KM	1 0000	7 60E+01	6 04E-01	2 45E+01	4 57E+01	1 57E+02	1 21E+03	3 27E+03	2 85E-04	85
CAN INJ/HYPOHYDRODISM	0 1609 KM	1 0000	3 62E+01	7 07E-02	6 38E+01	1 21E+02	7 70E+02	3 72E+02	5 48E+03	2 85E-04	85
CAN INJ/SKIN ERYTHEMA	0 1609 KM	1 0000	5 64E+00	0 00E+00	1 14E+01	3 06E+01	9 55E+01	3 72E+02	9 08E+02	2 85E-04	85
CAN INJ/TRANSEPIDERMAL	0 1609 KM	1 0000	1 03E+01	0 00E+00	2 03E+01	4 58E+01	1 98E+02	6 67E+02	1 29E+03	2 85E-04	85
ERL INJ/TOTAL	0 1609 KM	0 7956	1 67E+02	1 52E+01	8 98E+02	8 21E+02	3 03E+03	6 08E+03	9 51E+03	5 71E-04	123
ERL INJ/PROXIMAL VOMIT	0 1609 KM	0 8883	1 65E+02	2 23E+02	4 98E+03	9 67E+03	2 07E+04	NOT-FOUND	2 60E+04	1 21E-03	61
ERL INJ/DIARRHEA	0 1609 KM	0 7793	8 49E+02	4 87E+01	2 05E+03	4 76E+03	1 53E+04	2 52E+04	2 60E+04	7 21E-04	58
ERL INJ/HYPOHYDRODISM	0 1609 KM	0 9074	1 15E+02	1 13E+01	2 17E+02	5 83E+02	1 94E+03	3 61E+03	6 40E+03	2 85E-04	123

EARLY FATALITY DISTANCE (KM)

ERL FAT/TOTAL RISK > 0.000 1 0000 4 24E+00 3 53E+00 8 75E+00 1 15E+01 NOT-FOUND NOT-FOUND 2 09E+01 2 17E-02 50

POPULATION EXCEEDING DOSE

EARLY-ACUTE RISK MAIR > 1.500 SV 0 4924 9 57E+01 0 00E+00 1 15E+02 2 19E+02 2 54E+03 7 43E+03 1 09E+04 2 85E-05 87

EARLY-ACUTE LUNGS > 5.000 SV 0 3925 4 45E+01 0 00E+00 6 09E+01 1 18E+02 7 03E+02 4 76E+03 8 32E+03 2 85E-04 85

EARLY-LIFETIME EDEMBODY > 0.050 SV 1 0000 7 56E+04 2 98E+04 2 16E+05 3 18E+05 5 22E+05 6 91E+05 7 33E+05 4 06E-05 108

AVERAGE INDIVIDUAL RISK

ERL FAT/TOTAL 0-0 2 KM 1 0000 1 58E-01 1 41E-01 NOT-FOUND NOT-FOUND NOT-FOUND 2 23E-01 1 23E-01 2

ERL FAT/TOTAL 0 2-0 5 KM 0 9885 6 07E-02 3 34E-02 8 86E-02 9 91E-02 1 12E-01 1 31E-01 5 42E-04 28

ERL FAT/TOTAL 0 5 1 2 KM 0 6960 3 43E-02 3 70E-02 5 53E-02 5 53E-02 6 01E-02 6 78E-02 8 02E-02 5 42E-04 28

ERL FAT/TOTAL 1 2 1 6 KM 0 6802 2 49E-02 2 50E-02 NOT-FOUND NOT-FOUND NOT-FOUND 6 25E-02 1 20E-01 20

ERL FAT/TOTAL 1 6-2 1 KM 0 6561 1 99E-02 1 78E-02 5 99E-02 NOT-FOUND NOT-FOUND NOT-FOUND 6 25E-02 9 35E-02 20

2 NOV 89	14 25 06	PAGE 4	PROB NON-ZERO	MEAN	50TH	90TH	95TH	99TH	99 9TH	PEAK CONS	PEAK PROB	PEAK TRIAL
POPULATION	DOSE (SV)											
EDWBODY	TOT LIP	0 16 1 KM	0 9074	5 42E+03	8 07E+02	1 11E+04	2 48E+04	8 81E+04	1 75E+05	2 65E+05	2 85E-04	123
EDWBODY	TOT LIP	0 80 5 KM	1 0000	1 77E+04	8 64E+03	4 44E+04	6 63E+04	1 14E+05	2 25E+05	3 28E+05	2 85E-04	123
EDWBODY	TOT LIP	0 1609 KM	1 0000	3 04E+04	2 14E+04	6 26E+04	7 88E+04	1 23E+05	2 25E+05	3 28E+05	2 85E-04	123
POPULATION	WEIGHTED RISK											
PRL FAT/TOTAL		0 2 1 KM	0 2066	2 82E 02	0 00E+00	2 46E-02	1 01E-01	6 54E-01	NOT-FOUND	8 50E-01	3 56E-03	20
CAN FAT/TOTAL		0 16 1 KM	0 9074	1 56E-03	1 62E-04	2 92E 03	8 05E-03	2 73E-02	5 63E-02	8 72E 02	2 85E-04	123

DATE AND TIME OF RUN = MACCS 2-NOV 89 14 25 06 VERSION 1 5 11, 10/16/89, D CHANIN
 'ATMOS' DESCRIPTION = IN1A INP, SURRY, SAMPLE PROBLEM A, ATMOS INPUT
 'EARLY' DESCRIPTION = IN2A INP, SURRY, SAMPLE PROBLEM A, EARLY INPUT

SOURCE TERM 1 OF 2
 SECOND DRAFT 1150, WORST CASE SOURCE TERM FOR EARLY FATALITIES

RFSUITS FOR A SINGLE EMERGENCY RESPONSE COHORT WITHOUT ANY WEIGHTING FRACTIONS BEING APPLIED

COHORT 2 - NO EVACUATION, RELOCATION MODELS APPLY EVERYWHERE

2 NOV 89 14 25 06	PAGE	5	PROB NON-ZERO	MEAN	50TH	QUANTILES 90TH 95TH 99TH	99 9TH	PEAK CONS	PEAK PROB	PEAK TRIAL
HEALTH EFFECTS CASES										
ERL FAT/TOTAL	0	1609 KM	0 6828	3 71E+01	2 69E+00	8 33E+01	2 15E+02	5 14E+02	1 13E+03	3 12E+03
ERL INJ/PRODNOMAL VOMIT	0	1609 KM	0 8222	1 59E+02	2 65E+01	5 10E+02	8 78E+02	2 02E+03	3 32E+03	6 50E+03
ERL INJ/DIARRHEA	0	1609 KM	0 7434	7 95E+01	1 04E+01	2 22E+02	4 63E+02	1 00E+03	1 40E+03	3 94E+03
ERL INJ/PNEUMONITIS	0	1609 KM	0 5951	4 50E+00	1 17E-01	1 56E+01	2 45E+01	3 70E+01	5 29E+01	6 12E+02
ERL INJ/THYROIDITIS	0	1609 KM	0 5645	2 48E+00	4 69E-02	9 14E+00	1 31E+01	2 59E+01	NOT-FOUND	5 78E+01
ERL INJ/HYPOTHYROIDISM	0	1609 KM	0 9326	1 54E+02	3 18E+01	4 59E+02	7 39E+02	1 70E+03	NOT-FOUND	3 01E+03
ERL INJ/SKIN ERYTHEMA	0	1609 KM	0 9971	3 98E+03	1 09E+03	9 18E+03	1 66E+04	4 08E+04	6 46E+04	1 67E+05
ERL INJ/TRANSEPIDERMAL	0	1609 KM	0 9052	1 20E+03	2 22E+02	3 45E+03	5 21E+03	1 25E+04	2 32E+04	6 39E+04
CAN FAT/TOTAL	0	1609 KM	1 0000	5 61E+02	4 22E+02	1 10E+03	1 33E+03	2 03E+03	NOT-FOUND	3 35E+03
CAN FAT/LUNG	0	1609 KM	1 0000	1 05E+02	7 60E+01	2 08E+02	2 73E+02	4 65E+02	5 98E+02	6 61E+02
CAN FAT/THYROID	0	1609 KM	1 0000	1 24E+02	8 21E+01	2 54E+02	3 45E+02	6 10E+02	NOT-FOUND	1 05E+03
CAN FAT/BREAST	0	1609 KM	1 0000	1 04E+02	8 09E+01	2 11E+02	2 48E+02	3 24E+02	4 05E+02	7 45E+02
CAN FAT/GI	0	1609 KM	1 0000	1 25E+02	9 56E+01	2 40E+02	3 03E+02	4 71E+02	NOT-FOUND	8 00E+02
CAN FAT/LEUKEMIA	0	1609 KM	1 0000	3 50E+01	2 71E+01	6 74E+01	8 07E+01	1 17E+02	NOT-FOUND	1 88E+02
CAN FAT/BONE	0	1609 KM	1 0000	4 59E+00	3 10E+00	9 19E+00	1 23E+01	2 63E+01	3 27E+01	3 92E+01
CAN FAT/OTHER	0	1609 KM	1 0000	6 27E+01	4 76E+01	1 18E+02	1 45E+02	2 30E+02	NOT-FOUND	4 00E+02
CAN INJ/TOTAL	0	1609 KM	1 0000	2 01E+03	1 43E+03	3 92E+03	5 12E+03	8 05E+03	NOT-FOUND	1 43E+04
CAN FAT/TOTAL	0	80 5 KM	1 0000	3 65E+02	2 10E+02	8 80E+02	1 17E+03	2 03E+03	NOT-FOUND	3 35E+03
ERL FAT/TOTAL	0	16 1 KM	0 6815	3 70E+01	2 68E+00	8 33E+01	2 15E+02	5 11E+02	1 13E+03	3 12E+03
ERL INJ/PRODNOMAL VOMIT	0	16 1 KM	0 8172	1 50E+02	2 41E+01	4 71E+02	8 42E+02	1 88E+03	3 07E+03	6 50E+03
ERL INJ/DIARRHEA	0	16 1 KM	0 7413	7 74E+01	1 02E+01	2 19E+02	4 61E+02	9 47E+02	1 38E+03	3 94E+03
ERL INJ/PNEUMONITIS	0	16 1 KM	0 5951	4 50E+00	1 17E-01	1 56E+01	2 45E+01	3 70E+01	5 29E+01	6 12E+02
ERL INJ/THYROIDITIS	0	16 1 KM	0 5645	2 48E+00	4 69E-02	9 14E+00	1 31E+01	2 59E+01	NOT-FOUND	5 78E+01
ERL INJ/HYPOTHYROIDISM	0	16 1 KM	0 9242	1 19E+02	2 13E+01	3 82E+02	6 13E+02	1 12E+03	NOT-FOUND	2 10E+03
ERL INJ/SKIN ERYTHEMA	0	16 1 KM	0 9929	2 04E+03	5 19E+02	6 00E+03	9 62E+03	1 27E+04	1 80E+04	2 13E+04
ERL INJ/TRANSEPIDERMAL	0	16 1 KM	0 8986	9 44E+02	1 71E+02	3 15E+03	4 45E+03	9 71E+03	1 12E+04	1 26E+04
CAN FAT/TOTAL	0	16 1 KM	0 9993	1 49E+02	5 42E+01	4 00E+02	5 75E+02	1 03E+03	1 30E+03	1 93E+03
EARLY FATALITY DISTANCE (KM)										
ERL FAT/TOTAL RISK > 0 000	1	0000	7 63E+00	7 62E+00	1 35E+01	1 61E+01	NOT-FOUND	NOT-FOUND	2 09E+01	2 17E-02
POPULATION EXCEEDING DOSE										
EARLY-ACUTE RED MARR > 1 500 SV	0	6828	2 15E+02	1 74E+01	7 29E+02	1 27E+03	3 10E+03	5 08E+03	1 11E+04	2 00E-05
EARLY-ACUTE LUNGS > 5 000 SV	0	5951	4 12E+01	1 92E+00	5 94E+01	2 62E+02	5 65E+02	1 06E+03	1 19E+03	3 86E-05
EARLY-LIFETIME EDEWBODY > 0 050 SV	1	0000	8 19E+04	3 41E+04	2 29E+05	3 32E+05	5 62E+05	7 53E+05	7 60E+05	8 56E-04
AVERAGE INDIVIDUAL RISK										
ERL FAT/TOTAL	0-0	2 KM	1 0000	2 63E-01	2 48E-01	3 24E-01	3 40E-01	3 79E-01	4 42E-01	4 88E-01
ERL FAT/TOTAL	0	2-0 5 KM	1 0000	1 36E-01	1 10E-01	1 58E-01	1 84E-01	2 17E-01	2 51E-01	2 61E-01
ERL FAT/TOTAL	0	5-1 2 KM	0 8569	6 49E-02	6 83E-02	1 06E-01	1 12E-01	1 30E-01	1 60E-01	1 69E-01
ERL FAT/TOTAL	1	2-1 6 KM	0 8032	3 98E-02	4 20E-02	7 25E-02	7 68E-02	8 79E-02	1 13E-01	1 25E-01
ERL FAT/TOTAL	1	6-2 1 KM	0 7382	2 86E-02	3 11E-02	5 16E-02	5 97E-02	7 74E-02	1 01E-01	1 07E-01

2-NOV-89 14 25 06 PAGE 6 PROB NON ZERO MEAN 50TH 90TH 95TH 99TH 99 9TH PEAK CONS PEAK PROB TRIAL

POPULATION DOST (SV)	0 16 1 NM	0 9993	6 35E+03	2 66E+03	1 73E+04	2 52E+04	4 83E+04	NOT-FOUND	7 45E+04	1 06E-03	41
INDIVIDUAL NOT LIF	0 80 5 NM	1 0000	3 86E+04	1 07E+04	4 47E+04	6 42E+04	1 02E+05 <td>NOT-FOUND</td> <td>1 44E+05</td> <td>1 11E-03</td> <td>51</td>	NOT-FOUND	1 44E+05	1 11E-03	51
INDIVIDUAL NOT LIF	0 1609 NM	1 0000	3 13E+04	2 41E+04	6 12E+04	7 53E+04	1 04E+05	1 29E+05	1 58E+05	1 14E-04	112
POPULATION WEIGHTED RISK	0 2 1 NM	0 3572	4 74E-02	0 00E+00	4 54E-02	4 32E-01	7 06E-01	7 58E-01	8 51E-01	2 48E-05	57
FRL TAIL/TOTAL	0-16 1 NM	0 9993	2 04E-03	7 27E-04	5 78E-03	8 02E-03	1 35E-02	2 10E-02	2 63E-02	2 00E-05	39
CAN FRL/TOTAL											

DATE AND TIME OF RUN - MACCS 2-NOV-89 14:25:06 VERSION 1.5.11, 10/16/89, D. CHANIN
 "ATMOS" DESCRIPTION - INIA, INP, SURRY, SAMPLE PROBLEM A, ATMOS INPUT
 "EARLY" DESCRIPTION - INZA, INP, SURRY, SAMPLE PROBLEM A, EARLY INPUT

SOURCE TERM 1 OF 2:
 SECOND DRAFT 1150, WORST CASE SOURCE TERM FOR EARLY FATALITIES

RESULTS FOR A SINGLE EMERGENCY RESPONSE COHORT WITHOUT ANY WEIGHTING FRACTIONS BEING APPLIED

COHORT 3 - SHELTERING WITHIN 10 MILES, RELOCATION MODELS APPLY ELSEWHERE

2 NOV-89	14:25:06	PAGE	7	PROB	1	MEAN	50TH	90TH	Q/ANTILES	95TH	99.9TH	PEAK	PEAK	PEAK
				NON-ZERO								CONS	PROB	TRIAL
HEALTH EFFECTS CASES														
ERL PAT/TOTAL	0-1609 KM	0.6317	8.00E+00	5.25E-01	2.63E+01	3.94E+01	7.32E+01	1.26E+02	1.14E+03	7.15E-06	129			
ERL INJ/PROXIMAL VOMIT	0-1609 KM	0.7944	8.82E+01	1.10E+01	1.83E+02	3.84E+02	8.59E+02	1.20E+03	2.50E+03	2.00E-05	129			
ERL INJ/DIARRHEA	0-1609 KM	0.6742	2.78E+01	2.34E+00	7.08E+01	1.40E+02	3.14E+02	7.52E+02	1.41E+03	7.15E-06	129			
ERL INJ/PNEUMONITIS	0-1609 KM	0.5275	1.73E+00	4.15E-03	6.87E+00	1.00E+01	2.01E+01	2.31E+01	3.68E+01	5.84E-06	110			
ERL INJ/HYPOTHYROIDISM	0-1609 KM	0.5203	1.17E+00	8.41E-03	3.51E+00	7.60E+00	1.55E+01	2.31E+01	3.68E+01	1.06E-03	115			
ERL INJ/SKIN ERYTHEMA	0-1609 KM	0.8941	1.24E+02	2.60E+01	3.59E+02	5.71E+02	1.37E+03	NOT-FOUND	2.60E+03	1.11E-03	51			
ERL INJ/TRANSEPIDERMAL	0-1609 KM	0.8946	3.72E+03	9.55E+02	8.34E+03	1.02E+04	4.02E+04	6.46E+04	1.66E+05	5.71E-05	83			
CAN PAT/TOTAL	0-1609 KM	0.8941	1.02E+03	1.72E+02	3.10E+03	4.34E+03	1.19E+04	2.32E+04	6.31E+04	1.14E-04	75			
CAN PAT/LUNG	0-1609 KM	1.0000	5.19E+02	3.89E+01	1.02E+03	1.90E+02	2.47E+02	3.65E+02	5.64E+02	3.14E-04	116			
CAN PAT/BONE	0-1609 KM	1.0000	9.50E+01	7.97E+01	2.48E+02	3.37E+02	5.36E+02	NOT-FOUND	9.71E+02	1.11E-03	51			
CAN PAT/BREAST	0-1609 KM	1.0000	1.19E+02	7.68E+01	2.06E+02	2.43E+02	3.23E+02	4.04E+02	7.41E+02	1.14E-04	112			
CAN PAT/GI	0-1609 KM	1.0000	1.13E+02	8.63E+01	2.19E+02	2.71E+02	3.95E+02	NOT-FOUND	6.55E+02	1.11E-03	51			
CAN PAT/LEUKEMIA	0-1609 KM	1.0000	3.15E+01	2.44E+01	6.20E+01	7.45E+01	1.00E+02	1.30E+02	1.67E+02	1.14E-04	112			
CAN PAT/BONE	0-1609 KM	1.0000	4.15E+00	2.89E+00	8.31E+00	1.09E+01	2.07E+01	NOT-FOUND	3.33E+01	1.51E-03	86			
CAN PAT/OTHER	0-1609 KM	1.0000	5.67E+01	4.21E+01	1.08E+02	1.30E+02	1.98E+02	NOT-FOUND	3.28E+02	1.11E-03	51			
CAN PAT/TOTAL	0-1609 KM	1.0000	1.90E+03	1.35E+03	3.75E+03	4.96E+03	7.60E+03	NOT-FOUND	1.29E+04	1.11E-03	51			
ERL PAT/TOTAL	0-80.5 KM	1.0000	3.23E+02	1.83E+02	8.01E+02	1.08E+03	1.64E+03	NOT-FOUND	2.89E+03	1.11E-03	51			
ERL INJ/PROXIMAL VOMIT	0-16.1 KM	0.6304	7.88E+00	5.13E-01	2.62E+01	3.89E+01	7.12E+01	1.26E+02	1.14E+03	7.15E-06	129			
ERL INJ/DIARRHEA	0-16.1 KM	0.7858	5.91E+01	1.00E+01	1.56E+02	3.29E+02	7.58E+02	1.23E+03	2.50E+03	2.00E-05	129			
ERL INJ/PNEUMONITIS	0-16.1 KM	0.6720	2.57E+01	2.27E+00	6.54E+01	1.29E+02	3.09E+02	7.07E+02	1.41E+03	7.15E-06	129			
ERL INJ/HYPOTHYROIDISM	0-16.1 KM	0.5275	1.73E+00	4.15E-03	6.87E+00	1.00E+01	2.01E+01	2.31E+01	3.68E+01	5.84E-06	110			
ERL INJ/SKIN ERYTHEMA	0-16.1 KM	0.8855	8.78E+01	1.44E+01	2.94E+02	4.80E+02	9.55E+02	NOT-FOUND	1.59E+03	1.06E-03	41			
ERL INJ/TRANSEPIDERMAL	0-16.1 KM	0.9902	1.77E+03	4.44E+02	5.22E+03	8.03E+03	1.15E+04	1.48E+04	1.87E+04	1.14E-04	30			
CAN PAT/TOTAL	0-16.1 KM	0.8867	7.64E+02	1.33E+02	2.60E+03	3.80E+03	7.81E+03	1.07E+04	1.17E+04	1.14E-04	75			
EARLY FATALITY DISTANCE (KM)	0-16.1 KM	0.9993	1.07E+02	3.62E+01	3.19E+02	4.36E+02	8.07E+02	NOT-FOUND	1.35E+03	1.06E-03	41			
ERL PAT/TOTAL RISK > 0.000		1.0000	5.91E+00	5.82E+00	1.21E+01	1.52E+01	NOT-FOUND	NOT-FOUND	2.09E+01	2.17E-02	50			
POPULATION EXCEEDING DOSE														
EARLY-ACUTE RED MARR > 1.500 SV		0.6317	8.55E+01	4.80E+00	2.08E+02	4.13E+02	1.39E+03	NOT-FOUND	3.72E+03	1.08E-03	41			
EARLY-ACUTE LUNGS > 5.000 SV		0.5275	5.91E+00	2.64E-01	2.11E+01	3.04E+01	4.32E+01	5.66E+01	1.19E+03	7.15E-06	129			
EARLY-LIFETIME EDEMBODY > 0.050 SV		1.0000	7.95E+04	3.23E+04	2.25E+05	3.28E+05	5.62E+05	7.45E+05	7.52E+05	8.56E-04	96			
AVERAGE INDIVIDUAL RISK														
ERL PAT/TOTAL	0-0.2 KM	1.0000	2.55E-01	2.40E-01	3.19E-01	3.33E-01	3.67E-01	4.21E-01	4.60E-01	2.28E-04	18			
ERL PAT/TOTAL	0.2-0.5 KM	0.9837	1.20E-01	1.08E-01	1.39E-01	1.56E-01	2.02E-01	2.38E-01	2.49E-01	5.42E-04	10			
ERL PAT/TOTAL	0.5-1.2 KM	0.8341	5.31E-02	5.48E-02	9.84E-02	1.04E-01	1.14E-01	1.29E-01	1.34E-01	5.42E-04	82			
ERL PAT/TOTAL	1.2-1.6 KM	0.7409	2.97E-02	3.20E-02	5.36E-02	6.18E-02	7.83E-02	1.01E-01	1.05E-01	5.42E-04	82			
ERL PAT/TOTAL	1.6-2.1 KM	0.7291	2.21E-02	2.34E-02	3.86E-02	4.48E-02	5.59E-02	7.17E-02	8.62E-02	5.42E-04	28			

