PNL-4054 Sup2
NUREG/CR-3620
PNL-4054
Supplement No. 2

Intruder Dose Pathway Analysis for the Onsite Disposal of Radioactive Wastes: The ONSITE/MAXI1 Computer Program

Prepared by W. E. Kennedy, Jr., R. A. Peloquin, B. A. Napier/PNL
S. M. Neuder/NRC

Pacific Northwest Laboratory
Operated by
Battelle Memorial Institute

Prepared for
U.S. Nuclear Regulatory
Commission

REFERENCE COPY

NOTICE

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, or any of their employees, makes any warranty, expressed or implied, or assumes any legal liability of responsibility for any third party's use, or the results of such use, of any information, apparatus, product or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights.

NOTICE

Availability of Reference Materials Cited in NRC Publications

Most documents cited in NRC publications will be available from one of the following sources:

1. The NRC Public Document Room, 1717 H Street, N.W.
Washington, DC 20555
2. The Superintendent of Documents, U.S. Government Printing Office, Post Office Box 37082,
Washington, DC 20013-7082
3. The National Technical Information Service, Springfield, VA 22161

Although the listing that follows represents the majority of documents cited in NRC publications, it is not intended to be exhaustive.

Referenced documents available for inspection and copying for a fee from the NRC Public Document Room include NRC correspondence and internal NRC memoranda; NRC Office of Inspection and Enforcement bulletins, circulars, information notices, inspection and investigation notices; Licensee Event Reports; vendor reports and correspondence; Commission papers; and applicant and licensee documents and correspondence.

The following documents in the NUREG series are available for purchase from the GPO Sales Program: formal NRC staff and contractor reports, NRC-sponsored conference proceedings, and NRC booklets and brochures. Also available are Regulatory Guides, NRC regulations in the *Code of Federal Regulations*, and *Nuclear Regulatory Commission Issuances*.

Documents available from the National Technical Information Service include NUREG series reports and technical reports prepared by other federal agencies and reports prepared by the Atomic Energy Commission, forerunner agency to the Nuclear Regulatory Commission.

Documents available from public and special technical libraries include all open literature items, such as books, journal and periodical articles, and transactions. *Federal Register* notices, federal and state legislation, and congressional reports can usually be obtained from these libraries.

Documents such as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings are available for purchase from the organization sponsoring the publication cited.

Single copies of NRC draft reports are available free, to the extent of supply, upon written request to the Division of Technical Information and Document Control, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at the NRC Library, 7920 Norfolk Avenue, Bethesda, Maryland, and are available there for reference use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

Intruder Dose Pathway Analysis for the Onsite Disposal of Radioactive Wastes: The ONSITE/MAXI1 Computer Program

Manuscript Completed: November 1986
Date Published: February 1987

Prepared by
W. E. Kennedy, Jr., R. A. Peloquin, B. A. Napier, Pacific Northwest Laboratory
S. M. Neuder, U.S. Nuclear Regulatory Commission

Pacific Northwest Laboratory
Richland, WA 99352

Prepared for
Division of Waste Management
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555
NRC FIN B2476

PREFACE

Pacific Northwest Laboratory (PNL) prepared this document as a supplement to two previous documents that describe the ONSITE/MAXI1 computer software package. These documents are both entitled Intruder Dose Pathway Analysis for the Onsite Disposal of Radioactive Wastes: The ONSITE/MAXI1 Computer Program and are by Napier et al. (1984) and Kennedy et al. (1986). This document is a second supplement that summarizes our efforts to further modify and improve the ONSITE/MAXI1 computer software package for operation on a personal computer. To facilitate cross-referencing, this document follows the same format as the previous documentation. This version of the software permits the user to optionally select either of two sets of internal dose conversion factors: 1) factors based on the methods published by the International Commission on Radiological Protection (ICRP) in their Publication No. 30 (ICRP 1979-1982), or 2) factors based on the methods published by the ICRP in their Publication No. 2 (1959) (as implemented in the previous versions of the computer program). The pathway-to-human models used in the previous versions of the computer program have not been changed.