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					PROB				QUANTILES					PEAK		PEAK	PEAK	
					NON-ZERO	MEAN	50TH	90TH	95TH	99TH	99 9TH		CONS	PROB	TRIAL			
POPULATION	DOSE (SV)																	
EDFWBODY	TOT LIP	0-16	1 KM	0 9993	4 49E+03	1 72E+03	1 20E+04	1 75E+04	3 23E+04	NOT-FOUND	5 47E+04	1 06E-03	41					
EDFWBODY	TOT LIP	0-80	5 KM	1 0000	1 68E+04	9 56E+03	4 13E+04	6 06E+04	8 83E+04	NOT-FOUND	1 29E+05	1 11E-03	51					
EDFWBODY	TOT LIP	0 1609	KM	1 0000	2 94E+04	2 29E+04	5 83E+04	7 13E+04	9 64E+04	1 25E+05	1 57E+05	1 14E-04	112					
POPULATION	WEIGHTED RISK																	
TRI, FAT/TOTAL		0 2	1 KM	0 3154	3 74E-02	0 00E+00	3 20E-02	3 28E-01	5 40E-01	6 42E-01	8 50E-01	5 54E-05	28					
CAN FAT/TOTAL		0-16	1 KM	0 9993	1 46E-03	4 93E-04	4 03E-03	5 87E-03	1 09E-02	NOT-FOUND	1 84E-02	1 06E-03	41					

DATE AND TIME OF RUN = MACCS 2-NOV-89 14:25:06 VERSION 1.5.11, 10/16/89, D. CHANIN
 "ATMOS" DESCRIPTION = IN1A.INP, SURRY, SAMPLE PROBLEM A, ATMOS INPUT
 "EARLY" DESCRIPTION = IN2A.INP, SURRY, SAMPLE PROBLEM A, EARLY INPUT
 "CHRONC" DESCRIPTION = IN3A.INP, SURRY, SAMPLE PROBLEM A, CHRONC

SOURCE TERM 1 OF 2:
 SECOND DRAFT 1150, WORST CASE SOURCE TERM FOR EARLY FATALITIES

RESULTS FROM THE "CHRONC" MODULE ALONE

COHORT 4 = IN3A.INP, SURRY, SAMPLE PROBLEM A, CHRONC

2-NOV-89 14:25:06	PAGE	9	PROB NON-ZERO	MEAN	50TH	QUANTILES		90TH	95TH	99TH	99.9TH	PEAK CONS	PEAK PROB	PEAK TRIAL
HEALTH EFFECTS CASES														
CAN FAT/TOTAL	0-1609	KM	1.0000	4.42E+03	2.23E+03	1.08E+04	1.52E+04	2.86E+04	3.73E+04	4.32E+04	2.28E-04	4		
CAN FAT/LUNG	0-1609	KM	1.0000	4.35E+02	2.16E+02	1.08E+03	1.55E+03	2.66E+03	3.52E+03	4.00E+03	2.28E-04	4		
CAN FAT/THYROID	0-1609	KM	1.0000	1.92E+02	8.85E+01	5.08E+02	7.39E+02	1.17E+03	NOT-FOUND	1.73E+03	1.11E-03	135		
CAN FAT/BREAST	0-1609	KM	1.0000	1.43E+03	6.90E+02	3.51E+03	5.38E+03	9.21E+03	NOT-FOUND	1.37E+04	1.11E-03	135		
CAN FAT/GI	0-1609	KM	1.0000	1.28E+03	6.23E+02	3.19E+03	4.68E+03	7.91E+03	1.22E+04	1.43E+04	2.28E-04	4		
CAN FAT/LEUKEMIA	0-1609	KM	1.0000	4.24E+02	2.49E+02	1.05E+03	1.33E+03	2.23E+03	3.40E+03	3.98E+03	2.28E-04	4		
CAN FAT/BONE	0-1609	KM	1.0000	2.53E+01	1.54E+01	6.25E+01	7.92E+01	1.14E+02	1.73E+02	2.08E+02	2.28E-04	4		
CAN FAT/OTHER	0-1609	KM	1.0000	6.38E+02	3.17E+02	1.56E+03	2.29E+03	4.29E+03	6.03E+03	7.13E+03	2.28E-04	4		
CAN INJ/TOTAL	0-1609	KM	1.0000	1.02E+04	5.08E+03	2.54E+04	3.67E+04	6.80E+04	8.39E+04	9.46E+04	2.28E-04	4		
CAN FAT/TOTAL	0-80.5	KM	1.0000	2.83E+02	1.41E+02	6.75E+02	1.03E+03	1.60E+03	2.12E+03	2.30E+03	1.25E-04	38		
CAN FAT/TOTAL	0-16.1	KM	1.0000	2.70E+01	1.85E+01	5.96E+01	7.87E+01	1.09E+02	1.40E+02	2.17E+02	1.88E-05	39		
POPULATION DOSE (SV)														
EDEWBODY TOT LIF	0-16.1	KM	1.0000	1.56E+03	1.06E+03	3.40E+03	4.63E+03	6.53E+03	7.99E+03	1.12E+04	1.88E-05	39		
EDEWBODY TOT LIF	0-80.5	KM	1.0000	1.73E+04	8.69E+03	4.26E+04	6.52E+04	1.01E+05	1.18E+05	1.35E+05	1.25E-04	38		
EDEWBODY TOT LIF	0-1609	KM	1.0000	2.62E+05	1.29E+05	6.56E+05	8.97E+05	1.59E+06	2.19E+06	2.37E+06	2.28E-04	4		
POPULATION WEIGHTED RISK														
CAN FAT/TOTAL	0-16.1	KM	0.9790	1.10E-04	3.76E-05	2.77E-04	4.69E-04	1.08E-03	NOT-FOUND	1.39E-03	2.51E-03	89		
EDEWBODY POP. DOSE (SV)														
0-1609 KM														
TOTAL LONG-TERM PATHWAYS DOSE	1.0000		2.62E+05	1.29E+05	6.56E+05	8.97E+05	1.59E+06	2.19E+06	2.37E+06	2.28E-04	4			
LONG-TERM DIRECT EXPOSURE PATHWAYS	1.0000		1.90E+05	9.15E+04	4.48E+05	6.84E+05	1.22E+06	NOT-FOUND	2.17E+06	1.11E-03	135			
TOTAL INGESTION PATHWAYS DOSE	1.0000		6.97E+04	2.10E+04	1.65E+05	3.43E+05	7.98E+05	1.47E+06	2.04E+06	2.28E-04	4			
LONG-TERM GROUNDSHINE DOSE	1.0000		1.85E+05	8.82E+04	4.46E+05	6.83E+05	1.22E+06	NOT-FOUND	2.14E+06	1.11E-03	135			
LONG-TERM RESUSPENSION DOSE	1.0000		4.40E+03	2.82E+03	9.61E+03	1.32E+04	2.25E+04	3.34E+04	3.56E+04	6.85E-04	15			
POP. DEPENDENT DECONTAMINATION DOSE	1.0000		2.78E+03	1.46E+03	6.84E+03	9.39E+03	1.49E+04	2.25E+04	2.79E+04	1.14E-04	112			
AREA DEPENDENT DECONTAMINATION DOSE	0.8143		7.42E+00	1.76E+00	2.25E+01	3.33E+01	5.68E+01	8.71E+01	9.96E+01	4.00E-04	78			
MILK DIRECT-DEPOSITION DOSE	0.4083		6.68E+03	0.00E+00	1.78E+04	4.29E+04	1.02E+05	1.54E+05	2.37E+05	2.28E-04	6			
CROP DIRECT-DEPOSITION DOSE	0.4083		3.92E+04	0.00E+00	1.02E+05	2.23E+05	6.62E+05	1.40E+06	1.85E+06	2.28E-04	4			
MILK ROOT-UP TAKE DOSE	0.9938		4.09E+03	2.24E+03	1.09E+04	1.34E+04	2.07E+04	2.80E+04	4.03E+04	1.14E-04	105			
CROP ROOT-UP TAKE DOSE	0.9938		1.80E+04	1.04E+04	4.60E+04	6.15E+04	9.26E+04	1.29E+05	1.55E+05	2.28E-04	4			
WATER INGESTION DOSE	1.0000		1.74E+03	1.29E+03	3.45E+03	4.55E+03	6.33E+03	8.33E+03	1.22E+04	1.88E-05	39			
EDEWBODY POP. DOSE (SV)														
0-80.5 KM														
TOTAL LONG-TERM PATHWAYS DOSE	1.0000		1.73E+04	8.69E+03	4.26E+04	6.52E+04	1.01E+05	1.18E+05	1.35E+05	1.25E-04	38			
LONG-TERM DIRECT EXPOSURE PATHWAYS	1.0000		1.34E+04	5.87E+03	3.45E+04	5.56E+04	7.90E+04	9.98E+04	1.08E+05	1.25E-04	38			
TOTAL INGESTION PATHWAYS DOSE	1.0000		1.85E+03	1.31E+03	3.58E+03	5.17E+03	7.66E+03	1.02E+04	1.37E+04	1.88E-05	39			
LONG-TERM GROUNDSHINE DOSE	1.0000		1.26E+04	5.31E+03	3.28E+04	5.42E+04	7.85E+04	9.98E+04	1.08E+05	1.25E-04	38			
LONG-TERM RESUSPENSION DOSE	1.0000		8.71E+02	3.78E+02	2.30E+03	3.64E+03	6.44E+03	8.29E+03	1.28E+04	5.84E-06	109			

2-NOV 89 14 25 06 PAGE 10				PROB	QUANTILES					PEAK	PEAK	PEAK	
				NON-ZERO	MEAN	50TH	90TH	95TH	99TH	99 9TH	CONS	PROB	TRIAL
EDWBODY POP DOSE (SV) 0-80 5 KM													
POP DEPENDENT DECONTAMINATION DOSE	1	0000	2 05E+03	8 37E+02	5 70E+03	8 40E+03	1 39E+04	2 13E+04	2 44E+04	1 25E-04	38		
AREA DEPENDENT DECONTAMINATION DOSE	0 4804	5 33E 01	0 00E+00	1 61E+00	3 03E+00	5 30E+00	6 18E+00	6 90E+00	1 95E-04	10			
MILK DIRECT DEPOSITION DOSE	0 3847	3 35E+01	0 00E+00	1 02E+02	2 06E+02	5 03E+02	5 50E+02	6 44E+02	1 67E-05	20			
CROP DIRECT DEPOSITION DOSE	0 3851	2 57E+02	0 00E+00	7 96E+02	1 50E+03	4 09E+03	NOT-FOUND	5 13E+03	1 26E-03	34			
MILK ROOT UPTAKE DOSE	0 8847	7 14E+01	2 62E+01	2 09E+02	2 49E+02	3 16E+02	3 63E+02	3 97E+02	2 28E-04	78			
CROP ROOT UPTAKE DOSE	0 8847	3 24E+02	2 47E+02	7 23E+02	9 11E+02	1 07E+03	1 21E+03	1 49E+03	1 76E-05	20			
WATER INGESTION DOSE	1 0000	1 17E+03	8 03E+02	2 33E+03	3 03E+03	5 47E+03	8 27E+03	1 21E+04	1 88E-05	39			
ECONOMIC COST MEASURES (\$) 0-1609 KM													
TOTAL ECONOMIC COSTS	1	0000	1 27E+10	6 98E+09	2 55E+10	3 69E+10	6 89E+10	NOT-FOUND	2 71E+11	1 11E-03	2		
POP DEPENDENT COSTS	1	0000	1 12E+10	5 56E+09	2 32E+10	3 33E+10	6 43E+10	NOT-FOUND	2 69E+11	1 11E-03	76		
AREA DEPENDENT COSTS	1	0000	1 52E+09	8 68E+08	3 82E+09	5 17E+09	7 05E+09	9 78E+09	1 05E+10	8 56E-04	15		
POP DEPENDENT DECONTAMINATION COST	1	0000	2 68E+09	1 31E+09	5 69E+09	8 93E+09	1 81E+10	NOT-FOUND	6 60E+10	1 11E-03	76		
AREA DEPENDENT DECONTAMINATION COST	0 8143	1 16E+08	3 10E+07	3 38E+08	4 49E+08	1 00E+09	NOT-FOUND	1 20E+09	1 88E-03	76			
POP DEPENDENT INTERDICTION COST	1	0000	7 47E+09	3 51E+09	1 70E+10	2 84E+10	4 48E+10	NOT-FOUND	2 02E+11	1 11E-03	76		
AREA DEPENDENT INTERDICTION COST	0 8951	3 43E+08	1 41E+08	9 64E+08	1 36E+09	2 13E+09	2 54E+09	3 01E+09	1 14E-04	90			
POP DEPENDENT CONDEMNATION COST	0 9616	9 95E+08	2 49E+08	1 89E+09	4 44E+09	1 07E+10	1 70E+10	4 95E+10	2 15E-04	102			
AREA DEPENDENT CONDEMNATION COST	1	0000	8 18E+08	3 96E+08	2 13E+09	2 54E+09	4 16E+09	8 22E+09	8 46E+09	8 56E-04	15		
EVACUATION AND RELOCATION COST	1	0000	7 97E+06	5 02E+06	1 62E+07	3 10E+07	6 20E+07	NOT-FOUND	1 11E+08	1 11E-03	86		
MILK DISPOSAL COST	0 4314	2 82E+07	0 00E+00	8 51E+07	1 71E+08	2 83E+08	1 19E+09	1 91E+09	4 00E-04	4			
CROP DISPOSAL COST	0 4314	3 27E+08	0 00E+00	1 21E+09	1 93E+09	2 22E+09	NOT-FOUND	2 59E+09	1 06E-03	2			
ECONOMIC COST MEASURES (\$) 0-80 5 KM													
TOTAL ECONOMIC COSTS	1	0000	4 97E+09	2 30E+09	1 29E+10	2 08E+10	3 05E+10	4 38E+10	6 11E+10	2 15E-04	102		
POP DEPENDENT COSTS	1	0000	4 75E+09	2 03E+09	1 23E+10	2 05E+10	3 05E+10	4 38E+10	6 10E+10	2 15E-04	102		
AREA DEPENDENT COSTS	1	0000	2 16E+08	2 04E+08	3 24E+08	3 47E+08	4 05E+08	NOT-FOUND	5 01E+08	1 14E-03	15		
POP DEPENDENT DECONTAMINATION COST	1	0000	9 67E+08	3 53E+08	2 60E+09	4 34E+09	6 03E+09	NOT-FOUND	7 30E+09	2 37E-03	55		
AREA DEPENDENT DECONTAMINATION COST	0 4804	5 49E+06	0 00E+00	1 85E+07	2 52E+07	3 55E+07	NOT-FOUND	3 86E+07	5 68E-03	89			
POP DEPENDENT INTERDICTION COST	1	0000	2 78E+09	1 04E+09	7 89E+09	1 19E+10	2 32E+10	3 24E+10	3 58E+10	1 25E-04	38		
AREA DEPENDENT INTERDICTION COST	0 7611	1 47E+07	7 39E+06	3 71E+07	4 68E+07	7 15E+07	9 12E+07	1 01E+08	3 15E-04	16			
POP DEPENDENT CONDEMNATION COST	0 9616	9 95E+08	2 49E+08	1 89E+09	4 44E+09	1 07E+10	1 70E+10	4 95E+10	2 15E-04	102			
AREA DEPENDENT CONDEMNATION COST	1	0000	1 87E+08	1 72E+08	3 05E+08	3 12E+08	3 31E+08	3 59E+08	4 21E+08	1 04E-05	109		
EVACUATION AND RELOCATION COST	1	0000	7 88E+06	4 88E+06	1 61E+07	3 09E+07	6 20E+07	NOT-FOUND	1 11E+08	1 11E-03	86		
MILK DISPOSAL COST	0 4314	7 94E+05	0 00E+00	2 33E+06	3 04E+06	4 18E+06	5 16E+06	5 18E+06	8 28E-04	34			
CROP DISPOSAL COST	0 4314	1 27E+07	0 00E+00	3 89E+07	5 15E+07	6 76E+07	7 32E+07	8 19E+07	5 37E-06	24			
MAXIMUM LONG TERM ACTION DISTANCE (KM)													
AREA DEPENDENT DECONTAMINATION DIST	0 8143	1 62E+02	1 35E+02	3 75E+02	4 67E+02	NOT FOUND	NOT-FOUND	5 63E+02	4 04E-02	2			
POP DEPENDENT DECONTAMINATION DIST	1	0000	2 11E+02	1 96E+02	3 88E+02	4 79E+02	NOT-FOUND	NOT-FOUND	5 63E+02	4 36E-02	2		
AREA DEPENDENT INTERDICTION DIST	0 8951	2 23E+02	2 02E+02	NOT FOUND	NOT FOUND	NOT FOUND	NOT-FOUND	5 63E+02	1 30E-01	2			
POP DEPENDENT INTERDICTION DIST	1	0000	2 11E+02	1 96E+02	3 88E+02	4 79E+02	NOT-FOUND	NOT-FOUND	5 63E+02	4 36E-02	2		
AREA DEPENDENT CONDEMNATION DIST	1	0000	1 78E+02	1 54E+02	3 40E+02	4 00E+02	NOT-FOUND	NOT-FOUND	5 63E+02	1 92E-02	15		
POP DEPENDENT CONDEMNATION DIST	0 9616	2 40E+01	2 41E+01	3 56E+01	3 89E+01	4 79E+01	NOT FOUND	8 05E+01	1 12E-03	92			
MILK DISPOSAL DIST	0 4314	2 11E+02	0 00E+00	7 49E+02	8 41E+02	NOT-FOUND	NOT-FOUND	1 61E+03	1 78E 02	4			
CROP DISPOSAL DIST	0 4314	1 82E+02	0 00E+00	NOT-FOUND	NOT-FOUND	NOT-FOUND	NOT-FOUND	8 05E+02	1 04E-01	1			
AFFECTED AREA/POPULATION 0 1609 KM													
DECONTAMINATION AREA (HECTARES)	0 8143	1 96E+05	5 12E+04	5 43E+05	6 59E+05	1 42E+06	NOT-FOUND	2 13E+06	1 88E-03	76			
DECONTAMINATION POP (INDIVIDUALS)	1	0000	6 52E+05	2 88E+05	1 39E+06	2 62E+06	4 50E+06	NOT-FOUND	2 19E+07	1 11E-03	76		
INTERDICTION AREA (HECTARES)	0 8951	3 60E+05	1 60E+05	1 01E+06	1 23E+06	1 94E+06	NOT-FOUND	2 41E+06	1 26E-03	6			
INTERDICTION POP (INDIVIDUALS)	1	0000	6 52E+05	2 88E+05	1 39E+06	2 62E+06	4 50E+06	NOT-FOUND	2 19E+07	1 11E-03	76		
CONDEMNATION AREA (HECTARES)	1	0000	3 31E+05	1 75E+05	8 12E+05	1 01E+06	1 81E+06	NOT-FOUND	2 60E+06	1 17E-03	15		
CONDEMNATION POP (INDIVIDUALS)	0 9616	1 12E+04	2 96E+03	1 93E+04	4 45E+04	1 23E+05	2 22E+05	5 56E+05	2 15E-04	102			

2 NOV 89	14 25 06	PAGE 11	PROB NON ZERO	MEAN	50TH	QUANTILES 90TH 95TH	99TH	99 9TH	PEAK CONS	PEAK PROB	PEAK TRIAL
MILK DISPOSAL AREA (HCTARES)											
MILK DISPOSAL AREA (HCTARES)			0 4314	9 61E+05	0 00E+00	3 33E+06 5 08E+06	8 63E+06	3 21E+07	3 66E+07	2 28E-04	4
MILK DISPOSAL AREA (HCTARES)			0 4314	6 41E+05	0 00E+00	2 42E+06 3 90E+06	5 34E+06	6 06E+06	6 07E+06	9 70E-04	49
MILK DISPOSAL AREA (HCTARES)											
MILK DISPOSAL AREA (HCTARES)			0 4804	8 68E+03	0 00E+00	3 20E+04 4 17E+04	6 05E+04	NOT-FOUND	6 11E+04	9 45E-03	52
MILK DISPOSAL AREA (HCTARES)			1 0000	1 66E+05	6 22E+04	5 11E+05 7 21E+05	1 00E+06	1 03E+06	1 10E+06	7 47E-06	109
MILK DISPOSAL AREA (HCTARES)			0 7611	1 33E+04	8 78E+03	3 35E+04 4 11E+04	5 56E+04	7 89E+04	1 04E+05	3 15E-04	16
MILK DISPOSAL AREA (HCTARES)			1 0000	1 66E+05	6 22E+04	5 11E+05 7 21E+05	1 00E+06	1 03E+06	1 10E+06	7 47E-06	109
MILK DISPOSAL AREA (HCTARES)			1 0000	8 97E+04	8 46E+04	1 10E+05 1 15E+05	1 27E+05	1 48E+05	1 99E+05	1 04E-05	109
MILK DISPOSAL AREA (HCTARES)			0 9616	1 12E+04	2 96E+03	1 83E+04 4 43E+04	1 23E+05	2 22E+05	5 56E+05	2 15E-04	102
MILK DISPOSAL AREA (HCTARES)			0 4314	4 35E+04	0 00E+00	1 26E+05 1 63E+05	2 23E+05	2 81E+05	2 86E+05	8 28E-04	34
MILK DISPOSAL AREA (HCTARES)			0 4314	4 09E+04	0 00E+00	1 19E+05 1 53E+05	2 05E+05	2 19E+05	2 50E+05	9 57E-06	24

PEOPLE FRACTION =	0 9500		0 0500		0 0000		CHRONC RESULTS	
	EMER RESP # 1	PROB-X	EMER RESP # 2	PROB-X	EMER RESP # 3	PROB-X	X	
OVERALL	PROB-X		PROB-X		PROB-X		PROB-X	
X	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	
0.02	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	
0.04	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	
0.06	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	
0.08	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	
0.10	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	
0.12	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	
0.14	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	
0.16	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	
0.18	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	
0.20	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	
0.22	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	
0.24	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	
0.26	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	
0.28	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	
0.30	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	
0.32	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	
0.34	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	
0.36	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	
0.38	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	
0.40	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	
0.42	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	
0.44	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	
0.46	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	
0.48	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	
0.50	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	
0.52	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	
0.54	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	
0.56	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	
0.58	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	
0.60	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	
0.62	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	
0.64	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	
0.66	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	
0.68	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	
0.70	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	
0.72	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	
0.74	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	
0.76	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	
0.78	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	
0.80	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	
0.82	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	
0.84	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	
0.86	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	
0.88	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	
0.90	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	
0.92	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	
0.94	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	
0.96	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	
0.98	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	
1.00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	
0.02	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	
0.04	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	
0.06	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	
0.08	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	
0.10	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	
0.12	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	
0.14	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	
0.16	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	
0.18	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	
0.20	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	
0.22	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	
0.24	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	
0.26	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	
0.28	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	
0.30	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	
0.32	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	
0.34	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	
0.36	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	
0.38	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	
0.40	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	
0.42	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	
0.44	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	
0.46	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	
0.48	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	
0.50	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	
0.52	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	
0.54	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	
0.56	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	
0.58	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	
0.60	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	
0.62	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	
0.64	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	
0.66	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	
0.68	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	
0.70	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	
0.72	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	
0.74	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	
0.76	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	
0.78	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	
0.80	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	
0.82	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	
0.84	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	3 00E+00	
0.86	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	4 00E+00	
0.88	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	5 00E+00	
0.90	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	6 00E+00	
0.92	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	7 00E+00	
0.94	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	8 00E+00	
0.96	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	9 00E+00	
0.98	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	
1.00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	2 00E+00	

SOURCE TERM 1 OF 2
SECOND PHASE 11.50 WORST CASE SOURCE TERM FOR EARLY FATALITIES

REACTOR NAME POPULATION DOSE (SV)
TOWNSHIP TOTAL

0-80 5 KM

PROTECTORION =		0 9500		0 0500		0 0000	
OVERALL		EMER RESP # 1		EMER RESP # 2		EMER RESP # 3	
X		PROB>X		PROB>X		PROB>X	
1	00E-02	1	00E-03	1	00E-02	1	00E-03
2	00E-02	2	00E-03	2	00E-02	2	00E-03
3	00E-02	3	00E-03	3	00E-02	3	00E-03
4	00E-02	4	00E-03	4	00E-02	4	00E-03
5	00E-02	5	00E-03	5	00E-02	5	00E-03
6	00E-02	6	00E-03	6	00E-02	6	00E-03
7	00E-02	7	00E-03	7	00E-02	7	00E-03
8	00E-02	8	00E-03	8	00E-02	8	00E-03
9	00E-02	9	00E-03	9	00E-02	9	00E-03
10	00E-02	10	00E-03	10	00E-02	10	00E-03
11	00E-02	11	00E-03	11	00E-02	11	00E-03
12	00E-02	12	00E-03	12	00E-02	12	00E-03
13	00E-02	13	00E-03	13	00E-02	13	00E-03
14	00E-02	14	00E-03	14	00E-02	14	00E-03
15	00E-02	15	00E-03	15	00E-02	15	00E-03
16	00E-02	16	00E-03	16	00E-02	16	00E-03
17	00E-02	17	00E-03	17	00E-02	17	00E-03
18	00E-02	18	00E-03	18	00E-02	18	00E-03
19	00E-02	19	00E-03	19	00E-02	19	00E-03
20	00E-02	20	00E-03	20	00E-02	20	00E-03
21	00E-02	21	00E-03	21	00E-02	21	00E-03
22	00E-02	22	00E-03	22	00E-02	22	00E-03
23	00E-02	23	00E-03	23	00E-02	23	00E-03
24	00E-02	24	00E-03	24	00E-02	24	00E-03
25	00E-02	25	00E-03	25	00E-02	25	00E-03
26	00E-02	26	00E-03	26	00E-02	26	00E-03
27	00E-02	27	00E-03	27	00E-02	27	00E-03
28	00E-02	28	00E-03	28	00E-02	28	00E-03
29	00E-02	29	00E-03	29	00E-02	29	00E-03
30	00E-02	30	00E-03	30	00E-02	30	00E-03
31	00E-02	31	00E-03	31	00E-02	31	00E-03
32	00E-02	32	00E-03	32	00E-02	32	00E-03
33	00E-02	33	00E-03	33	00E-02	33	00E-03
34	00E-02	34	00E-03	34	00E-02	34	00E-03
35	00E-02	35	00E-03	35	00E-02	35	00E-03
36	00E-02	36	00E-03	36	00E-02	36	00E-03
37	00E-02	37	00E-03	37	00E-02	37	00E-03
38	00E-02	38	00E-03	38	00E-02	38	00E-03
39	00E-02	39	00E-03	39	00E-02	39	00E-03
40	00E-02	40	00E-03	40	00E-02	40	00E-03
41	00E-02	41	00E-03	41	00E-02	41	00E-03
42	00E-02	42	00E-03	42	00E-02	42	00E-03
43	00E-02	43	00E-03	43	00E-02	43	00E-03
44	00E-02	44	00E-03	44	00E-02	44	00E-03
45	00E-02	45	00E-03	45	00E-02	45	00E-03
46	00E-02	46	00E-03	46	00E-02	46	00E-03
47	00E-02	47	00E-03	47	00E-02	47	00E-03
48	00E-02	48	00E-03	48	00E-02	48	00E-03
49	00E-02	49	00E-03	49	00E-02	49	00E-03
50	00E-02	50	00E-03	50	00E-02	50	00E-03
51	00E-02	51	00E-03	51	00E-02	51	00E-03
52	00E-02	52	00E-03	52	00E-02	52	00E-03
53	00E-02	53	00E-03	53	00E-02	53	00E-03
54	00E-02	54	00E-03	54	00E-02	54	00E-03
55	00E-02	55	00E-03	55	00E-02	55	00E-03
56	00E-02	56	00E-03	56	00E-02	56	00E-03
57	00E-02	57	00E-03	57	00E-02	57	00E-03
58	00E-02	58	00E-03	58	00E-02	58	00E-03
59	00E-02	59	00E-03	59	00E-02	59	00E-03
60	00E-02	60	00E-03	60	00E-02	60	00E-03
61	00E-02	61	00E-03	61	00E-02	61	00E-03
62	00E-02	62	00E-03	62	00E-02	62	00E-03
63	00E-02	63	00E-03	63	00E-02	63	00E-03
64	00E-02	64	00E-03	64	00E-02	64	00E-03
65	00E-02	65	00E-03	65	00E-02	65	00E-03
66	00E-02	66	00E-03	66	00E-02	66	00E-03
67	00E-02	67	00E-03	67	00E-02	67	00E-03
68	00E-02	68	00E-03	68	00E-02	68	00E-03
69	00E-02	69	00E-03	69	00E-02	69	00E-03
70	00E-02	70	00E-03	70	00E-02	70	00E-03
71	00E-02	71	00E-03	71	00E-02	71	00E-03
72	00E-02	72	00E-03	72	00E-02	72	00E-03
73	00E-02	73	00E-03	73	00E-02	73	00E-03
74	00E-02	74	00E-03	74	00E-02	74	00E-03
75	00E-02	75	00E-03	75	00E-02	75	00E-03
76	00E-02	76	00E-03	76	00E-02	76	00E-03
77	00E-02	77	00E-03	77	00E-02	77	00E-03
78	00E-02	78	00E-03	78	00E-02	78	00E-03
79	00E-02	79	00E-03	79	00E-02	79	00E-03
80	00E-02	80	00E-03	80	00E-02	80	00E-03
81	00E-02	81	00E-03	81	00E-02	81	00E-03
82	00E-02	82	00E-03	82	00E-02	82	00E-03
83	00E-02	83	00E-03	83	00E-02	83	00E-03
84	00E-02	84	00E-03	84	00E-02	84	00E-03
85	00E-02	85	00E-03	85	00E-02	85	00E-03
86	00E-02	86	00E-03	86	00E-02	86	00E-03
87	00E-02	87	00E-03	87	00E-02	87	00E-03
88	00E-02	88	00E-03	88	00E-02	88	00E-03
89	00E-02	89	00E-03	89	00E-02	89	00E-03
90	00E-02	90	00E-03	90	00E-02	90	00E-03
91	00E-02	91	00E-03	91	00E-02	91	00E-03
92	00E-02	92	00E-03	92	00E-02	92	00E-03
93	00E-02	93	00E-03	93	00E-02	93	00E-03
94	00E-02	94	00E-03	94	00E-02	94	00E-03
95	00E-02	95	00E-03	95	00E-02	95	00E-03
96	00E-02	96	00E-03	96	00E-02	96	00E-03
97	00E-02	97	00E-03	97	00E-02	97	00E-03
98	00E-02	98	00E-03	98	00E-02	98	00E-03
99	00E-02	99	00E-03	99	00E-02	99	00E-03
100	00E-02	100	00E-03	100	00E-02	100	00E-03