This document is written for two audiences, each with different documentation requirements. The first is a scientific or technical audience and includes persons concerned with the mathematical models and computer algorithms. The second is an audience concerned with the details of the computer programming and includes persons that want to exercise the computer program and scenarios for specific onsite disposal applications. Six sample problems are presented and discussed to assist the user in operating the computer program. Summaries of the input and output for the sample problems are included along with a discussion of the calculations performed by hand to verify the correct software operation. Computer listings of the ONSITE/MAXI1 computer program with a complete data base listing are included in the appendices of this document.

EXECUTIVE SUMMARY

This document describes how the ONSITE/MAXII computer program (Napier et al. 1984; Kennedy et al. 1986) has been enhanced and modified to meet the needs of the U.S. Nuclear Regulatory Commission (NRC) by making the program operable on the IBM PC/XT/AT^(a) computer, and by permitting the user to optionally select dose conversion factors based on the dosimetry methods and metabolic data given by the International Commission on Radiological Protection (ICRP) in their Publication No. 30 (ICRP 1979-1982). The original documentation for the ONSITE/MAXII software package contains detailed instructions for operation on the CDC^(b) 6600-7600 computer (Napier et al. 1984) and VAX^(c) 11-780 computer (Kennedy et al. 1986). The NRC has established guidance for onsite disposal by subsurface burial in NUREG-1101, Vol. 1 (Neuder 1986). Applications by licensees to the NRC for proposed disposal activities that do not fit the NRC guidance will be evaluated against more complete guidance using a documented technical methodology (Neuder and Kennedy 1986). The ONSITE/MAXII computer program described in this document is part of the NRC methodology for estimating radiation doses for human intruder scenarios.

The version of the ONSITE/MAXII computer program presented in this document uses the same methodology (with the addition of ICRP Publication No. 30 methods) and produces essentially the same results as earlier versions of the computer program documented by Napier et al. (1984) and Kennedy et al. (1986). Inhalation doses varied from those in earlier versions, because default inhalation parameter values were changed to be consistent with those used in ICRP Publication No. 30. Six sample problems were presented in the two earlier documents. The results of those sample problems were verified by hand-using the equations presented in this document. When those six sample problems are executed using the version of ONSITE/MAXII presented in this document, the results are the same as those documented in Napier et al. (1984) and Kennedy et al. (1986).

This document contains the user information and instructions for operation of ONSITE/MAXII on the IBM PC/XT/AT computer. Additional details and user instructions for program execution on the CDC 6600-7600 computers are presented in Napier et al. (1984), along with detailed instructions for interacting with the ONSITE computer program. Further information on the VAX 11-780 computer and the MAXI time line is found in Kennedy et al. (1986).

The documentation of the ONSITE/MAXII computer program is written for two audiences, who have different documentation requirements. The first audience is scientific or technical and includes persons concerned with the mathematical models and computer algorithms. The second audience is concerned with the

-
- (a) IBM PC/XT/AT is a registered trademark of the International Business Machines Corporation, Boca Raton, Florida.
 - (b) Control Data Corporation, St. Paul, Minnesota.
 - (c) VAX is a registered trademark of Digital Equipment Corporation, Nashua, New Hampshire.

details of the computer programming and includes persons who want to exercise the computer program and scenarios for specific onsite disposal applications. Section 2 of this document contains information useful to the first audience and describes the mathematical models and computer software for assessing onsite disposal impacts. Section 3 of this document contains information useful to the second audience and describes the procedures used to operate the software on the IBM PC/XT/AT. Six sample problems that demonstrate the scenario operations of the ONSITE/MAXI1 computer software are also given in Section 3. Section 4 also contains information useful to the second audience and describes the programming structure and hierarchy. It previously was necessary to execute the MAXI2 and MAXI3 computer programs to generate internal dose rate factors that were then used by MAXI1. The major change made to the personal computer version of the software package is the incorporation of the MAXI2 and MAXI3 computer programs for calculating dose from terrestrial and aquatic food pathways (Napier et al 1985; Kennedy et al. 1986) into MAXI1. Complete listings of the ONSITE/MAXI1 software package and supporting data libraries are included in the appendices. The organization of this document roughly follows the organization of the previous documentation for the ONSITE/MAXI1 computer software to facilitate cross-referencing.