SOURCE TERM 1 OF 2

SECOND DRAFT 1150, WORST CASE SOURCE TERM FOR EARLY FATALITIES

RESULT NAME - POPULATION DOSE (SV)
EDEMBODY TOT LIF

0-1609 KM

PEOPLE FRACTION =		0 9500		0 0500		0 0000		CHRONIC RESULTS	
OVERALL		EMER RESP # 1		EMER RESP # 2		EMER RESP # 3		X	
X	PROB-X	X	PROB-X	X	PROB-X	X	PROB-X	X	PROB-X
1 00E+01	1 00E+00	1 00E-02	1 00E+00	1 00E-02	1 00E+00	1 00E-02	1 00E+00	1 00E-01	1 00E+00
2 00E+01	1 00E+00	2 00E-02	1 00E+00	2 00E-02	1 00E+00	2 00E-02	1 00E+00	2 00E-01	1 00E+00
3 00E+01	1 00E+00	3 00E-02	1 00E+00	3 00E-02	1 00E+00	3 00E-02	1 00E+00	3 00E-01	1 00E+00
5 00E+01	1 00E+00	5 00E-02	1 00E+00	5 00E-02	1 00E+00	5 00E-02	1 00E+00	5 00E-01	1 00E+00
7 00E+01	1 00E+00	7 00E-02	1 00E+00	7 00E-02	1 00E+00	7 00E-02	1 00E+00	7 00E-01	1 00E+00
1 00E+00	1 00E+00	1 00E-01	1 00E+00	1 00E-01	1 00E+00	1 00E-01	1 00E+00	1 00E-00	1 00E+00
2 00E+00	1 00E+00	2 00E-01	1 00E+00	2 00E-01	1 00E+00	2 00E-01	1 00E+00	2 00E+00	1 00E+00
3 00E+00	1 00E+00	3 00E-01	1 00E+00	3 00E-01	1 00E+00	3 00E-01	1 00E+00	3 00E+00	1 00E+00
5 00E+00	1 00E+00	5 00E-01	1 00E+00	5 00E-01	1 00E+00	5 00E-01	1 00E+00	5 00E+00	1 00E+00
7 00E+00	1 00E+00	7 00E-01	1 00E+00	7 00E-01	1 00E+00	7 00E-01	1 00E+00	7 00E+00	1 00E+00
1 00E+01	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+00	1 00E+01	1 00E+00
2 00E+01	1 00E+00	2 00E+00	1 00E+00	2 00E+00	1 00E+00	2 00E+00	1 00E+00	2 00E+01	1 00E+00
3 00E+01	1 00E+00	3 00E+00	1 00E+00	3 00E+00	1 00E+00	3 00E+00	1 00E+00	3 00E+01	1 00E+00
5 00E+01	1 00E+00	5 00E+00	1 00E+00	5 00E+00	1 00E+00	5 00E+00	1 00E+00	5 00E+01	1 00E+00
7 00E+01	1 00E+00	7 00E+00	1 00E+00	7 00E+00	1 00E+00	7 00E+00	1 00E+00	7 00E+01	1 00E+00
1 00E+02	1 00E+00	1 00E+01	1 00E+00	1 00E+01	1 00E+00	1 00E+01	1 00E+00	1 00E+02	1 00E+00
2 00E+02	1 00E+00	2 00E+01	1 00E+00	2 00E+01	1 00E+00	2 00E+01	1 00E+00	2 00E+02	1 00E+00
3 00E+02	1 00E+00	3 00E+01	1 00E+00	3 00E+01	1 00E+00	3 00E+01	1 00E+00	3 00E+02	1 00E+00
5 00E+02	1 00E+00	5 00E+01	1 00E+00	5 00E+01	1 00E+00	5 00E+01	1 00E+00	5 00E+02	1 00E+00
7 00E+02	1 00E+00	7 00E+01	1 00E+00	7 00E+01	1 00E+00	7 00E+01	1 00E+00	7 00E+02	1 00E+00
1 00E+03	1 00E+00	1 00E+02	1 00E+00	1 00E+02	1 00E+00	1 00E+02	1 00E+00	1 00E+03	1 00E+00
2 00E+03	1 00E+00	2 00E+02	1 00E+00	2 00E+02	1 00E+00	2 00E+02	1 00E+00	2 00E+03	1 00E+00
3 00E+03	1 00E+00	3 00E+02	1 00E+00	3 00E+02	1 00E+00	3 00E+02	1 00E+00	3 00E+03	1 00E+00
5 00E+03	1 00E+00	5 00E+02	1 00E+00	5 00E+02	1 00E+00	5 00E+02	1 00E+00	5 00E+03	9 96E-01
7 00E+03	9 99E-01	7 00E+02	1 00E+00	7 00E+02	1 00E+00	7 00E+02	1 00E+00	7 00E+03	9 89E-01
1 00E+04	9 96E-01	1 00E+03	9 59E-01	1 00E+03	1 00E+00	1 00E+03	1 00E+00	1 00E+04	9 82E-01
2 00E+04	9 71E-01	2 00E+03	9 94E-01	2 00E+03	9 99E-01	2 00E+03	1 00E+00	2 00E+04	9 60E-01
3 00E+04	9 19E-01	3 00E+03	9 88E-01	3 00E+03	9 97E-01	3 00E+03	9 98E-01	3 00E+04	9 00E-01
5 00E+04	8 38E-01	5 00E+03	9 73E-01	5 00E+03	9 85E-01	5 00E+03	9 94E-01	5 00E+04	8 38E-01
7 00E+04	7 76E-01	7 00E+03	9 41E-01	7 00E+03	9 59E-01	7 00E+03	9 84E-01	7 00E+04	7 42E-01
1 00E+05	6 69E-01	1 00E+04	8 67E-01	1 00E+04	8 67E-01	1 00E+04	8 43E-01	1 00E+05	6 72E-01
2 00E+05	4 19E-01	2 00E+04	5 41E-01	2 00E+04	5 94E-01	2 00E+04	5 79E-01	2 00E+05	5 66E-01
3 00E+05	3 16E-01	3 00E+04	3 37E-01	3 00E+04	4 07E-01	3 00E+04	3 74E-01	3 00E+05	4 05E-01
5 00E+05	1 69E-01	5 00E+04	1 73E-01	5 00E+04	1 81E-01	5 00E+04	1 66E-01	5 00E+05	2 88E-01
7 00E+05	0 10E-01	7 00E+04	7 59E-02	7 00E+04	6 73E-02	7 00E+04	5 49E-02	7 00E+05	1 56E-01
1 00E+06	4 93E-02	1 00E+05	2 17E-02	1 00E+05	1 57E-02	1 00E+05	8 23E-03	1 00E+06	9 98E-02
2 00E+06	5 37E-03	2 00E+05	2 65E-03	2 00E+05	1 14E-04	2 00E+05	1 44E-04	2 00E+06	3 86E-02
3 00E+06	2 28E-04	3 00E+05	2 85E-04	3 00E+05	1 58E+05	3 00E+05	1 57E+05	3 00E+06	5 14E-03
5 00E+06	2 20E-05	5 00E+05	2 28E+05	5 00E+05	1 14E-04	5 00E+05	1 14E-04	5 00E+06	2 38E-04
7 00E+06	2 20E-06	7 00E+05	2 28E+05	7 00E+05	1 14E-04	7 00E+05	1 14E-04	7 00E+06	2 38E-04
1 00E+07	N D	1 00E+06	N D	1 00E+06	N D	1 00E+06	N D	1 00E+07	N D
2 00E+07	N D	2 00E+06	N D	2 00E+06	N D	2 00E+06	N D	2 00E+07	N D
3 00E+07	N D	3 00E+06	N D	3 00E+06	N D	3 00E+06	N D	3 00E+07	N D
5 00E+07	N D	5 00E+06	N D	5 00E+06	N D	5 00E+06	N D	5 00E+07	N D
7 00E+07	N D	7 00E+06	N D	7 00E+06	N D	7 00E+06	N D	7 00E+07	N D
1 00E+08	N D	1 00E+07	N D	1 00E+07	N D	1 00E+07	N D	1 00E+08	N D
2 00E+08	N D	2 00E+07	N D	2 00E+07	N D	2 00E+07	N D	2 00E+08	N D
3 00E+08	N D	3 00E+07	N D	3 00E+07	N D	3 00E+07	N D	3 00E+08	N D
5 00E+08	N D	5 00E+07	N D	5 00E+07	N D	5 00E+07	N D	5 00E+08	N D
7 00E+08	N D	7 00E+07	N D	7 00E+07	N D	7 00E+07	N D	7 00E+08	N D
1 00E+09	N D	1 00E+08	N D	1 00E+08	N D	1 00E+08	N D	1 00E+09	N D
2 00E+09	N D	2 00E+08	N D	2 00E+08	N D	2 00E+08	N D	2 00E+09	N D
3 00E+09	N D	3 00E+08	N D	3 00E+08	N D	3 00E+08	N D	3 00E+09	N D
5 00E+09	N D	5 00E+08	N D	5 00E+08	N D	5 00E+08	N D	5 00E+09	N D
7 00E+09	N D	7 00E+08	N D	7 00E+08	N D	7 00E+08	N D	7 00E+09	N D
1 00E+10	N D	1 00E+09	N D	1 00E+09	N D	1 00E+09	N D	1 00E+10	N D
2 00E+10	N D	2 00E+09	N D	2 00E+09	N D	2 00E+09	N D	2 00E+10	N D
3 00E+10	N D	3 00E+09	N D	3 00E+09	N D	3 00E+09	N D	3 00E+10	N D
5 00E+10	N D	5 00E+09	N D	5 00E+09	N D	5 00E+09	N D	5 00E+10	N D
7 00E+10	N D	7 00E+09	N D	7 00E+09	N D	7 00E+09	N D	7 00E+10	N D
1 00E+11	N D	1 00E+10	N D	1 00E+10	N D	1 00E+10	N D	1 00E+11	N D
2 00E+11	N D	2 00E+10	N D	2 00E+10	N D	2 00E+10	N D	2 00E+11	N D
3 00E+11	N D	3 00E+10	N D	3 00E+10	N D	3 00E+10	N D	3 00E+11	N D
5 00E+11	N D	5 00E+10	N D	5 00E+10	N D	5 00E+10	N D	5 00E+11	N D
7 00E+11	N D	7 00E+10	N D	7 00E+10	N D	7 00E+10	N D	7 00E+11	N D
1 00E+12	N D	1 00E+11	N D	1 00E+11	N D	1 00E+11	N D	1 00E+12	N D
2 00E+12	N D	2 00E+11	N D	2 00E+11	N D	2 00E+11	N D	2 00E+12	N D
3 00E+12	N D	3 00E+11	N D	3 00E+11	N D	3 00E+11	N D	3 00E+12	N D
5 00E+12	N D	5 00E+11	N D	5 00E+11	N D	5 00E+11	N D	5 00E+12	N D
7 00E+12	N D	7 00E+11	N D	7 00E+11	N D	7 00E+11	N D	7 00E+12	N D
1 00E+13	N D	1 00E+12	N D	1 00E+12	N D	1 00E+12	N D	1 00E+13	N D
2 00E+13	N D	2 00E+12	N D	2 00E+12	N D	2 00E+12	N D	2 00E+13	N D
3 00E+13	N D	3 00E+12	N D	3 00E+12	N D	3 00E+12	N D	3 00E+13	N D
5 00E+13	N D	5 00E+12	N D	5 00E+12	N D	5 00E+12	N D	5 00E+13	N D
7 00E+13	N D	7 00E+12	N D	7 00E+12	N D	7 00E+12	N D	7 00E+13	N D
1 00E+14	N D	1 00E+13	N D	1 00E+13	N D	1 00E+13	N D	1 00E+14	N D
2 00E+14	N D	2 00E+13	N D	2 00E+13	N D	2 00E+13	N D	2 00E+14	N D
3 00E+14	N D	3 00E+13	N D	3 00E+13	N D	3 00E+13	N D	3 00E+14	N D
5 00E+14	N D	5 00E+13	N D	5 00E+13	N D	5 00E+13	N D	5 00E+14	N D
7 00E+14	N D	7 00E+13	N D	7 00E+13	N D	7 00E+13	N D	7 00E+14	N D
1 00E+15	N D	1 00E+14	N D	1 00E+14	N D	1 00E+14	N D	1 00E+15	N D
2 00E+15	N D	2 00E+14	N D	2 00E+14	N D	2 00E+14	N D	2 00E+15	N D
3 00E+15	N D	3 00E+14	N D	3 00E+14	N D	3 00E+14	N D	3 00E+15	N D
5 00E+15	N D	5 00E+14	N D	5 00E+14	N D	5 00E+14	N D	5 00E+15	N D
7 00E+15	N D	7 00E+14	N D	7 00E+14	N D	7 00E+14	N D	7 00E+15	N D
1 00E+16	N D	1 00E+15	N D	1 00E+15	N D	1 00E+15	N D	1 00E+16	N D
2 00E+16	N D	2 00E+15	N D	2 00E+15	N D	2 00E+15	N D	2 00E+16	N D
3 00E+16	N D	3 00E+15	N D	3 00E+15	N D	3 00E+15	N D	3 00E+16	N D
5 00E+16	N D	5 00E+15	N D	5 00E+15	N D	5 00E+15	N D	5 00E+16	N D
7 00E+16	N D	7 00E+15	N D	7 00E+15	N D	7 00E+15	N D	7 00E+16	N D

RESULT	NAML	POPULATION WEIGHTED RISK ERL FAT/TOTAL
1	0.000000	0.000000
2	0.000000	0.000000
3	0.000000	0.000000
4	0.000000	0.000000
5	0.000000	0.000000
6	0.000000	0.000000
7	0.000000	0.000000
8	0.000000	0.000000
9	0.000000	0.000000
10	0.000000	0.000000
11	0.000000	0.000000
12	0.000000	0.000000
13	0.000000	0.000000
14	0.000000	0.000000
15	0.000000	0.000000
16	0.000000	0.000000
17	0.000000	0.000000
18	0.000000	0.000000
19	0.000000	0.000000
20	0.000000	0.000000
21	0.000000	0.000000
22	0.000000	0.000000
23	0.000000	0.000000
24	0.000000	0.000000
25	0.000000	0.000000
26	0.000000	0.000000
27	0.000000	0.000000
28	0.000000	0.000000
29	0.000000	0.000000
30	0.000000	0.000000
31	0.000000	0.000000
32	0.000000	0.000000
33	0.000000	0.000000
34	0.000000	0.000000
35	0.000000	0.000000
36	0.000000	0.000000
37	0.000000	0.000000
38	0.000000	0.000000
39	0.000000	0.000000
40	0.000000	0.000000
41	0.000000	0.000000
42	0.000000	0.000000
43	0.000000	0.000000
44	0.000000	0.000000
45	0.000000	0.000000
46	0.000000	0.000000
47	0.000000	0.000000
48	0.000000	0.000000
49	0.000000	0.000000
50	0.000000	0.000000
51	0.000000	0.000000
52	0.000000	0.000000
53	0.000000	0.000000
54	0.000000	0.000000
55	0.000000	0.000000
56	0.000000	0.000000
57	0.000000	0.000000
58	0.000000	0.000000
59	0.000000	0.000000
60	0.000000	0.000000
61	0.000000	0.000000
62	0.000000	0.000000
63	0.000000	0.000000
64	0.000000	0.000000
65	0.000000	0.000000
66	0.000000	0.000000
67	0.000000	0.000000
68	0.000000	0.000000
69	0.000000	0.000000
70	0.000000	0.000000
71	0.000000	0.000000
72	0.000000	0.000000
73	0.000000	0.000000
74	0.000000	0.000000
75	0.000000	0.000000
76	0.000000	0.000000
77	0.000000	0.000000
78	0.000000	0.000000
79	0.000000	0.000000
80	0.000000	0.000000
81	0.000000	0.000000
82	0.000000	0.000000
83	0.000000	0.000000
84	0.000000	0.000000
85	0.000000	0.000000
86	0.000000	0.000000
87	0.000000	0.000000
88	0.000000	0.000000
89	0.000000	0.000000
90	0.000000	0.000000
91	0.000000	0.000000
92	0.000000	0.000000
93	0.000000	0.000000
94	0.000000	0.000000
95		

0-2 1 KM

PEOPLE	FRACTION	OVERALL			0 9500			0 0500			0 0000			CHRONC RESULTS			
		X	PROB-X	EMHR	RESP	PROB-X	EMHR	RESP	PROB-X	EMHR	RESP	PROB-X	EMHR	RESP	X	PROB-X	
1	0.0E+00	3	57E-01	1	0.0E-09	1	0.0E+08	3	57E-01	1	0.0E-09	1	0.0E+08	1	0.0E-09	1	0.0E+08
2	0.0E+00	3	57E-01	2	0.0E-09	2	0.0E-08	3	57E-01	2	0.0E-08	3	57E-01	2	0.0E-09	3	13E-01
3	0.0E+00	3	57E-01	3	0.0E-09	3	0.0E-08	3	57E-01	3	0.0E-08	3	57E-01	3	0.0E-09	3	13E-01
4	0.0E+00	3	57E-01	4	0.0E-09	4	0.0E-08	3	57E-01	4	0.0E-08	3	57E-01	4	0.0E-09	3	13E-01
5	0.0E+00	3	57E-01	5	0.0E-09	5	0.0E-08	3	57E-01	5	0.0E-08	3	57E-01	5	0.0E-09	3	13E-01
6	0.0E+00	3	57E-01	6	0.0E-09	6	0.0E-08	3	57E-01	6	0.0E-08	3	57E-01	6	0.0E-09	3	13E-01
7	0.0E+00	3	57E-01	7	0.0E-09	7	0.0E-08	3	57E-01	7	0.0E-08	3	57E-01	7	0.0E-09	3	13E-01
8	0.0E+00	3	57E-01	8	0.0E-09	8	0.0E-08	3	57E-01	8	0.0E-08	3	57E-01	8	0.0E-09	3	13E-01
9	0.0E+00	3	57E-01	9	0.0E-09	9	0.0E-08	3	57E-01	9	0.0E-08	3	57E-01	9	0.0E-09	3	13E-01
10	0.0E+00	3	57E-01	10	0.0E-09	10	0.0E-08	3	57E-01	10	0.0E-08	3	57E-01	10	0.0E-09	3	13E-01
11	0.0E+00	3	57E-01	11	0.0E-09	11	0.0E-08	3	57E-01	11	0.0E-08	3	57E-01	11	0.0E-09	3	13E-01
12	0.0E+00	3	57E-01	12	0.0E-09	12	0.0E-08	3	57E-01	12	0.0E-08	3	57E-01	12	0.0E-09	3	13E-01
13	0.0E+00	3	57E-01	13	0.0E-09	13	0.0E-08	3	57E-01	13	0.0E-08	3	57E-01	13	0.0E-09	3	13E-01
14	0.0E+00	3	57E-01	14	0.0E-09	14	0.0E-08	3	57E-01	14	0.0E-08	3	57E-01	14	0.0E-09	3	13E-01
15	0.0E+00	3	57E-01	15	0.0E-09	15	0.0E-08	3	57E-01	15	0.0E-08	3	57E-01	15	0.0E-09	3	13E-01
16	0.0E+00	3	57E-01	16	0.0E-09	16	0.0E-08	3	57E-01	16	0.0E-08	3	57E-01	16	0.0E-09	3	13E-01
17	0.0E+00	3	57E-01	17	0.0E-09	17	0.0E-08	3	57E-01	17	0.0E-08	3	57E-01	17	0.0E-09	3	13E-01
18	0.0E+00	3	57E-01	18	0.0E-09	18	0.0E-08	3	57E-01	18	0.0E-08	3	57E-01	18	0.0E-09	3	13E-01
19	0.0E+00	3	57E-01	19	0.0E-09	19	0.0E-08	3	57E-01	19	0.0E-08	3	57E-01	19	0.0E-09	3	13E-01
20	0.0E+00	3	57E-01	20	0.0E-09	20	0.0E-08	3	57E-01	20	0.0E-08	3	57E-01	20	0.0E-09	3	13E-01
21	0.0E+00	3	57E-01	21	0.0E-09	21	0.0E-08	3	57E-01	21	0.0E-08	3	57E-01	21	0.0E-09	3	13E-01
22	0.0E+00	3	57E-01	22	0.0E-09	22	0.0E-08	3	57E-01	22	0.0E-08	3	57E-01	22	0.0E-09	3	13E-01
23	0.0E+00	3	57E-01	23	0.0E-09	23	0.0E-08	3	57E-01	23	0.0E-08	3	57E-01	23	0.0E-09	3	13E-01
24	0.0E+00	3	57E-01</														