ACKNOWLEDGMENTS

The authors would like to thank all of those individuals at Pacific Northwest Laboratory who have helped make this work possible. The historical development of the MAXI computer program included major contributions from Ed Watson, Glenn Hoenes, and Joe Soldat. We greatly appreciate the guidance, assistance, technical review, and encouragement offered by these individuals in the development of the methods and philosophy applied in this report. We would like to thank Jaime Lara for converting the ONSITE program for execution on a personal computer, and for updating, enhancing, and testing the computer program. We would like to thank Gus Rodriguez for his careful checking of dose conversion factors included in this software package and Joe Soldat and Bill Farris for their helpful technical review of the mathematical models contained in this document. We would also like to thank Kay Hopkins and Carolyn Schauls for their contributions in typing, organizing, and correcting the draft and final manuscripts. Finally, we would like to thank Virginia Brouns for her editorial assistance in the preparation of the manuscript.

CONTENTS

PREFACE	iii
EXECUTIVE SUMMARY	v
ACKNOWLEDGMENT	vii
1.0 INTRODUCTION	1.1
REFERENCES	1.3
2.0 MATHEMATICAL MODELS AND COMPUTER SOFTWARE FOR ASSESSING ONSITE DISPOSAL IMPACTS	2.1
2.1 DEFINITION AND SOLUTION OF THE PROBLEM	2.1
2.1.1 Applying the Pathway Analysis Models	2.2
2.1.2 Onsite Disposal "Environment" Description	2.3
2.1.3 Onsite Disposal Scenario Descriptions	2.6
2.1.4 Mathematical Models	2.7
2.2 COMPUTER IMPLEMENTATION	2.23
2.2.1 Computer System Requirements	2.23
2.2.2 Descriptions of Computer Programs	2.23
2.2.3 Operation of the ONSITE/MAXII Software Package	2.24
2.2.4 Capabilities, Restrictions and Performance	2.25
2.2.5 Software Package	2.25
2.3 DATA BASE	2.25
2.3.1 Radionuclide Master List - RMDONS	2.26
2.3.2 Radionuclide Master Data Library - RMDLIB	2.26
2.3.3 Organ Data Library - ORGLIB	2.27
2.3.4 Food Transfer Factor Library - FTRANS	2.28
2.3.5 Bioaccumulation Factor Library - BIOAC1	2.28
2.3.6 External Exposure Dose Rate Factors - Waste Modeled as a Plane Source	2.29
2.3.7 External Exposure Dose Rate Factors - Waste Modeled as a Slab Source	2.31
2.3.8 Inhalation Dose Rate Factors - FILE23	2.31
2.3.9 Dose Factors - Library LB30SVBQ	2.32
REFERENCES	2.33

3.0	PROCEDURES	3.1
3.1	USER INSTRUCTIONS	3.2
3.1.1	Installing ONSITE/MAXI1 on a Hard Disk	3.2
3.1.2	Interaction with ONSITE: The First Level of Operation	3.3
3.1.3	Interaction with the MAXI1 Input File: The Second Level of Operation	3.4
3.1.4	Batch Mode Processing of ONSITE/MAXI1	3.5
3.2	SAMPLE PROBLEMS	3.6
3.2.1	Sample Problem One	3.7
3.2.2	Sample Problem Two	3.15
3.2.3	Sample Problem Three	3.23
3.2.4	Sample Problem Four	3.34
3.2.5	Sample Problem Five	3.46
3.2.6	Sample Problem Six	3.59
3.3	INPUT PARAMETERS	3.68
3.4	ERROR AND RECOVERY	3.79
3.4.1	Error and Recovery - ONSITE	3.79
3.4.2	Error and Recovery - MAXI1	3.79
	REFERENCES	3.82
4.0	PROGRAMMING STRUCTURE AND HIERARCHY	4.1
	APPENDIX A - COMPUTER PROGRAM LISTINGS	A.1
	APPENDIX B - COMPLETE DATA BASE LISTING	B.1

FIGURES

2.1	Exposure Rate Versus Source Area	2.21
2.2	Exposure Rate Ratio Versus Fractional Hectare of Source Area .	2.21
2.3	Area Correction Factors for External Exposure and the Inhalation Pathway	2.22
2.4	Area Correction Factors for the Ingestion Pathway	2.22
3.1	Sample Problem One Input	3.8
3.2	Sample Problem One Output	3.10
3.3	Sample Problem Two Input	3.16
3.4	Sample Problem Two Output	3.18
3.5	Sample Problem Three Input	3.24
3.6	Sample Problem Three Output	3.26
3.7	Sample Problem Four Input	3.35
3.8	Sample Problem Four Output	3.37
3.9	Sample Problem Five Input	3.47
3.10	Sample Problem Five Output	3.49
3.11	Sample Problem Six Input	3.60
3.12	Sample Problem Six Output	3.62
4.1	ONSITE Module Heirarchy and Function	4.2
4.2	MAXI Module Hierarchy and Function	4.3