PEOPLE FRACTION -		0 9500		0 0500		0 0000		CHRONC RESULTS	
OVERALL		EMER RESP # 1		EMER RESP # 2		EMER RESP # 3		CHRONC RESULTS	
X	PROB-X	X	PROB-X	X	PROB-X	X	PROB-X	X	PROB-X
1 00E-09	9 99E-01	1 00E-09	9 07E-01	1 00E-09	9 99E-01	1 00E-09	9 99E-01	1 00E-10	9 79E-01
2 00E-09	9 99E-01	2 00E-09	9 07E-01	2 00E-09	9 99E-01	2 00E-09	9 99E-01	2 00E-10	9 79E-01
3 00E-09	9 99E-01	3 00E-09	9 05E-01	3 00E-09	9 99E-01	3 00E-09	9 99E-01	3 00E-10	9 79E-01
4 00E-09	9 99E-01	4 00E-09	9 04E-01	4 00E-09	9 99E-01	4 00E-09	9 99E-01	4 00E-10	9 79E-01
5 00E-09	9 99E-01	5 00E-09	9 03E-01	5 00E-09	9 99E-01	5 00E-09	9 99E-01	5 00E-10	9 79E-01
6 00E-09	9 99E-01	6 00E-09	9 03E-01	6 00E-09	9 99E-01	6 00E-09	9 99E-01	6 00E-10	9 79E-01
7 00E-09	9 99E-01	7 00E-09	9 03E-01	7 00E-09	9 99E-01	7 00E-09	9 99E-01	7 00E-10	9 79E-01
8 00E-09	9 99E-01	8 00E-09	9 03E-01	8 00E-09	9 99E-01	8 00E-09	9 99E-01	8 00E-10	9 79E-01
9 00E-09	9 99E-01	9 00E-09	9 03E-01	9 00E-09	9 99E-01	9 00E-09	9 99E-01	9 00E-10	9 79E-01
1 00E-08	9 99E-01	1 00E-08	9 03E-01	1 00E-08	9 99E-01	1 00E-08	9 99E-01	1 00E-09	9 79E-01
2 00E-08	9 99E-01	2 00E-08	9 03E-01	2 00E-08	9 99E-01	2 00E-08	9 99E-01	2 00E-09	9 79E-01
3 00E-08	9 99E-01	3 00E-08	9 03E-01	3 00E-08	9 99E-01	3 00E-08	9 99E-01	3 00E-09	9 79E-01
4 00E-08	9 99E-01	4 00E-08	9 03E-01	4 00E-08	9 99E-01	4 00E-08	9 99E-01	4 00E-09	9 79E-01
5 00E-08	9 99E-01	5 00E-08	9 03E-01	5 00E-08	9 99E-01	5 00E-08	9 99E-01	5 00E-09	9 79E-01
6 00E-08	9 99E-01	6 00E-08	9 03E-01	6 00E-08	9 99E-01	6 00E-08	9 99E-01	6 00E-09	9 79E-01
7 00E-08	9 99E-01	7 00E-08	9 03E-01	7 00E-08	9 99E-01	7 00E-08	9 99E-01	7 00E-09	9 79E-01
8 00E-08	9 99E-01	8 00E-08	9 03E-01	8 00E-08	9 99E-01	8 00E-08	9 99E-01	8 00E-09	9 79E-01
9 00E-08	9 99E-01	9 00E-08	9 03E-01	9 00E-08	9 99E-01	9 00E-08	9 99E-01	9 00E-09	9 79E-01
1 00E-07	9 99E-01	1 00E-07	8 85E-01	1 00E-07	9 99E-01	1 00E-07	9 99E-01	1 00E-08	9 79E-01
2 00E-07	9 99E-01	2 00E-07	8 85E-01	2 00E-07	9 99E-01	2 00E-07	9 99E-01	2 00E-08	9 79E-01
3 00E-07	9 99E-01	3 00E-07	8 77E-01	3 00E-07	9 99E-01	3 00E-07	9 99E-01	3 00E-08	9 79E-01
4 00E-07	9 99E-01	4 00E-07	8 77E-01	4 00E-07	9 99E-01	4 00E-07	9 99E-01	4 00E-08	9 79E-01
5 00E-07	9 99E-01	5 00E-07	8 74E-01	5 00E-07	9 99E-01	5 00E-07	9 99E-01	5 00E-08	9 79E-01
6 00E-07	9 99E-01	6 00E-07	8 70E-01	6 00E-07	9 99E-01	6 00E-07	9 99E-01	6 00E-08	9 79E-01
7 00E-07	9 99E-01	7 00E-07	8 69E-01	7 00E-07	9 99E-01	7 00E-07	9 99E-01	7 00E-08	9 79E-01
8 00E-07	9 99E-01	8 00E-07	8 62E-01	8 00E-07	9 99E-01	8 00E-07	9 99E-01	8 00E-08	9 79E-01
9 00E-07	9 99E-01	9 00E-07	8 62E-01	9 00E-07	9 99E-01	9 00E-07	9 99E-01	9 00E-08	9 79E-01
1 00E-06	9 99E-01	1 00E-06	8 62E-01	1 00E-06	9 99E-01	1 00E-06	9 99E-01	1 00E-07	9 79E-01
2 00E-06	9 99E-01	2 00E-06	8 55E-01	2 00E-06	9 99E-01	2 00E-06	9 99E-01	2 00E-07	9 79E-01
3 00E-06	9 99E-01	3 00E-06	8 46E-01	3 00E-06	9 99E-01	3 00E-06	9 99E-01	3 00E-07	9 79E-01
4 00E-06	9 99E-01	4 00E-06	8 36E-01	4 00E-06	9 99E-01	4 00E-06	9 99E-01	4 00E-07	9 79E-01
5 00E-06	9 99E-01	5 00E-06	8 36E-01	5 00E-06	9 99E-01	5 00E-06	9 99E-01	5 00E-07	9 79E-01
6 00E-06	9 99E-01	6 00E-06	8 32E-01	6 00E-06	9 99E-01	6 00E-06	9 99E-01	6 00E-07	9 79E-01
7 00E-06	9 99E-01	7 00E-06	8 21E-01	7 00E-06	9 99E-01	7 00E-06	9 99E-01	7 00E-07	9 79E-01
8 00E-06	9 99E-01	8 00E-06	8 21E-01	8 00E-06	9 99E-01	8 00E-06	9 99E-01	8 00E-07	9 79E-01
9 00E-06	9 99E-01	9 00E-06	8 21E-01	9 00E-06	9 99E-01	9 00E-06	9 99E-01	9 00E-07	9 79E-01
1 00E-05	9 99E-01	1 00E-05	7 70E-01	1 00E-05	9 98E-01	1 00E-05	9 85E-01	1 00E-06	9 64E-01
2 00E-05	9 98E-01	2 00E-05	7 33E-01	2 00E-05	9 94E-01	2 00E-05	9 58E-01	2 00E-06	9 27E-01
3 00E-05	9 90E-01	3 00E-05	6 69E-01	3 00E-05	9 76E-01	3 00E-05	9 27E-01	3 00E-06	8 24E-01
4 00E-05	9 80E-01	4 00E-05	6 06E-01	4 00E-05	9 53E-01	4 00E-05	8 94E-01	4 00E-06	7 45E-01
5 00E-05	9 60E-01	5 00E-05	5 62E-01	5 00E-05	9 20E-01	5 00E-05	8 64E-01	5 00E-06	6 85E-01
6 00E-05	9 40E-01	6 00E-05	5 06E-01	6 00E-05	8 04E-01	6 00E-05	7 47E-01	6 00E-06	6 17E-01
7 00E-05	9 20E-01	7 00E-05	4 75E-01	7 00E-05	7 66E-01	7 00E-05	6 54E-01	7 00E-06	5 58E-01
8 00E-05	9 00E-01	8 00E-05	4 06E-01	8 00E-05	6 66E-01	8 00E-05	5 50E-01	8 00E-06	4 35E-01
9 00E-05	8 79E-01	9 00E-05	3 32E-01	9 00E-05	6 10E-01	9 00E-05	4 96E-01	9 00E-06	3 59E-01
1 00E-04	8 28E-01	1 00E-04	2 74E-01	1 00E-04	5 08E-01	1 00E-04	4 09E-01	1 00E-05	2 60E-01
2 00E-04	8 28E-01	2 00E-04	2 31E-01	2 00E-04	4 42E-01	2 00E-04	3 32E-01	2 00E-05	1 39E-01
3 00E-04	8 28E-01	3 00E-04	1 97E-01	3 00E-04	3 74E-01	3 00E-04	2 15E-01	3 00E-05	9 22E-02
4 00E-04	8 28E-01	4 00E-04	1 60E-01	4 00E-04	3 08E-01	4 00E-04	1 55E-01	4 00E-05	4 58E-02
5 00E-04	8 28E-01	5 00E-04	1 27E-01	5 00E-04	2 33E-01	5 00E-04	1 24E-02	5 00E-05	3 42E-02
6 00E-04	8 28E-01	6 00E-04	9 70E-02	6 00E-04	1 63E-01	6 00E-04	1 02E-02	6 00E-05	2 14E-02
7 00E-04	8 28E-01	7 00E-04	6 67E-02	7 00E-04	1 02E-02	7 00E-04	6 32E-02	7 00E-05	1 47E-02
8 00E-04	8 28E-01	8 00E-04	4 12E-02	8 00E-04	6 01E-02	8 00E-04	4 46E-02	8 00E-05	9 51E-03
9 00E-04	8 28E-01	9 00E-04	2 71E-02	9 00E-04	3 01E-02	9 00E-04	2 38E-02	9 00E-05	5 18E-03
1 00E-03	8 28E-01	1 00E-03	1 71E-02	1 00E-03	2 00E-05	1 00E-03	1 84E-02	1 00E-04	3 39E-03
2 00E-03	8 28E-01	2 00E-03	1 19E-02	2 00E-03	2 63E-02	2 00E-03	1 20E-02	2 00E-04	2 51E-03
3 00E-03	8 28E-01	3 00E-03	8 48E-03	3 00E-03	2 63E-02	3 00E-03	1 20E-02	3 00E-04	2 51E-03
4 00E-03	8 28E-01	4 00E-03	5 05E-02	4 00E-03	2 63E-02	4 00E-03	1 20E-02	4 00E-04	2 51E-03
5 00E-03	8 28E-01	5 00E-03	2 85E-04	5 00E-03	2 63E-02	5 00E-03	1 20E-02	5 00E-04	2 51E-03
6 00E-03	8 28E-01	6 00E-03	1 98E-03	6 00E-03	2 63E-02	6 00E-03	1 20E-02	6 00E-04	2 51E-03
7 00E-03	8 28E-01	7 00E-03	8 72E-02	7 00E-03	2 63E-02	7 00E-03	1 20E-02	7 00E-04	2 51E-03
8 00E-03	8 28E-01	8 00E-03	2 85E-04	8 00E-03	2 63E-02	8 00E-03	1 20E-02	8 00E-04	2 51E-03
9 00E-03	8 28E-01	9 00E-03	8 72E-02	9 00E-03	2 63E-02	9 00E-03	1 20E-02	9 00E-04	2 51E-03
1 00E-02	8 28E-01	1 00E-02	2 85E-04	1 00E-02	2 63E-02	1 00E-02	1 20E-02	1 00E-03	2 51E-03
2 00E-02	8 28E-01	2 00E-02	1 98E-03	2 00E-02	2 63E-02	2 00E-02	1 20E-02	2 00E-03	2 51E-03
3 00E-02	8 28E-01	3 00E-02	8 72E-02	3 00E-02	2 63E-02	3 00E-02	1 20E-02	3 00E-03	2 51E-03
4 00E-02	8 28E-01	4 00E-02	2 85E-04	4 00E-02	2 63E-02	4 00E-02	1 20E-02	4 00E-03	2 51E-03
5 00E-02	8 28E-01	5 00E-02	1 98E-03	5 00E-02	2 63E-02	5 00E-02	1 20E-02	5 00E-03	2 51E-03
6 00E-02	8 28E-01	6 00E-02	8 72E-02	6 00E-02	2 63E-02	6 00E-02	1 20E-02	6 00E-03	2 51E-03
7 00E-02	8 28E-01	7 00E-02	2 85E-04	7 00E-02	2 63E-02	7 00E-02	1 20E-02	7 00E-03	2 51E-03
8 00E-02	8 28E-01	8 00E-02	1 98E-03	8 00E-02	2 63E-02	8 00E-02	1 20E-02	8 00E-03	2 51E-03
9 00E-02	8 28E-01	9 00E-02	8 72E-02	9 00E-02	2 63E-02	9 00E-02	1 20E-02	9 00E-03	2 51E-03
1 00E-01	8 28E-01	1 00E-01	2 85E-04	1 00E-01	2 63E-02	1 00E-01	1 20E-02	1 00E-02	2 51E-03
2 00E-01	8 28E-01	2 00E-01	1 98E-03	2 00E-01	2 63E-02	2 00E-01	1 20E-02	2 00E-02	2 51E-03
3 00E-01	8 28E-01	3 00E-01	8 72E-02	3 00E-01	2 63E-02	3 00E-01	1 20E-02	3 00E-02	2 51E-03
4 00E-01	8 28E-01	4 00E-01	2 85E-04	4 00E-01	2 63E-02	4 00E-01	1 20E-02	4 00E-02	2 51E-03
5 00E-01	8 28E-01	5 00E-01	1 98E-03	5 00E-01	2 63E-02	5 00E-01	1 20E-02	5 00E-02	2 51E-03
6 00E-01	8 28E-01	6 00E-01	8 72E-02	6 00E-01	2 63E-02	6 00E-01	1 20E-02	6 00E-02	2 51E-03
7 00E-01	8 28E-01	7 00E-01	2 85E-04	7 00E-01	2 63E-02	7 00E-01	1 20E-02	7 00E-02	2 51E-03
8 00E-01	8 28E-01	8 00E-01	1 98E-03	8 00E-01	2 63E-02	8 00E-01	1 20E-02	8 00E-02	2 51E-03
9 00E-01	8 28E-01	9 00E-01	8 72E-02	9 00E-01	2 63E-02	9 00E-01	1 20E-02	9 00E-02	2 51E-03

D-81

DATE AND TIME OF RUN - MACCS 2-NOV-89 14 25 06 VERSION 1 5 11, 10/16/89, D CHANIN
 "ATMOS" DESCRIPTION - IN1A INP, SURRY, SAMPLE PROBLEM A, ATMOS INPUT
 "EARLY" DESCRIPTION - IN2A INP, SURRY, SAMPLE PROBLEM A, EARLY INPUT
 "CHRONC" DESCRIPTION - IN3A INP, SURRY, SAMPLE PROBLEM A, CHRONC

SOURCE TERM 2 OF 2
 RELEASE FRACTIONS OF SOURCE TERM 1 REDUCED BY A FACTOR OF TEN

OVERALL RESULTS OBTAINED BY COMBINING 3 EMERGENCY RESPONSE COHORTS FROM "EARLY" WITH THE WEIGHTING FRACTIONS BELOW APPLIED TO THEM

	FRACTION OF THE PEOPLE

COHORT 1 - EVACUATION WITHIN 10 MILES, RELOCATION MODELS APPLY ELSEWHERE	0 950
COHORT 2 - NO EVACUATION, RELOCATION MODELS APPLY EVERYWHERE	0 050
COHORT 3 - SHELTERING WITHIN 10 MILES, RELOCATION MODELS APPLY ELSEWHERE	0 000

AND THEN MERGING THE 3 RESULTS ABOVE WITH THE SINGLE SET OF RESULTS FROM "CHRONC" DESCRIBED BELOW

COHORT 4 - IN3A INP, SURRY, SAMPLE PROBLEM A, CHRONC

RESULTS WHICH ARE PRODUCED ONLY BY "EARLY" OR ONLY BY "CHRONC" ARE PRESENTED IN LATER SECTIONS

2-NOV-89 14 25 06 PAGE 19	PROB	NON-ZERO	MEAN	50TH	QUANTILES		90TH	95TH	99TH	99 9TH	PEAK	PEAK	PEAK
											CONS	PROB	TRIAL
HEALTH EFFECTS CASES													
ERL FAT/TOTAL	0 1609 KM	0 2027	4 57E-03	0 00E+00	1 51E-03	1 13E-02	1 34E-01	2 70E-01	9 04E-01	1 14E-04	17		
ERL INJ/PRODRONAL VOMIT	0-1609 KM	0 5015	1 41E-01	7 80E-05	3 24E-01	7 72E-01	2 69E+00	4 81E+00	6 61E+00	8 28E-04	94		
ERL INJ/DIARRHEA	0-1609 KM	0 3055	3 31E-02	0 00E+00	4 24E-02	1 33E-01	8 15E-01	1 98E+00	2 32E+00	1 14E-04	17		
ERL INJ/PNEUMONITIS	0-1609 KM	0 0338	4 20E-04	0 00E+00	0 00E+00	0 00E+00	1 36E-02	2 92E-02	3 73E-01	1 14E-04	17		
ERL INJ/THYROIDITIS	0-1609 KM	0 0888	6 46E-03	0 00E+00	0 00E+00	3 12E-02	1 35E-01	4 73E-01	1 03E+00	8 28E-04	94		
ERL INJ/HYPOTHYROIDISM	0-1609 KM	0 6489	7 67E+00	1 10E-01	1 37E+01	2 73E+01	1 48E+02	3 77E+02	6 38E+02	2 85E-04	85		
ERL INJ/SKIN ERYTHEMA	0-1609 KM	0 8407	3 92E+02	3 12E+01	5 63E+02	1 78E+03	7 63E+03	1 44E+04	2 48E+04	2 85E-04	123		
ERL INJ/TRANSEPIDERMAL	0-1609 KM	0 7089	8 32E+01	8 89E-01	1 22E+02	2 26E+02	1 80E+03	4 92E+03	8 77E+03	3 14E-04	87		
CAN FAT/TOTAL	0-1609 KM	1 0000	9 41E+02	5 93E+02	2 19E+03	3 11E+03	4 68E+03	NOT-FOUND	8 14E+03	1 77E-03	5		
CAN FAT/LUNG	0-1609 KM	1 0000	9 35E+01	6 05E+01	2 13E+02	2 97E+02	4 78E+02	7 17E+02	7 68E+02	1 14E-04	112		
CAN FAT/THYROID	0-1609 KM	1 0000	5 48E+01	3 58E+01	1 17E+02	1 52E+02	2 54E+02	NOT-FOUND	3 88E+02	1 77E-03	5		
CAN FAT/BREAST	0 1609 KM	1 0000	2 92E+02	1 84E+02	7 16E+02	9 65E+02	1 63E+03	2 27E+03	2 69E+03	1 14E-04	112		
CAN FAT/GI	0-1609 KM	1 0000	2 72E+02	1 53E+02	6 97E+02	9 78E+02	1 64E+03	NOT-FOUND	2 67E+03	1 77E-03	5		
CAN FAT/LEUKEMIA	0-1609 KM	1 0000	8 80E+01	5 85E+01	2 00E+02	2 91E+02	4 33E+02	5 91E+02	6 82E+02	2 28E-04	4		
CAN FAT/BONE	0-1609 KM	1 0000	5 24E+00	3 60E+00	1 07E+01	1 45E+01	2 19E+01	2 77E+01	3 36E+01	2 28E-04	4		
CAN FAT/OTHER	0 1609 KM	1 0000	1 36E+02	8 04E+01	3 30E+02	4 88E+02	7 84E+02	NOT-FOUND	1 33E+03	1 77E-03	5		
CAN INJ/TOTAL	0-1609 KM	1 0000	2 26E+03	1 39E+03	5 27E+03	7 25E+03	1 17E+04	NOT-FOUND	1 87E+04	1 77E-03	5		
CAN FAT/TOTAL	0-80 5 KM	1 0000	1 85E+02	1 00E+02	4 83E+02	7 13E+02	1 01E+03	1 26E+03	1 64E+03	5 71E-05	75		
ERL FAT/TOTAL	0-16 1 KM	0 2027	4 57E-03	0 00E+00	1 51E-03	1 13E-02	1 34E-01	2 70E-01	9 04E-01	1 14E-04	17		
ERL INJ/PRODRONAL VOMIT	0-16 1 KM	0 5015	1 41E-01	7 80E-05	3 24E-01	7 72E-01	2 69E+00	4 81E+00	6 61E+00	8 28E-04	94		
ERL INJ/DIARRHEA	0-16 1 KM	0 3055	3 31E-02	0 00E+00	4 24E-02	1 33E-01	8 15E-01	1 98E+00	2 32E+00	1 14E-04	17		
ERL INJ/PNEUMONITIS	0-16 1 KM	0 0338	4 20E-04	0 00E+00	0 00E+00	0 00E+00	1 36E-02	2 92E-02	3 73E-01	1 14E-04	17		
ERL INJ/THYROIDITIS	0-16 1 KM	0 0888	6 46E-03	0 00E+00	0 00E+00	3 12E-02	1 35E-01	4 73E-01	1 03E+00	8 28E-04	94		
ERL INJ/HYPOTHYROIDISM	0-16 1 KM	0 6476	7 58E+00	1 07E-01	1 34E+01	2 72E+01	1 48E+02	3 77E+02	6 38E+02	2 85E-04	85		
ERL INJ/SKIN ERYTHEMA	0-16 1 KM	0 8386	3 81E+02	2 70E+01	5 08E+02	1 76E+03	7 63E+03	1 44E+04	2 48E+04	2 85E-04	123		
ERL INJ/TRANSEPIDERMAL	0-16 1 KM	0 7089	8 32E+01	8 89E-01	1 22E+02	2 26E+02	1 80E+03	4 92E+03	8 77E+03	3 14E-04	87		
CAN FAT/TOTAL	0-16 1 KM	1 0000	2 26E+01	1 09E+01	4 94E+01	7 78E+01	2 02E+02	4 07E+02	5 88E+02	2 85E-04	85		
EARLY FATALITY DISTANCE (KM)													
ERL FAT/TOTAL RISK > 0 000		0 9998	7 34E-01	5 24E-01	2 01E+00	2 42E+00	NOT-FOUND	NOT-FOUND	3 22E+00	2 25E-02	94		

2-NOV 89 14 25 06 PAGE 20			PROB	MEAN	50TH	QUANTILES		99TH	99 9TH	PEAK	PEAK	PEAK
			NON-ZERO			90TH	95TH			CONS	PROB	TRIAL
POPULATION EXCEEDING DOSE												
EARLY ACUTE RED MARR > 1 500 SV			0 7027	8 11E-02	0 00E+00	1 08E-01	2 90E-01	2 28E+00	6 66E+00	7.20E+00	8 48E-04	94
EARLY ACUTE LUNGS > 5 000 SV			0 0338	8 09E-03	0 00E+00	0 00E+00	0 00E+00	1 59E 01	8 86E-01	2.83E+00	2 63E-04	17
EARLY-LIFETIME EDEWBODY > 0 050 SV			0 9999	6 94E+03	2 03E+03	1 58E+04	2 83E+04	8 76E+04	1 32E+05	2 15E+05	5 71E-05	75
AVERAGE INDIVIDUAL RISK												
ENL FAT/TOTAL	0-0 2 KM	0 9998	7 24E 02	7 55E-02	1 07E-01	1 12E-01	1 24E-01	1.43E-01	1 48E-01	5 42E-04	28	
ERL FAT/TOTAL	0 2-0 5 KM	0 7827	5 98E-03	1 63E-03	3 00E-02	3 08E-02	3 28E-02	3.57E-02	3 67E-02	4 85E-04	57	
ENL FAT/TOTAL	0 5-1 2 KM	0 6689	5 25E-04	1 24E-04	1 52E-03	2 19E-03	5 48E-03	NOT-FOUND	8.78E-03	4.14E-03	17	
ERL FAT/TOTAL	1 2-1 6 KM	0 5820	1 16E-04	5 54E-06	5 03E-04	5 79E-04	1 05E-03	1 41E-03	1.55E-03	4 85E-04	33	
ERL FAT/TOTAL	1 6-2 1 KM	0 3860	4 20E-05	0 00E+00	1 29E-04	2.30E-04	NOT-FOUND	NOT-FOUND	7 27E-04	1.00E-02	79	
POPULATION DOSE (SV)												
EDEWBODY TOT LIF	0-16 1 KM	1 0000	1 34E+03	6 49E+02	2 95E+03	4 49E+03	1 08E+04	2 23E+04	2.92E+04	2.85E-04	123	
EDEWBODY TOT LIF	0-80.5 KM	1 0000	1 12E+04	5 89E+03	2 94E+04	4 04E+04	5 92E+04	7.70E+04	9 70E+04	5 71E-05	75	
EDEWBODY TOT LIF	0-1609 KM	1.0000	5 55E+04	3.49E+04	1 24E+05	1.81E+05	2.79E+05	NOT-FOUND	4.49E+05	1.77E-03	5	
POPULATION WEIGHTED RISK												
ERL FAT/TOTAL	0-2 1 KM	0.1312	2 03E-04	0.00E+00	2 39E-05	2 91E-04	7 45E-03	1.57E-02	4.38E-02	1 14E-04	17	
CAN FAT/TOTAL	0-16.1 KM	0.9993	2.60E-04	1.11E-04	5.88E-04	9.48E-04	2 53E-03	4 85E-03	7.75E-03	2.85E-04	85	

DATE AND TIME OF RUN = MACCS 2 NOV 89 14 25 06 VERSION 1 5 11, 10/16/89, D CHANIN
 "ATMOS" DESCRIPTION = IN1A INP, SURRY, SAMPLE PROBLEM A, ATMOS INPUT
 "EARLY" DESCRIPTION = IN2A INP, SURRY, SAMPLE PROBLEM A, EARLY INPUT

SOURCE TERM 2 OF 2

RELEASE FRACTIONS OF SOURCE TERM 1 REDUCED BY A FACTOR OF TEN

RESULTS FOR A SINGLE EMERGENCY RESPONSE COHORT WITHOUT ANY WEIGHTING FRACTIONS BEING APPLIED

COHORT 1 = EVACUATION WITHIN 10 MILES, RELOCATION MODELS APPLY ELSEWHERE

2-NOV-89	14 25 06	PAGE	21	PROB NON-ZERO	MEAN	50TH	QUANTILES 90TH	95TH	99TH	99 9TH	PEAK CONS	PEAK PROB	PEAK TRIAL
HEALTH EFFECTS CASES													
ERL FAT/TOTAL	0-1609 KM	0	0404	1	40E-03	0	00E+00	0	00E+00	5	13E-02	1	48E-01
ERL INJ/PRODRMAL VOMIT	0-1609 KM	0	2546	1	20E-01	0	00E+00	2	17E-01	6	89E-01	2	29E+00
ERL INJ/DIARRHEA	0-1609 KM	0	1157	2	38E-02	0	00E+00	7	32E-03	7	65E-02	6	64E-01
ERL INJ/PNEUMONITIS	0-1609 KM	0	0074	1	28E-04	0	00E+00	0	00E+00	0	00E+00	6	75E-03
ERL INJ/THYROIDITIS	0-1609 KM	0	0837	6	67E-03	0	00E+00	0	00E+00	3	12E-02	1	35E-01
ERL INJ/HYPOTHYROIDISM	0-1609 KM	0	5385	7	87E+00	2	71E-02	1	39E+01	2	93E+01	1	55E+02
ERL INJ/SKIN ERYTHEMA	0-1609 KM	0	6775	4	00E+02	1	70E+01	5	62E+02	1	88E+03	7	86E+03
ERL INJ/TRANSEPIDERMAL	0-1609 KM	0	5785	8	68E+01	2	22E-01	1	29E+02	2	46E+02	1	80E+03
CAN FAT/TOTAL	0-1609 KM	1	0000	5	53E+01	3	67E+01	1	10E+02	1	45E+02	2	64E+02
CAN FAT/LUNG	0-1609 KM	1	0000	7	83E+00	5	52E+00	1	52E+01	2	07E+01	3	34E+01
CAN FAT/THYROID	0-1609 KM	1	0000	1	46E+01	8	38E+00	3	12E+01	4	47E+01	1	05E+02
CAN FAT/BREAST	0-1609 KM	1	0000	1	21E+01	8	48E+00	2	46E+01	3	25E+01	5	38E+01
CAN FAT/GI	0-1609 KM	1	0000	1	16E+01	8	02E+00	2	32E+01	3	07E+01	5	13E+01
CAN FAT/LEUKEMIA	0-1609 KM	1	0000	3	12E+00	2	23E+00	6	38E+00	7	98E+00	1	24E+01
CAN FAT/BONE	0-1609 KM	1	0000	2	89E-01	2	12E-01	6	30E-01	7	98E-01	1	13E+00
CAN FAT/OTHER	0-1609 KM	1	0000	5	78E+00	3	92E+00	1	14E+01	1	47E+01	2	65E+01
CAN INJ/TOTAL	0-1609 KM	1	0000	2	22E+02	1	38E+02	4	58E+02	6	32E+02	1	26E+03
CAN FAT/TOTAL	0-80 5 KM	1	0000	3	57E+01	1	65E+01	8	71E+01	1	27E+02	2	62E+02
ERL FAT/TOTAL	0-16 1 KM	0	0404	1	40E-03	0	00E+00	0	00E+00	0	00E+00	5	13E-02
ERL INJ/PRODRMAL VOMIT	0-16 1 KM	0	2546	1	20E-01	0	00E+00	2	17E-01	6	89E-01	2	29E+00
ERL INJ/DIARRHEA	0-16 1 KM	0	1157	2	38E-02	0	00E+00	7	32E-03	7	65E-02	6	64E-01
ERL INJ/PNEUMONITIS	0-16 1 KM	0	0074	1	28E-04	0	00E+00	0	00E+00	0	00E+00	6	75E-03
ERL INJ/THYROIDITIS	0-16 1 KM	0	0837	6	67E-03	0	00E+00	0	00E+00	3	12E-02	1	35E-01
ERL INJ/HYPOTHYROIDISM	0-16 1 KM	0	5357	7	78E+00	2	23E-02	1	35E+01	2	92E+01	1	55E+02
ERL INJ/SKIN ERYTHEMA	0-16 1 KM	0	6610	3	88E+02	1	21E+01	5	10E+02	1	85E+03	7	86E+03
ERL INJ/TRANSEPIDERMAL	0-16 1 KM	0	5785	8	68E+01	2	22E-01	1	29E+02	2	46E+02	1	80E+03
CAN FAT/TOTAL	0-16 1 KM	0	9074	9	47E+00	1	32E+00	1	88E+01	4	12E+01	1	33E+02
EARLY FATALITY DISTANCE (KM)													
ERL FAT/TOTAL RISK > 0 000				0	9630	6	81E-01	5	23E-01	2	01E+00	2	42E+00
POPULATION EXCEEDING DOSE													
EARLY-ACUTE RED MARR > 1 500 SV				0	0404	5	32E-02	0	00E+00	0	00E+00	2	26E+00
EARLY-ACUTE LUNGS > 5 000 SV				0	0074	6	01E-03	0	00E+00	0	00E+00	8	90E-01
EARLY-LIFETIME EDWBODY > 0 050 SV				0	9418	6	86E+03	1	98E+03	1	55E+04	2	82E+04
AVERAGE INDIVIDUAL RISK													
ERI FAT/TOTAL	0-0 2 KM	0	9630	6	71E-02	7	24E-02	1	06E-01	1	10E-01	1	22E-01
ERL FAT/TOTAL	0 2-0 5 KM	0	5391	4	83E-03	9	61E-05	2	28E-02	3	03E-02	3	34E-02
ERL FAT/TOTAL	0 5-1 2 KM	0	2889	2	43E-04	0	00E+00	7	79E-04	1	19E-03	4	59E-03
ERL FAT/TOTAL	1 2-1 6 KM	0	1349	4	97E-05	0	00E+00	1	65E-04	3	95E-04	6	05E-04
ERL FAT/TOTAL	1 6-2 1 KM	0	1024	1	29E-05	0	00E+00	5	17E-05	9	88E-05	NOT-FOUND	NOT-FOUND

2-NOV 89	14	25	06	PAGE	22	PROB NON-ZERO	MEAN	50TH	QUANTILES 90TH 95TH	99TH	9TH	PEAK CONS	PEAK PROB	PEAK TRIAL	
POPULATION DISE (SV)															
POP-MEMORY	NOT	IF		0 16	1 KM	0 9074	5 42E+02	8 07E+01	1 11E+03	2 48E+03	8 81E+03	1 75E+04	2 65E+04	2 85E-04	123
POP-MEMORY	NOT	LIF		0 80	5 KM	1 0000	2 16E+03	1 03E+03	5 30E+03	8 10E+03	1 58E+04	2 71E+04	3 50E+04	2 85E-04	123
POP-MEMORY	TOT	LIF		0 1609	KM	1 0000	3 43E+03	2 31E+03	7 08E+03	9 13E+03	1 62E+04	2 71E+04	3 50E+04	2 85E-04	123
POPULATION WEIGHTED RISK															
LRI, PAL/TOTAL				0 2	1 KM	0 0404	6 83E-05	0 00E+00	0 00E+00	0 00E+00	3 03E-03	6 04E-03	3 45E-02	1 14E-04	17
CAN FAT/TOTAL				0 16	1 KM	0 9074	1 29E-04	1 79E-05	2 55E-04	5 60E-04	2 08E-03	4 69E-03	7 27E-03	2 85E-04	85

DATE AND TIME OF RUN = MACCS 2 NOV 89 14 25 06 VERSION 1 5 11, 10/16/89, D CHANIN
 "ATMOS" DESCRIPTION = IN1A INP, SURRY, SAMPLE PROBLEM A, ATMOS INPUT
 "EARLY" DESCRIPTION = IN2A INP, SURRY, SAMPLE PROBLEM A, EARLY INPUT

SOURCE TERM 2 OF 2
 RELEASE FRACTIONS OF SOURCE TERM 1 REDUCED BY A FACTOR OF TEN

RESULTS FOR A SINGLE EMERGENCY RESPONSE COHORT WITHOUT ANY WEIGHTING FRACTIONS BEING APPLIED

COHORT 2 = NO EVACUATION, RELOCATION MODELS APPLY EVERYWHERE

2 NOV 89 14 25 06	PAGE 23	PROB NON-ZERO	MEAN	50TH	QUANTILES 90TH	95TH	99TH	99 9TH	PEAK CONS	PEAK PROB	PEAK TRIAL
HEALTH EFFECTS CASES											
ERL FAT/TOTAL	0-1609 KM	0 2027	6 48E-02	0 00E+00	2 98E-02	2 20E-01	2 11E+00	3 29E+00	8 18E+00	3 06E-05	130
ERL INJ/PRODRONTAL VOMIT	0-1609 KM	0 5015	5 42E-01	1 23E-03	1 50E+00	3 37E+00	7 47E+00	1 18E+01	6 00E+01	7 15E-06	129
ERL INJ/DIARRHEA	0-1609 KM	0 3055	2 09E-01	0 00E+00	4 74E-01	1 21E+00	3 55E+00	7 04E+00	1 35E+01	5 84E-06	130
ERL INJ/PNEUMONITIS	0 1609 KM	0 0330	5 98E-03	0 00E+00	0 00E+00	0 00E+00	3 04E-01	4 83E-01	2 18E+00	3 50E-05	46
ERL INJ/THYROIDITIS	0-1609 KM	0 0387	2 37E-03	0 00E+00	0 00E+00	0 00E+00	1 05E-01	1 77E-01	4 84E-01	3 50E-05	46
ERL INJ/HYPOTHYROIDISM	0-1609 KM	0 6265	3 85E+00	1 50E-01	9 54E+00	2 39E+01	5 23E+01	NOT-FOUND	1 02E+02	1 06E-03	41
ERL INJ/SKIN ERYTHEMA	0-1609 KM	0 8379	2 43E+02	3 57E+01	7 17E+02	1 36E+03	3 25E+03	5 66E+03	7 80E+03	1 14E-04	83
ERL INJ/TRANSEPIDERMAL	0-1609 KM	0 6991	1 35E+01	1 27E+00	4 43E+01	6 71E+01	1 38E+02	NOT-FOUND	3 61E+02	1 06E-03	115
CAN FAT/TOTAL	0-1609 KM	1 0000	5 99E+01	4 41E+01	1 17E+02	1 56E+02	2 27E+02	3 08E+02	4 50E+02	2 15E-04	102
CAN FAT/LUNG	0-1609 KM	1 0000	9 19E+00	6 92E+00	1 78E+01	2 32E+01	3 22E+01	3 95E+01	5 27E+01	5 71E-05	75
CAN FAT/THYROID	0-1609 KM	1 0000	1 37E+01	8 91E+00	2 72E+01	3 84E+01	7 42E+01	NOT-FOUND	1 09E+02	1 11E-03	51
CAN FAT/BREAST	0 1609 KM	1 0000	1 35E+01	1 02E+01	2 68E+01	3 40E+01	5 27E+01	9 00E+01	1 42E+02	2 15E-04	102
CAN FAT/GI	0-1609 KM	1 0000	1 29E+01	9 70E+00	2 55E+01	3 21E+01	4 62E+01	7 18E+01	1 11E+02	2 15E-04	102
CAN FAT/LEUKEMIA	0-1609 KM	1 0000	3 62E+00	2 72E+00	7 22E+00	9 15E+00	1 30E+01	2 05E+01	3 07E+01	2 15E-04	102
CAN FAT/BONE	0-1609 KM	1 0000	3 90E-01	2 78E-01	7 82E-01	1 00E+00	1 91E+00	2 29E+00	3 09E+00	1 28E-05	56
CAN FAT/OTHER	0-1609 KM	1 0000	6 47E+00	4 83E+00	1 25E+01	1 62E+01	2 35E+01	3 61E+01	5 57E+01	2 15E-04	102
CAN INJ/TOTAL	0-1609 KM	1 0000	2 23E+02	1 56E+02	4 41E+02	6 03E+02	1 02E+03	NOT-FOUND	1 38E+03	1 11E-03	51
CAN FAT/TOTAL	0-80 5 KM	1 0000	4 03E+01	2 30E+01	9 73E+01	1 43E+02	2 27E+02	3 08E+02	4 49E+02	2 15E-04	102
ERL FAT/TOTAL	0-16 1 KM	0 2027	6 48E-02	0 00E+00	2 98E-02	2 20E-01	2 11E+00	3 29E+00	8 18E+00	3 06E-05	130
ERL INJ/PRODRONTAL VOMIT	0-16 1 KM	0 5015	5 42E-01	1 23E-03	1 50E+00	3 37E+00	7 47E+00	1 18E+01	6 00E+01	7 15E-06	129
ERL INJ/DIARRHEA	0 16 1 KM	0 3055	2 09E-01	0 00E+00	4 74E-01	1 21E+00	3 55E+00	7 04E+00	1 35E+01	5 84E-06	130
ERL INJ/PNEUMONITIS	0-16 1 KM	0 0330	5 98E-03	0 00E+00	0 00E+00	0 00E+00	3 04E-01	4 83E-01	2 18E+00	3 50E-05	46
ERL INJ/THYROIDITIS	0-16 1 KM	0 0387	2 37E-03	0 00E+00	0 00E+00	0 00E+00	1 05E-01	1 77E-01	4 84E-01	3 50E-05	46
ERL INJ/HYPOTHYROIDISM	0-16 1 KM	0 6253	3 76E+00	1 47E-01	9 36E+00	2 33E+01	4 98E+01	NOT-FOUND	1 02E+02	1 06E-03	41
ERL INJ/SKIN ERYTHEMA	0-16 1 KM	0 8358	2 32E+02	3 51E+01	6 94E+02	1 32E+03	2 87E+03	5 28E+03	6 13E+03	1 14E-04	30
ERL INJ/TRANSEPIDERMAL	0-16 1 KM	0 6991	1 35E+01	1 27E+00	4 43E+01	6 71E+01	1 38E+02	NOT-FOUND	3 61E+02	1 06E-03	115
CAN FAT/TOTAL	0-16 1 KM	0 9993	1 41E+01	6 27E+00	3 65E+01	5 09E+01	9 07E+01	NOT-FOUND	1 49E+02	1 06E-03	41
EARLY FATALITY DISTANCE (KM)											
ERL FAT/TOTAL RISK > 0 000		0 9998	1 74E+00	1 44E+00	3 58E+00	4 20E+00	NOT-FOUND	NOT-FOUND	5 63E+00	2 32E-02	34
POPULATION EXCEEDING DOSE											
EARLY-ACUTE RED MARR > 1 500 SV		0 2027	6 12E-01	0 00E+00	2 02E+00	4 64E+00	9 35E+00	1 74E+01	3 50E+01	5 84E-06	130
EARLY-ACUTE LUNGS > 5 000 SV		0 0330	4 76E-02	0 00E+00	0 00E+00	0 00E+00	2 13E+00	2 85E+00	6 00E+00	5 84E-06	130
EARLY-LIFETIME EDEWBODY > 0 050 SV		0 9982	8 59E+03	3 25E+03	2 04E+04	3 43E+04	9 08E+04	1 34E+05	2 30E+05	5 71E-05	75
AVERAGE INDIVIDUAL RISK											
ERL FAT/TOTAL	0-0 2 KM	0 9998	1 72E-01	1 40E-01	2 23E-01	2 44E-01	NOT FOUND	NOT-FOUND	2 82E-01	1 55E-02	59
ERL FAT/TOTAL	0 2-0 5 KM	0 7827	2 79E-02	2 27E-02	6 21E-02	7 07E-02	8 18E-02	1 03E-01	1 25E-01	5 42E-04	28
ERL FAT/TOTAL	0 5-1 2 KM	0 6646	5 90E-03	2 66E-03	2 07E-02	2 27E-02	2 80E-02	5 07E-02	7 07E-02	5 42E-04	28
ERL FAT/TOTAL	1 2 1 6 KM	0 5820	1 37E-03	1 12E-04	3 47E-03	5 52E-03	1 25E-02	1 99E-02	3 09E-02	4 85E-04	33
ERL FAT/TOTAL	1 6-2 1 KM	0 3860	5 95E-04	0 00E+00	1 14E-03	1 58E-03	NOT-FOUND	NOT-FOUND	1 45E-02	1 00E-02	79