TABLES

2.1	Parameters Used for Calculation of Radiation Doses from Consumption of Terrestrial Foods	2.4
2.2	Parameters Used for Calculation of Radiation Doses from Drinking Water and Aquatic Foods	2.4
2.3	Radionuclides Considered in the ONSITE Disposal Environment	2.5
2.4	External Dose Conversion Factors (mrem/h per Ci/m ³) for Selected Waste Form Densities (ρ) and Slab Thicknesses with 0.0-m Overburden	2.19
2.5	Dose Rate Factor Files for External Exposure	2.29
2.6	ISOSHL D Parameter Values Used for External Exposure Dose Rate Factors	2.30
3.1	Scenario Default Parameter Values	3.77
3.2	Sample Problem Parameter Values	3.78

1.0 INTRODUCTION

The ONSITE/MAXII computer program (Napier et al. 1984; Kennedy et al. 1986) is used to estimate radiation doses to humans from a variety of exposure pathways and scenarios. This computer program was originally developed for the U.S. Nuclear Regulatory Commission's (NRC) waste management staff by Pacific Northwest Laboratory (PNL). It has been used by the NRC in estimating human-intrusion scenario doses for evaluating licensee applications for onsite burial of low-activity radioactive wastes. Current NRC regulations require that disposal of radioactive materials by licensees, unless otherwise authorized, be specifically approved by the NRC pursuant to 10 CFR 20.302(a) (1984). This regulation states:

Any licensee or applicant for a license may apply to the Commission for approval of proposed procedures to dispose of licensed material in a manner not otherwise authorized in the regulations in this chapter. Each application should include a description of the licensed material and any other radioactive material involved, including the quantities and kinds of such material and the levels of radioactivity involved, and the proposed manner and conditions of disposal. The application should also include an analysis and evaluation of pertinent information as to the nature of the environment, including topographical, geological, meteorological, and hydrological characteristics; usage of ground and surface waters in the general area; the nature and locations of other potentially affected facilities; and procedures to be observed to minimize the risk of unexpected or hazardous exposures.

To reduce the number of licensee applications that must be reviewed, in 1986 the NRC issued guidance that identifies the categories and limiting conditions for total activity, waste packaging, burial frequency, and other conditions that are likely to be acceptable for subsurface disposal. This guidance is contained in Onsite Disposal of Radioactive Waste: Guidance for Disposal by Subsurface Burial, NUREG-1101, Vol. 1 (Neuder 1986). Applications for proposed disposal activities that do not fit the NRC guidance will be evaluated against more complete guidance using a documented technical methodology. This methodology is described in NUREG-1101, Vol. 2 (Neuder and Kennedy 1986). The ONSITE/MAXII computer program described in this document is part of the Vol. 2 NRC methodology for estimating radiation doses for human intrusion scenarios.

As part of the ONSITE/MAXII project, specific human intrusion scenarios used in evaluating doses from onsite disposal of radioactive wastes have been developed (Napier et al. 1984). These scenarios consider various potential combinations of direct exposure to penetrating radiation, inhalation of airborne radionuclides, ingestion of agricultural products raised in contaminated soil, and ingestion of radionuclides in drinking water. They are activated by running the ONSITE/MAXII computer software package. As a continuation of the initial work, the ONSITE/MAXII software package was enhanced to consider additional optional external exposure dose factors and revisions to the documentation were made to more fully explain the computer software (Kennedy et al. 1986). In addition, scenarios and options for alternative land-use conditions were

developed that permit the user to select from a meat diet, vegetable diet, or a combination of the two.

As a further extension of the development effort, we have produced a modified version of the ONSITE/MAXI1 computer software package that operates on an IBM PC/XT/AT^(a) computer. This version also permits the user to optionally select the use of dose conversion factors based on the dosimetry methods and metabolic data given by the International Commission on Radiological Protection (ICRP) in their Publication No. 30 (ICRP 1979-1982) in place of those given by the ICRP in Publication No. 2 (1959) and supplied with the original ONSITE/MAXI1 computer software.