2 NOV-89	14	25	06	PAGE	24	PROB NON-ZERO	MEAN	50TH	QUANTILES			99TH	99TH	PEAK CONS	PEAK PROB	PEAK TRIAL
POPULATION DOSE (SV)																
LDH-WHODY	NOT	LIF				0 16 1 NM	0 9993	7 78E+02	3 19E+02	2 13E+03	2 78E+03	4 85E+03	NOT-FOUND	8 08E+03	1 06E-03	41
LDH-WHODY	TOP	LIF				0 80 5 NM	1 0000	2 40E+03	1 28E+03	5 62E+03	8 66E+03	1 27E+04	1 89E+04	2 67E+04	2 15E-04	102
LDH-WHODY	TOP	LIF				0 1609 NM	1 0000	3 67E+03	2 74E+03	7 29E+03	9 66E+03	1 29E+04	1 89E+04	2 67E+04	2 15E-04	102
POPULATION UNLIGHTED RISK																
ERL IAT/TOTAL						0 2 1 NM	0 1312	2 77E-03	0 00E+00	4 19E-04	4 54E-03	1 06E-01	1 66E-01	3 51E-01	2 48E-05	33
CAN IAT/TOTAL						0 16 1 NM	0 9993	1 92E-04	8 61E-05	5 26E-04	6 93E-04	1 13E-03	NOT-FOUND	2 04E-03	1 06E-03	41

DATE AND TIME OF RUN = MACCS 2-NOV-89 14 25 06 VERSION 1 5 11, 10/16/89, D CHANIN
 "ATMOS" DESCRIPTION = IN1A INP, SURRY, SAMPLE PROBLEM A, ATMOS INPUT
 "EARLY" DESCRIPTION = IN2A INP, SURRY, SAMPLE PROBLEM A, EARLY INPUT

SOURCE TERM 2 OF 2
 RELEASE FRACTIONS OF SOURCE TERM 1 REDUCED BY A FACTOR OF TEN

RESULTS FOR A SINGLE EMERGENCY RESPONSE COHORT WITHOUT ANY WEIGHTING FRACTIONS BEING APPLIED

COHORT 3 = SHELTERING WITHIN 10 MILES, RELOCATION MODELS APPLY ELSEWHERE

2-NOV-89 14 25 06 PAGE 25	PROB NON-ZERO	MEAN	50TH	QUANTILES 90TH 95TH	99TH	99 9TH	PEAK CONS	PEAK PROB	PEAK TRIAL
HEALTH EFFECTS CASES									
ERL FAT/TOTAL	0 1609 KM	0 0987	1 62E-02	0 00E+00	0 00E+00	1 32E-02	7 51E-01	1 59E+00	3 89E+00 2 48E-05 33
ERL INJ/PRODRMAL VOMIT	0-1609 KM	0 4274	1 83E-01	0 00E+00	3 53E-01	1 01E+00	3 40E+00	6 06E+00	1 09E+01 5 84E-06 130
ERL INJ/DIARRHEA	0-1609 KM	0 2012	6 65E-02	0 00E+00	7 24E-02	3 24E-01	1 65E+00	3 14E+00	5 05E+00 2 48E-05 33
ERL INJ/PNEUMONITIS	0-1609 KM	0 0151	8 24E-04	0 00E+00	0 00E+00	0 00E+00	3 04E-02	4 83E-02	8 81E-01 3 50E-05 46
ERL INJ/THYROIDITIS	0-1609 KM	0 0204	1 16E-03	0 00E+00	0 00E+00	0 00E+00	6 69E-02	9 63E-02	2 91E-01 3 50E-05 46
ERL INJ/HYPOTHYROIDISM	0-1609 KM	0 6147	2 16E+00	6 90E-02	6 10E+00	1 22E+01	2 85E+01	NOT-FOUND	7 02E+01 1 06E-03 50
ERL INJ/SKIN ERYTHEMA	0-1609 KM	0 8072	1 60E+02	2 20E+01	4 72E+02	9 16E+02	2 08E+03	3 64E+03	6 18E+03 1 14E-04 83
ERL INJ/TRANSEPIDERMAL	0-1609 KM	0 6480	7 42E+00	5 62E-01	2 57E+01	3 62E+01	6 30E+01	NOT-FOUND	1 38E+02 1 06E-03 115
CAN FAT/TOTAL	0-1609 KM	1 0000	5 35E+01	3 90E+01	1 03E+02	1 31E+02	2 11E+02	2 88E+02	4 44E+02 2 15E-04 102
CAN FAT/LUNG	0-1609 KM	1 0000	8 04E+00	6 03E+00	1 60E+01	2 10E+01	2 97E+01	3 97E+01	4 81E+01 2 15E-04 102
CAN FAT/THYROID	0-1609 KM	1 0000	1 27E+01	8 48E+00	2 57E+01	3 66E+01	6 85E+01	NOT-FOUND	1 01E+02 1 11E-03 51
CAN FAT/BREAST	0-1609 KM	1 0000	1 21E+01	8 87E+00	2 43E+01	3 19E+01	5 06E+01	8 96E+01	1 40E+02 2 15E-04 102
CAN FAT/GI	0-1609 KM	1 0000	1 14E+01	8 48E+00	2 28E+01	3 04E+01	4 28E+01	6 89E+01	1 10E+02 2 15E-04 102
CAN FAT/LEUKEMIA	0-1609 KM	1 0000	3 18E+00	2 39E+00	6 44E+00	8 02E+00	1 19E+01	1 97E+01	3 03E+01 2 15E-04 102
CAN FAT/BONE	0-1609 KM	1 0000	3 37E-01	2 44E-01	6 86E-01	9 00E-01	1 47E+00	2 04E+00	2 18E+00 1 28E-05 56
CAN FAT/OTHER	0-1609 KM	1 0000	5 70E+00	4 16E+00	1 10E+01	1 38E+01	2 18E+01	3 57E+01	5 50E+01 2 15E-04 102
CAN INJ/TOTAL	0-1609 KM	1 0000	2 03E+02	1 42E+02	4 02E+02	5 58E+02	9 03E+02	1 18E+03	1 35E+03 2 15E-04 102
CAN FAT/TOTAL	0-80 5 KM	1 0000	3 40E+01	1 83E+01	8 24E+01	1 16E+02	2 10E+02	2 88E+02	4 44E+02 2 15E-04 102
ERL FAT/TOTAL	0-16 1 KM	0 0987	1 62E-02	0 00E+00	0 00E+00	1 32E-02	7 51E-01	1 59E+00	3 89E+00 2 48E-05 33
ERL INJ/PRODRMAL VOMIT	0-16 1 KM	0 4274	1 83E-01	0 00E+00	3 53E-01	1 01E+00	3 40E+00	6 06E+00	1 09E+01 5 84E-06 130
ERL INJ/DIARRHEA	0-16 1 KM	0 2012	6 65E-02	0 00E+00	7 24E-02	3 24E-01	1 65E+00	3 14E+00	5 05E+00 2 48E-05 33
ERL INJ/PNEUMONITIS	0-16 1 KM	0 0151	8 24E-04	0 00E+00	0 00E+00	0 00E+00	3 04E-02	4 83E-02	8 81E-01 3 50E-05 46
ERL INJ/THYROIDITIS	0-16 1 KM	0 0204	1 16E-03	0 00E+00	0 00E+00	0 00E+00	6 69E-02	9 63E-02	2 91E-01 3 50E-05 46
ERL INJ/HYPOTHYROIDISM	0-16 1 KM	0 6135	2 07E+00	6 78E-02	5 96E+00	1 15E+01	2 63E+01	NOT-FOUND	5 79E+01 1 06E-03 41
ERL INJ/SKIN ERYTHEMA	0-16 1 KM	0 8026	1 48E+02	2 16E+01	4 24E+02	8 64E+02	1 90E+03	NOT-FOUND	3 92E+03 1 06E-03 41
ERL INJ/TRANSEPIDERMAL	0-16 1 KM	0 6480	7 42E+00	5 62E-01	2 57E+01	3 62E+01	6 30E+01	NOT-FOUND	1 38E+02 1 06E-03 115
CAN FAT/TOTAL	0-16 1 KM	0 9993	7 69E+00	3 24E+00	2 17E+01	2 91E+01	5 48E+01	NOT-FOUND	9 40E+01 1 06E-03 41
EARLY FATALITY DISTANCE (KM)									
ERL FAT/TOTAL RISK > 0 000		0 9998	1 15E+00	1 09E+00	2 77E+00	3 10E+00	3 48E+00	4 12E+00	4 83E+00 1 14E-04 130
POPULATION EXCEEDING DOSE									
EARLY ACUTE RED MARR > 1 500 SV		0 0987	1 80E-01	0 00E+00	0 00E+00	4 54E-01	5 47E+00	9 23E+00	1 20E+01 3 06E-05 130
EARLY ACUTE LUNGS > 5 000 SV		0 0151	2 64E-02	0 00E+00	0 00E+00	0 00E+00	2 01E+00	2 54E+00	2 71E+00 5 20E-04 17
EARLY LIFETIME PDEWBODY > 0 050 SV		0 9462	7 07E+03	2 25E+03	1 58E+04	3 09E+04	8 43E+04	1 31E+05	2 17E+05 5 71E-05 75
AVERAGE INDIVIDUAL RISK									
ERL FAT/TOTAL	0-0 2 KM	0 9998	1 44E-01	1 19E-01	1 85E-01	2 13E-01	NOT-FOUND	NOT-FOUND	2 55E-01 1 55E-02 59
ERL FAT/TOTAL	0 2-0 5 KM	0 6667	1 66E-02	4 22E-03	4 25E-02	5 08E-02	5 80E-02	7 11E-02	1 09E-01 5 42E-04 28
ERL FAT/TOTAL	0 5-1 2 KM	0 5428	1 94E-03	3 19E-04	7 59E-03	1 16E-02	2 14E-02	3 03E-02	4 12E-02 4 85E-04 33
ERL FAT/TOTAL	1 2-1 6 KM	0 3593	2 54E-04	0 00E+00	4 99E-04	7 64E-04	5 69E-03	8 25E-03	8 82E-03 4 85E-04 133
ERL FAT/TOTAL	1 6-2 1 KM	0 2811	8 15E-05	0 00E+00	2 01E-04	2 54E-04	2 04E-03	2 24E-03	2 28E-03 6 85E-04 46

2 NOV 89	14 25 06	PAGE 26	PROB NON ZERO	MEAN	50 TH	QUANTILES 90TH 95TH	99 9TH	PEAK CONS	PEAK PROB	PEAK TRIAL
POPULATION DISE (SV)										
100 MIBODY	NOT LIF	0 16 1 KM	0 9993	4 49E+02	1 72E+02	1 20E+03 1 75E+03	3 23E+03 NOT-FOUND	5 47E+03	1 06E-03	41
100 MIBODY	NOT LIF	0 00 5 KM	1 0000	2 07E+03	1 11E+03	5 18E+03 7 86E+03	1 24E+04 1 88E+04	2 64E+04	2 15E-04	102
100 MIBODY	NOT LIF	0 1609 KM	1 0000	3 34E+03	2 47E+03	6 47E+03 8 71E+03	1 26E+04 1 88E+04	2 64E+04	2 15E-04	102
POPULATION WEIGHTED RISK										
FHL FAT/TOTAL		0 2 1 KM	0 0978	7 94F 04	0 00E+00	0 00E+00 5 54E-04	3 31E-02 6 68E-02	1 95E-01	2 48E-05	33
CAN FAT/TOTAL		0 16 1 KM	0 9993	1 03E 04	4 29E-03	3 02E-04 4 15E-04	7 54E-04 NOT-FOUND	1 28E-03	1 06E-03	41

DATE AND TIME OF RUN = MACCS 2 NOV-89 14 25 06 VERSION 1 5 11, 10/16/89, D CHANIN
 'ATHOS' DESCRIPTION = IN1A INP, SURRY, SAMPLE PROBLEM A, ATHOS INPUT
 'EARLY' DESCRIPTION = IN2A INP, SURRY, SAMPLE PROBLEM A, EARLY INPUT
 'CHRONC' DESCRIPTION = IN3A INP, SURRY, SAMPLE PROBLEM A, CHRONC

SOURCE TERM 2 OF 2
 RELEASE FRACTIONS OF SOURCE TERM 1 REDUCED BY A FACTOR OF TEN

RESULTS FROM THE 'CHRONC' MODULE ALONE

COHORT 4 = IN3A INP, SURRY, SAMPLE PROBLEM A, CHRONC

2-NOV-89 14 25 06 PAGE 27	PROB NON-ZERO	MEAN	50TH	QUANTILES 90TH	95TH	99TH	99 9TH	PEAK CONS	PEAK PROB	PEAK TRIAL
HEALTH EFFECTS CASES										
CAN FAT/TOTAL	0-1609 KM 1 0000	8 86E+02	5 29E+02	2 14E+03	3 02E+03	4 66E+03	NOT-FOUND	8 09E+03	1 77E-03	5
CAN FAT/LUNG	0-1609 KM 1 0000	8 56E+01	5 18E+01	2 08E+02	2 93E+02	4 60E+02	NOT-FOUND	7 56E+02	1 77E-03	5
CAN FAT/THYROID	0-1609 KM 1 0000	4 03E+01	2 24E+01	1 05E+02	1 36E+02	2 42E+02	NOT-FOUND	3 79E+02	1 77E-03	5
CAN FAT/BREAST	0-1609 KM 1 0000	2 80E+02	1 67E+02	7 10E+02	9 63E+02	1 63E+03	2 25E+03	2 62E+03	1 14E-04	112
CAN FAT/GI	0-1609 KM 1 0000	2 60E+02	1 43E+02	6 64E+02	9 52E+02	1 63E+03	NOT-FOUND	2 66E+03	1 77E-03	5
CAN FAT/LEUKEMIA	0-1609 KM 1 0000	8 48E+01	5 57E+01	1 98E+02	2 85E+02	4 32E+02	5 89E+02	6 79E+02	2 28E-04	4
CAN FAT/BONE	0-1609 KM 1 0000	4 95E+00	3 35E+00	1 04E+01	1 34E+01	2 13E+01	2 75E+01	3 33E+01	2 28E-04	4
CAN FAT/OTHER	0-1609 KM 1 0000	1 30E+02	7 41E+01	3 25E+02	4 73E+02	7 84E+02	NOT-FOUND	1 33E+03	1 77E-03	5
CAN INJ/TOTAL	0-1609 KM 1 0000	2 04E+03	1 19E+03	5 12E+03	7 17E+03	1 14E+04	NOT-FOUND	1 85E+04	1 77E-03	5
CAN FAT/TOTAL	0-80 5 KM 1 0000	1 49E+02	7 42E+01	3 67E+02	5 51E+02	8 68E+02	1 09E+03	1 25E+03	5 71E-05	75
CAN FAT/TOTAL	0-16 1 KM 1 0000	1 29E+01	7 06E+00	3 10E+01	4 30E+01	7 32E+01	8 73E+01	1 05E+02	1 71E-04	63
POPULATION DOSE (SV)										
EDEWBODY TOT LIP	0-16 1 KM 1 0000	7 89E+02	4 27E+02	1 80E+03	2 59E+03	3 93E+03	5 39E+03	6 06E+03	1 71E-04	63
EDEWBODY TOT LIP	0-80 5 KM 1 0000	9 04E+03	4 49E+03	2 31E+04	3 28E+04	5 18E+04	6 28E+04	7 43E+04	5 71E-05	75
EDEWBODY TOT LIP	0-1609 KM 1 0000	5 21E+04	3 18E+04	1 21E+05	1 80E+05	2 76E+05	NOT-FOUND	4 47E+05	1 77E-03	5
POPULATION WEIGHIED RISK										
CAN FAT/TOTAL	0-16 1 KM 0 9828	1 28E-04	4 64E-05	3 49E-04	4 83E-04	7 37E-04	8 87E-04	1 12E-03	1 71E-04	63
EDEWBODY POP DOSE (SV) 0-1609 KM										
TOTAL LONG-TERM PATHWAYS DOSE	1 0000	5 21E+04	3 18E+04	1 21E+05	1 80E+05	2 76E+05	NOT-FOUND	4 47E+05	1 77E-03	5
LONG TERM DIRECT EXPOSURE PATHWAYS	1 0000	3 23E+04	2 23E+04	6 60E+04	9 05E+04	1 81E+05	2 87E+05	4 24E+05	1 14E-04	112
TOTAL INGESTION PATHWAYS DOSE	1 0000	1 94E+04	4 98E+03	4 99E+04	1 04E+05	1 96E+05	NOT-FOUND	3 98E+05	1 77E-03	5
LONG-TERM GROUNDSHINE DOSE	1 0000	3 16E+04	2 16E+04	6 52E+04	9 04E+04	1 81E+05	2 87E+05	4 19E+05	1 14E-04	112
LONG-TERM RESUSPENSION DOSE	1 0000	6 93E+02	4 85E+02	1 47E+03	2 02E+03	2 66E+03	4 25E+03	5 27E+03	1 14E-04	112
POP DEPENDENT DECONTAMINATION DOSE	1 0000	3 10E+02	1 41E+02	7 22E+02	1 25E+03	2 66E+03	4 37E+03	1 05E+04	5 71E-05	75
AREA DEPENDENT DECONTAMINATION DOSE	0 7813	7 88E-01	3 35E-01	2 08E+00	2 66E+00	5 49E+00	NOT-FOUND	6 12E+00	4 42E-03	49
MILK DIRECT-DEPOSITION DOSE	0 4097	2 52E+03	0 00E+00	8 16E+03	1 69E+04	3 21E+04	5 36E+04	6 22E+04	2 28E-04	4
CROP DIRECT-DEPOSITION DOSE	0 4097	1 19E+04	0 00E+00	3 17E+04	8 04E+04	1 65E+05	NOT-FOUND	3 23E+05	1 77E-03	5
MILK ROOT-UP TAKE DOSE	1 0000	8 90E+02	6 03E+02	2 19E+03	2 65E+03	3 28E+03	3 92E+03	4 63E+03	1 14E-04	105
CROP ROOT-UP TAKE DOSE	1 0000	3 92E+03	2 69E+03	9 46E+03	1 07E+04	1 29E+04	1 68E+04	2 00E+04	2 28E-04	4
WATER INGESTION DOSE	1 0000	1 74E+02	1 29E+02	3 45E+02	4 55E+02	6 33E+02	8 33E+02	1 22E+03	1 88E-05	39
EDEWBODY POP DOSE (SV) 0-80 5 KM										
TOTAL LONG-TERM PATHWAYS DOSE	1 0000	9 04E+03	4 49E+03	2 31E+04	3 28E+04	5 18E+04	6 28E+04	7 43E+04	5 71E-05	75
LONG-TERM DIRECT EXPOSURE PATHWAYS	1 0000	7 49E+03	3 01E+03	2 17E+04	3 10E+04	4 78E+04	NOT-FOUND	6 73E+04	2 37E-03	55
TOTAL INGESTION PATHWAYS DOSE	1 0000	1 25E+03	9 32E+02	2 35E+03	3 55E+03	6 12E+03	7 65E+03	7 72E+03	8 28E-04	34
LONG-TERM GROUNDSHINE DOSE	1 0000	7 22E+03	2 84E+03	2 09E+04	3 09E+04	4 73E+04	NOT-FOUND	6 66E+04	2 37E-03	55
LONG-TERM RESUSPENSION DOSE	1 0000	2 72E+02	1 28E+02	5 95E+02	1 06E+03	2 10E+03	2 84E+03	5 06E+03	3 64E-04	68

2 NOV 89 14 25 06 PAGE 28			PROB	NON ZERO		MEAN	50TH	QUANTILES		90TH	95TH	99TH	99 9TH	PEAK	PEAK	PEAK			
				0 80 5										CONS	PROB	TRIAL			
BIOBODDY POP DOSE (SV)			0 80 5	KM															
POP DEPENDENT DECONTAMINATION DOSE	0	9999	3	03E+02	1	31E+02	7	20E+02	1	25E+03	2	66E+03	4	37E+03	1	05E+04	5	71E-05	75
AREA DEPENDENT DECONTAMINATION DOSE	0	7619	6	57E+01	2	71E 01	1	65E+00	2	29E+00	5	31E+00	NOT FOUND	5	60E+00	5	51E-03	86	
MILK DIRECT DEPOSITION DOSE	0	4096	4	87E+01	0	00E+00	1	34E+02	2	15E+02	7	16E+02	9	19E+02	9	38E+02	8	28E-04	34
CROP DIRECT DEPOSITION DOSE	0	4096	3	77E+02	0	00E+00	1	31E+03	2	30E+03	3	65E+03	5	12E+03	5	15E+03	8	28E-04	34
MILK ROCK UPTAKE DOSE	1	0000	1	31E+02	1	08E+02	2	49E+02	3	02E+02	3	31E+02	NOT-FOUND	3	65E+02	1	88E-03	52	
CROP ROCK UPTAKE DOSE	1	0000	5	72E+02	5	23E+02	9	79E+02	1	06E+03	1	23E+03	NOT-FOUND	1	50E+03	1	17E-03	15	
WATER INGESTION DOSE	1	0000	1	17E+02	8	03E+01	2	33E+02	3	03E+02	5	47E+02	8	27E+02	1	21E+03	1	88E-05	39
ECONOMIC COST MEASURES (\$)			0-1609	KM															
TOTAL ECONOMIC COSTS	1	0000	1	50E+09	8	48E+08	3	20E+09	6	40E+09	8	88E+09	1	21E+10	1	70E+10	5	71E-05	75
POP DEPENDENT COSTS	1	0000	1	31E+09	6	32E+08	3	03E+09	6	21E+09	8	84E+09	1	21E+10	1	69E+10	5	71E-05	75
AREA DEPENDENT COSTS	1	0000	1	90E+08	1	09E+08	4	46E+08	5	88E+08	1	10E+09	1	90E+09	1	95E+09	8	85E-04	2
POP DEPENDENT DECONTAMINATION COST	1	0000	3	30E+08	1	32E+08	7	25E+08	1	49E+09	2	59E+09	3	99E+09	5	28E+09	2	15E-04	102
AREA DEPENDENT DECONTAMINATION COST	0	7813	1	20E+07	6	99E+06	3	04E+07	5	10E+07	6	01E+07	7	71E+07	8	19E+07	5	99E-04	83
POP DEPENDENT INTERDICTION COST	1	0000	8	79E+08	3	91E+08	2	33E+09	4	25E+09	6	23E+09	8	96E+09	1	26E+10	5	71E-05	75
AREA DEPENDENT INTERDICTION COST	0	9698	3	89E+07	2	24E+07	1	03E+08	1	20E+08	1	71E+08	2	08E+08	2	24E+08	5	71E-05	32
POP DEPENDENT CONDEMNATION COST	0	6839	9	89E+07	3	87E+06	2	56E+08	7	16E+08	1	32E+09	2	48E+09	6	22E+09	3	86E 05	42
AREA DEPENDENT CONDEMNATION COST	1	0000	7	05E+07	4	84E+07	1	40E+08	1	93E+08	3	58E+08	NOT-FOUND	4	97E+08	1	17E-03	49	
EVACUATION AND RELOCATION COST	1	0000	3	58E+06	2	92E+06	7	92E+06	9	07E+06	1	15E+07	1	55E+07	2	85E+07	5	71E-05	75
MILK DISPOSAL COST	0	4314	4	93E+06	0	00E+00	1	15E+07	2	14E+07	1	03E+08	NOT-FOUND	1	59E+08	1	06E-03	135	
CROP DISPOSAL COST	0	4314	7	53E+07	0	00E+00	2	55E+08	4	16E+08	9	05E+08	1	68E+09	1	73E+09	8	85E-04	2
ECONOMIC COST MEASURES (\$)			0-80 5	KM															
TOTAL ECONOMIC COSTS	1	0000	1	32E+09	6	28E+08	2	96E+09	6	17E+09	8	85E+09	1	21E+10	1	70E+10	5	71E-05	75
POP DEPENDENT COSTS	1	0000	1	24E+09	5	51E+08	2	88E+09	6	14E+09	8	84E+09	1	21E+10	1	69E+10	5	71E-05	75
AREA DEPENDENT COSTS	1	0000	8	80E+07	7	55E+07	1	49E+08	1	86E+08	2	18E+08	2	51E+08	3	18E+08	6	54E 06	109
POP DEPENDENT DECONTAMINATION COST	0	9999	3	10E+08	1	16E+08	6	88E+08	1	46E+09	2	59E+09	3	89E+09	5	28E+09	2	15E-04	102
AREA DEPENDENT DECONTAMINATION COST	0	7619	8	48E+06	4	91E+06	2	16E+07	2	40E+07	3	09E+07	NOT-FOUND	3	39E+07	7	45E-03	49	
POP DEPENDENT INTERDICTION COST	0	9999	8	23E+08	3	40E+08	2	21E+09	4	20E+09	6	23E+09	8	96E+09	1	26E+10	5	71E-05	75
AREA DEPENDENT INTERDICTION COST	0	9553	2	25E+07	1	64E+07	4	92E+07	6	50E+07	7	61E+07	NOT-FOUND	8	15E+07	3	14E-03	52	
POP DEPENDENT CONDEMNATION COST	0	6839	9	89E+07	3	87E+06	2	56E+08	7	16E+08	1	32E+09	2	48E+09	6	22E+09	3	86E-05	42
AREA DEPENDENT CONDEMNATION COST	1	0000	5	81E+07	4	64E+07	1	10E+08	1	24E+08	1	64E+08	2	07E+08	2	40E+08	6	54E-06	109
EVACUATION AND RELOCATION COST	1	0000	3	58E+06	2	92E+06	7	92E+06	9	07E+06	1	15E+07	1	55E+07	2	85E+07	5	71E-05	75
MILK DISPOSAL COST	0	4314	4	66E+05	0	00E+00	1	36E+06	2	00E+06	2	26E+06	NOT-FOUND	2	68E+06	1	06E-03	135	
CROP DISPOSAL COST	0	4314	6	86E+06	0	00E+00	2	10E+07	2	63E+07	3	41E+07	NOT-FOUND	4	28E+07	1	14E-03	49	
MAXIMUM LONG TERM ACTION DISTANCE (KM)																			
AREA DEPENDENT DECONTAMINATION DIST	0	7813	5	64E+01	5	43E+01	1	11E+02	1	32E+02	NOT-FOUND	NOT-FOUND	1	61E+02	2	26E-02	13		
POP DEPENDENT DECONTAMINATION DIST	1	0000	6	87E+01	6	14E+01	1	14E+02	1	35E+02	NOT-FOUND	NOT-FOUND	1	61E+02	2	42E-02	13		
AREA DEPENDENT INTERDICTION DIST	0	9698	8	09E+01	7	80E+01	1	13E+02	1	21E+02	1	41E+02	1	76E+02	2	41E+02	2	57E 04	32
POP DEPENDENT INTERDICTION DIST	1	0000	6	87E+01	6	14E+01	1	14E+02	1	35E+02	NOT-FOUND	NOT-FOUND	1	61E+02	2	42E-02	13		
AREA DEPENDENT CONDEMNATION DIST	1	0000	6	12E+01	5	10E+01	9	78E+01	1	26E+02	NOT-FOUND	NOT-FOUND	1	61E+02	2	58E-02	21		
POP DEPENDENT CONDEMNATION DIST	0	6839	6	75E+00	7	64E+00	1	20E+01	1	33E+01	1	68E+01	2	94E+01	3	22E+01	9	42E-04	25
MILK DISPOSAL DIST	0	4314	1	04E+02	0	00E+00	3	61E+02	NOT-FOUND	NOT-FOUND	NOT-FOUND	NOT-FOUND	5	63E+02	5	23E-02	2		
CROP DISPOSAL DIST	0	4314	9	00E+01	0	00E+00	3	09E+02	3	93E+02	NOT-FOUND	NOT-FOUND	NOT-FOUND	5	63E+02	2	47E-02	2	
AFFECTED AREA/POPULATION			0-1609	KM															
DECONTAMINATION AREA (HECTARES)	0	7813	2	04E+04	1	05E+04	5	49E+04	7	38E+04	8	97E+04	1	32E+05	1	46E+05	5	99E-04	83
DECONTAMINATION POP (INDIVIDUALS)	1	0000	7	48E+04	2	73E+04	2	10E+05	3	67E+05	5	55E+05	6	75E+05	8	21E+05	2	15E-04	102
INTERDICTION AREA (HECTARES)	0	9698	4	16E+04	2	42E+04	1	01E+05	1	08E+05	1	26E+05	1	58E+05	2	25E+05	5	71E 05	32
INTERDICTION POP (INDIVIDUALS)	1	0000	7	48E+04	2	73E+04	2	10E+05	3	67E+05	5	55E+05	6	75E+05	8	21E+05	2	15E-04	102
CONDEMNATION AREA (HECTARES)	1	0000	3	31E+04	2	28E+04	6	26E+04	9	12E+04	1	75E+05	NOT-FOUND	2	11E+05	1	23E-03	49	
CONDEMNATION POP (INDIVIDUALS)	0	6839	1	12E+03	6	19E+01	3	30E+03	7	39E+03	1	63E+04	2	50E+04	6	99E+04	3	86E-05	42

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	PROB NON-ZERO	MEAN	50TH	QUANTILES						PEAK CONS	PEAK PROB	PEAK TRIAL
				90TH	95TH	99TH	99.9TH					
AFFECTED AREA/POPULATION	0-1609	KM										
MILK DISPOSAL AREA (HECTARES)	0 4314	1 98E+05	0 00E+00	6 45E+05	9 71E+05	2 12E+06	NOT-FOUND	2 42E+06	1 88E-03	135		
CROP DISPOSAL AREA (HECTARES)	0 4314	1 45E+05	0 00E+00	4 22E+05	7 76E+05	1 85E+06	NOT-FOUND	2 26E+06	1 88E-03	2		
AFFECTED AREA/POPULATION	0-80.5	KM										
DECONTAMINATION AREA (HECTARES)	0 7619	1 40E+04	8 34E+03	3 23E+04	3 47E+04	4 10E+04	NOT-FOUND	4 89E+04	1 80E-03	121		
DECONTAMINATION POP (INDIVIDUALS)	0 9999	6 90E+04	2 32E+04	2 04E+05	3 54E+05	5 55E+05	6 75E+05	8 21E+05	2 15E-04	102		
INTERDICTION AREA (HECTARES)	0 9553	2130E+04	1 69E+04	4 70E+04	5 50E+04	7 04E+04	7 42E+04	8 17E+04	1 41E-05	109		
INTERDICTION POP (INDIVIDUALS)	0 9999	6 90E+04	2 32E+04	2 04E+05	3 54E+05	5 55E+05	6 75E+05	8 21E+05	2 15E-04	102		
CONDEMNATION AREA (HECTARES)	1 0000	2 79E+04	2 19E+04	5 42E+04	6 19E+04	7 51E+04	8 90E+04	1 13E+05	1 04E-05	109		
CONDEMNATION POP (INDIVIDUALS)	0 6839	1 12E+03	6 19E+01	3 30E+03	7 39E+03	1 63E+04	2 50E+04	6 99E+04	3 86E-05	42		
MILK DISPOSAL AREA (HECTARES)	0 4314	2 55E+04	0 00E+00	7 58E+04	1 03E+05	1 19E+05	NOT-FOUND	1 46E+05	1 06E-03	135		
CROP DISPOSAL AREA (HECTARES)	0 4314	2 21E+04	0 00E+00	6 50E+04	8 36E+04	1 06E+05	NOT-FOUND	1 19E+05	1 17E-03	49		

SOURCE TERM 2 OF 2

RELEASE FRACTIONS OF SOURCE TERM 1 REDUCED BY A FACTOR OF TEN

RESULT NAME - HEALTH EFFECTS CASES

ENL INJ/PROXIMAL VOMIT 0-1609 KM

PEOPLE FRACTION -			0 9500			0 0500			0 0000			CHRONC RESULTS		
OVERALL			EMER RESP # 1			EMER RESP # 2			EMER RESP # 3			PROB>X		
X			PROB>X			PROB>X			PROB>X			X		
1	00E-08	5 02E-01	1	00E-08	2 55E-01	1	00E-07	5 02E-01	1	00E-07	4 27E-01	1	00E-07	4 27E-01
2	00E-08	5 02E-01	2	00E-08	2 55E-01	2	00E-07	5 02E-01	2	00E-07	4 27E-01	2	00E-07	4 27E-01
3	00E-08	5 02E-01	3	00E-08	2 55E-01	3	00E-07	5 02E-01	3	00E-07	4 27E-01	3	00E-07	4 27E-01
4	00E-08	5 02E-01	4	00E-08	2 55E-01	4	00E-07	5 02E-01	4	00E-07	4 27E-01	4	00E-07	4 27E-01
5	00E-08	5 02E-01	5	00E-08	2 55E-01	5	00E-07	5 02E-01	5	00E-07	4 27E-01	5	00E-07	4 27E-01
6	00E-08	5 02E-01	6	00E-08	2 55E-01	6	00E-07	5 02E-01	6	00E-06	4 27E-01	6	00E-06	4 27E-01
7	00E-07	5 02E-01	7	00E-07	2 55E-01	7	00E-07	5 02E-01	7	00E-06	4 27E-01	7	00E-06	4 27E-01
8	00E-07	5 02E-01	8	00E-07	2 55E-01	8	00E-07	5 02E-01	8	00E-06	4 27E-01	8	00E-06	4 27E-01
9	00E-07	5 02E-01	9	00E-07	2 55E-01	9	00E-07	5 02E-01	9	00E-06	4 27E-01	9	00E-06	4 27E-01
10	00E-06	5 02E-01	10	00E-06	2 55E-01	10	00E-06	5 02E-01	10	00E-05	4 27E-01	10	00E-05	4 27E-01
11	00E-06	5 02E-01	11	00E-06	2 55E-01	11	00E-05	5 02E-01	11	00E-05	4 27E-01	11	00E-05	4 27E-01
12	00E-06	5 02E-01	12	00E-06	2 55E-01	12	00E-05	5 02E-01	12	00E-05	4 27E-01	12	00E-05	4 27E-01
13	00E-05	5 02E-01	13	00E-05	2 55E-01	13	00E-05	5 02E-01	13	00E-04	4 27E-01	13	00E-04	4 27E-01
14	00E-05	5 02E-01	14	00E-05	2 55E-01	14	00E-05	5 02E-01	14	00E-04	4 27E-01	14	00E-04	4 27E-01
15	00E-05	5 02E-01	15	00E-05	2 55E-01	15	00E-04	5 02E-01	15	00E-04	4 27E-01	15	00E-04	4 27E-01
16	00E-05	5 02E-01	16	00E-05	2 55E-01	16	00E-04	5 02E-01	16	00E-04	4 27E-01	16	00E-04	4 27E-01
17	00E-04	4 97E-01	17	00E-04	2 55E-01	17	00E-04	5 02E-01	17	00E-03	4 27E-01	17	00E-03	4 27E-01
18	00E-04	4 81E-01	18	00E-04	2 55E-01	18	00E-03	4 97E-01	18	00E-03	4 15E-01	18	00E-03	4 15E-01
19	00E-04	4 73E-01	19	00E-04	2 55E-01	19	00E-03	4 86E-01	19	00E-03	4 02E-01	19	00E-03	4 02E-01
20	00E-04	4 60E-01	20	00E-04	2 55E-01	20	00E-03	4 74E-01	20	00E-03	3 83E-01	20	00E-03	3 83E-01
21	00E-04	4 39E-01	21	00E-04	2 55E-01	21	00E-03	4 69E-01	21	00E-03	3 65E-01	21	00E-03	3 65E-01
22	00E-03	4 30E-01	22	00E-03	2 55E-01	22	00E-02	4 60E-01	22	00E-02	3 11E-01	22	00E-02	3 11E-01
23	00E-03	4 05E-01	23	00E-03	2 44E-01	23	00E-02	4 28E-01	23	00E-02	2 85E-01	23	00E-02	2 85E-01
24	00E-03	3 88E-01	24	00E-03	2 20E-01	24	00E-02	4 13E-01	24	00E-02	2 37E-01	24	00E-02	2 37E-01
25	00E-03	3 51E-01	25	00E-03	2 12E-01	25	00E-02	3 87E-01	25	00E-02	2 15E-01	25	00E-02	2 15E-01
26	00E-02	3 27E-01	26	00E-02	1 97E-01	26	00E-01	3 63E-01	26	00E-01	1 92E-01	26	00E-01	1 92E-01
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30	00E-02	2 04E-01	30	00E-02	1 41E-01	30	00E-01	1 72E-01	30	00E-01	6 53E-02	30	00E-01	6 53E-02
31	00E-02	1 86E-01	31	00E-02	1 32E-01	31	00E+00	1 54E-01	31	00E+00	5 03E-02	31	00E+00	5 03E-02
32	00E-01	1 67E-01	32	00E-01	1 03E-01	32	00E+00	1 38E-01	32	00E+00	2 80E-02	32	00E+00	2 80E-02
33	00E-01	1 30E-01	33	00E-01	9 04E-02	33	00E+00	5 73E-02	33	00E+00	1 90E-02	33	00E+00	1 90E-02
34	00E-01	1 07E-01	34	00E-01	6 32E-02	34	00E+00	1 35E-02	34	00E+00	1 36E-02	34	00E+00	1 36E-02
35	00E-01	6 70E-02	35	00E-01	4 95E-02	35	00E+00	1 38E-02	35	00E+00	7 85E-04	35	00E+00	7 85E-04
36	00E-01	5 36E-02	36	00E-01	4 02E-02	36	00E+00	1 38E-02	36	00E+00	5 84E-06	36	00E+00	5 84E-06
37	00E+00	4 17E-02	37	00E+00	1 56E-02	37	00E+00	1 38E-02	37	00E+00	1 09E+01	37	00E+00	1 09E+01
38	00E+00	1 91E-02	38	00E+00	1 05E-02	38	00E+00	1 38E-02	38	00E+00	5 N D	38	00E+00	5 N D
39	00E+00	8 85E-03	39	00E+00	4 95E-03	39	00E+00	1 15E-05	39	00E+00	5 N D	39	00E+00	5 N D
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41	00E+00	8 28E-04	41	00E+00	8 28E-04	41	00E+00	1 15E-05	41	00E+00	5 N D	41	00E+00	5 N D
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75	00E+00	8 28E-04	75	00E+00	8 28E-04	75	00E+00	1 15E-05	75	00E+00	5 N D	75	00E+00	5 N D
76	00E+00	8 28E-04	76	00E+00	8 28E-04	76	00E+00	1 15E-05	76	00E+00	5 N D	76		

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10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)

This report describes the MACCS computer code. The purpose of this code is to simulate the impact of severe accidents at nuclear power plants on the surrounding environment. MACCS has been developed for the U.S. Nuclear Regulatory Commission to replace the previous CRAC2 code and it incorporates many improvements in modeling flexibility in comparison to CRAC2.

The principal phenomena considered in MACCS are atmospheric transport, mitigative actions based on dose projection, dose accumulation by a number of pathways including food and water ingestion, early and latent health effects, and economic costs.

The MACCS code can be used for a variety of applications. These include (1) probabilistic risk assessment (PRA) of nuclear power plants and other nuclear facilities, (2) sensitivity studies to gain a better understanding of the parameters important to PRA, and (3) cost-benefit analysis.

This report is composed of three volumes. Volume I, the User's Guide, describes the input data requirements of the MACCS code and provides directions for its use as illustrated by three sample problems. Volume II, the Model Description, describes the underlying models that are implemented in the code, and Volume III, the Programmer's Reference Manual, describes the code's structure and database management.

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