The ONSITE computer program is the interactive user interface that allows the end-user to simply and efficiently create and use the radiation exposure scenarios. The MAXI1 computer program is then used with the scenario information to calculate the maximum annual dose to the exposed individual from selected pathways. Intermediate dose conversion factors for the external exposure pathways, ICRP Publication No. 2 internal dose conversion factors (ICRP 1959), and ICRP Publication No. 30 effective dose equivalent factors for internal inhalation and ingestion (ICRP 1979-1982) are stored in data files. These factors can be found in the ICRP publications or calculated using codes external to the ONSITE/MAXI1 software package. The inhalation dose conversion factors are derived from the model in ICRP Publication No. 2 (ICRP 1959) and are calculated using the Task Group Lung Model (TGLM) (ICRP 1966) as contained in the DACRIN (Houston, Streng and Watson 1974) computer program. Additional metabolic data for the inhalation calculations were obtained from ICRP Publication No. 19 (ICRP 1972). The external dose conversion factors for various waste disposal geometries and densities are calculated using the ISOSHL (Engel, Greenborg and Hendrickson 1966) shielding program.

This report documents the resulting IBM PC/XT/AT computer version of the ONSITE/MAXI1 computer software package. It is designed to function both as a reference document and as an instructional document. Section 2 contains technical information on the mathematical models and computer algorithms used in the ONSITE/MAXI1 computer programs. Section 3 contains user information on the procedures for executing ONSITE/MAXI1 computer programs, including a discussion of sample problems and hand calculations performed to verify correct operation of the computer program. Section 4 contains additional details on the structure and organization of the computer programs and is provided for those who wish to modify the computer programs. Listings of the computer programs, data libraries, and dose conversion factors are provided in the appendices.

(a) IBM PC/XT/AT is a registered trademark of the International Business Machines Corporation, Boca Raton, Florida.

REFERENCES

- Engel, R. L., J. Greenborg, and M. M. Hendrickson. 1966. ISOSHL - A Computer Code for General Purpose Isotope Shielding Analysis. BNWL-236, Pacific Northwest Laboratory, Richland, Washington.
- Houston, J. R., D. L. Streng, and E. C. Watson. 1974. DACRIN - A Computer Program for Calculating Organ Dose from Acute or Chronic Radionuclide Inhalation. BNWL-B-389, Pacific Northwest Laboratory, Richland, Washington.
- International Commission on Radiological Protection (ICRP). 1959. Report of ICRP Committee II on Permissible Dose for Internal Radiation. ICRP Publication No. 2, Pergamon Press, New York, New York.
- International Commission on Radiological Protection (ICRP). 1966. "Deposition and Retention Models for Internal Dosimetry of the Human Respiratory Tract." Health Phys. 12:173-207.
- International Commission on Radiological Protection (ICRP). 1972. The Metabolism of Compounds of Plutonium and Other Actinides. ICRP Publication No. 19, Pergamon Press, New York, New York.
- International Commission on Radiological Protection (ICRP). 1979-1982. Limits for Intakes of Radionuclides by Workers. ICRP Publication No. 30, Part 1 (and subsequent parts and supplements), Vol. 2, No. 3/4 through Vol. 8, No 4, Pergamon Press, New York, New York.
- Kennedy, W. E., Jr., R. A. Peloquin, B. A. Napier, and S. M. Neuder. 1986. Intruder Dose Pathway Analysis for the Onsite Disposal of Radioactive Wastes: The ONSITE/MAXII Computer Program. NUREG/CR-3620, Supplement No. 1, (PNL-4054), U.S. Nuclear Regulatory Commission, Washington, D.C.
- Neuder, S. M. 1986. Onsite Disposal of Radioactive Waste: Guidance for Disposal by Subsurface Burial. NUREG-1101, Vol 1, U.S. Nuclear Regulatory Commission, Washington, D.C.
- Neuder, S. M., and W. E. Kennedy, Jr. 1986. Onsite Disposal of Radioactive Waste: Methodology for the Radiological Assessment of Disposal by Subsurface Burial. NUREG-1101, Vol. 2, U.S. Nuclear Regulatory Commission, Washington, D.C.
- Napier, B. A., G. R. Hoenes, W. E. Kennedy, Jr., and E. C. Watson. 1979. "The Maximum Annual Dose Resulting from Residual Radioactive Contamination." Paper presented at the 24th Annual Meeting of the Health Physics Society, July 8-13, 1979, Philadelphia, Pennsylvania. PNL-SA-7496, Pacific Northwest Laboratory, Richland, Washington.
- Napier, B. A., R. A. Peloquin, W. E. Kennedy, Jr., and S. M. Neuder. 1984. Intruder Dose Pathway Analysis for the Onsite Disposal of Radioactive Wastes: The ONSITE/MAXII Computer Program. NUREG/CR-3620 (PNL-4054), U.S. Nuclear Regulatory Commission, Washington, D.C.
- Standards for Protection Against Radiation, 10 CFR 20 (1984).

2.0 MATHEMATICAL MODELS AND COMPUTER SOFTWARE FOR ASSESSING ONSITE DISPOSAL IMPACTS

This section contains descriptions of the radiation exposure scenarios, mathematical models, computer programs, and data bases for assessing the potential doses to intruders at onsite waste disposal sites using the ONSITE/MAXII IBM PC/XT/AT^(a) computer software package. The information in this section is designed to be useful to persons concerned with the mathematical models and computer algorithms. The method used for assessing potential doses to intruders is presented first, followed by a discussion of the computer implementation of that method, and then a description of the associated data base.

2.1 DEFINITION AND SOLUTION OF THE PROBLEM

In the Draft and Final Environmental Impact Statements in support of 10 CFR 61 (NRC 1981, 1982), the NRC modeled the potential exposure pathways to man from buried radioactive wastes. In the analysis, the NRC identified four human-intrusion scenarios to account for the actions of humans after the loss of institutional controls (NRC 1981, p. H-15):

- Intruder-Construction Scenario. An individual excavates at a closed disposal site to build a house.
- Intruder-Discovery Scenario. This scenario is a subset of the intruder-construction scenario and also involves excavation into a closed site. The time over which the excavation proceeds is reduced compared to the intruder-construction scenario.
- Intruder-Agriculture Scenario. An individual lives in a house built on a closed disposal site surrounded by contaminated soil resulting from the intruder-construction scenario. The individual consumes vegetables grown in the contaminated soil.
- Intruder-Well Scenario. An individual uses contaminated water from a well on a closed disposal site.

The disposal limits that result are based on an annual 500-mrem total-body dose to the maximally exposed individual who intrudes after 100 years of site control. Of the four human-intrusion scenarios defined, only the intruder-construction and intruder-agriculture scenarios affect the determination of disposal limits.

In this report, an approach similar to that applied in the Draft EIS in support of 10 CFR 61 (NRC 1981) is used for the assessment of risks associated with onsite disposal. That is, radiation exposure scenarios are established for the

(a) IBM PC/XT/AT is a registered trademark of the International Business Machines Corporation, Boca Raton, Florida.

maximally exposed individual (an intruder), and a means of determining the resulting radiation dose is provided.

Five scenarios are identified as being of potential interest in assessing doses to intruders at onsite disposal sites:

1. External Exposure Scenario. An individual is assumed to work in an area previously used for onsite disposal. Surface soil contamination, wastes buried at depths of 0.5 m or 1.0 m, or entry into a room (or vault) that is used for waste storage or disposal are considered.
2. External Exposure Plus Inhalation Scenario. An individual is assumed to work in an area with limited surface-soil contamination and is exposed to external sources and resuspended dusts.
3. Agricultural Scenario. An individual is assumed to raise his annual diet (or a fraction of it) in soil contaminated by the onsite disposal of radioactive wastes. External exposure and inhalation of resuspended radionuclides in soil are considered.
4. Irrigation/Drinking-Water Scenario. An individual is assumed to use a water supply contaminated by radionuclides from an onsite disposal site for irrigation and/or drinking. In addition, external exposure and inhalation of resuspended radionuclides that are deposited on the surface of the soil by the irrigation water are considered.
5. User-Defined Scenario. The user may construct his own scenario by selecting exposure pathways and defining conditions described in the ONSITE/MAXI1 computer software package.

The following sections contain descriptions of the pathway analysis models used for these scenarios, a definition of the required environmental criteria, descriptions of the scenarios as they are implemented, and descriptions of the mathematical models.

2.1.1 Applying the Pathway Analysis Models

The five types of intruder scenarios can be simulated with the pathway analysis models contained in the IBM PC/XT/AT version of the ONSITE/MAXI1 computer software package. The computer programs implement these models in a way substantially different from the one described in the previously documented versions of ONSITE/MAXI1 (Napier et al. 1984; Kennedy et al. 1986). This implementation greatly reduces the size of the data base and provides greater flexibility during scenario generation. The revised program incorporates the MAXI2 and MAXI3 computer programs into the MAXI1 program.

In the previous versions of MAXI1, an "environment" was defined by the general agricultural and aquatic practices of the geographical area, and the general lifestyle of the intruder. Scenarios were then defined within the context of that environment. A scenario indicated pathways of interest, further defined the life style of the maximally exposed individual, identified the source and

location of the contamination, and quantified the inventory. A scenario modified the maximally exposed individual's lifestyle assumptions by indicating amounts of exposure and by applying percentage factors to established dose rates. The definition of the environment was an intermediate step that simplified scenario creation and streamlined scenario executions. Dose conversion factors that applied to the defined environment were created by auxiliary programs in the software package (MAXI2 and MAXI3) and stored in the data base where they were accessed during the scenario simulations controlled by the main computer program, MAXI1.

However, defining additional environments, relying on modified pathway parameters, caused the MAXI1 data base to become extremely large and cumbersome. It was decided that the most effective way to implement the ONSITE/MAXI software package on the IBM PC/XT/AT computer was to incorporate the MAXI2 and MAXI3 computer programs into MAXI1, thus substantially reducing the size of the data base. With this program consolidation, the user now has more flexibility when creating scenarios because the user may modify the default values used in defining the environment when constructing a scenario.

The following sections contain discussions of the default values used to define the environment, the mathematical models used for the five intruder scenarios, and the mathematical models that may be used for determining the dose to intruders at onsite disposal sites.

2.1.2 Onsite Disposal "Environment" Description

The default environment defined for onsite disposal assumes intruder activity at an onsite low-level waste disposal site. The reference environment is based on a site with an area of 1 ha; however, area correction factors may be included to consider smaller sites. The intruder may be exposed to radioactive contamination via any of the following pathways: external exposure, inhalation of resuspended contaminants, ingestion of farm products grown on a contaminated site, consumption of drinking water from a contaminated well, or ingestion of aquatic food products from a contaminated water source. For external exposure, wastes may be located on the surface, buried at 0.5- or 1.0-meter depths, or stored in a room-type structure. For inhalation and ingestion, the default parameters used in defining the reference environment are based on those found in Regulatory Guide 1.109 (NRC 1977). The intruder's entire diet for the reference environment consists of vegetables, fruits, and animal products grown on the site. Table 2.1 contains a listing of the intruder's terrestrial food product diet and Table 2.2 contains a listing of the intruder's aquatic food product diet for the reference environment. The intruder is assumed to drink 1.2 liters of water per day from a contaminated well.

Contaminated farm products may result from radioactive wastes located on the soil surface or from irrigation with contaminated water. The radionuclides expected to be of interest in the reference environment are listed in Table 2.3. This list includes 105 radionuclides that might come from the use of radiopharmaceuticals or industrial sources, or from wastes generated as part of the commercial nuclear fuel cycle.

TABLE 2.1. Parameters Used for Calculation of Radiation Doses from Consumption of Terrestrial Foods

Food	Growing Period (days)	Yield (kg/m ²)	Holdup (days) ^(a)	Consumption (kg/yr) ^(b)
Leafy vegetables	90	1.5	1	9.5
Other aboveground vegetables	60	0.7	1	9.5
Root vegetables	90	9	1	76
Fruit	90	1.7	14	42
Wheat and grain	90	0.72	10	51
Eggs	90	0.84 ^(c)	2	19
Milk	30	1.3 ^(c)	2	110 ^(d)
Beef	90	0.84 ^(c)	15	39
Pork	90	0.84 ^(c)	15	29
Poultry	90	0.84 ^(c)	15	8.5

(a) Time between harvest and consumption.

(b) These rates are obtained from Regulatory Guide 1.109 (NRC 1977) and prorated by food category using the fraction of total consumed by an average individual as calculated from Napier (1981, Table 8).

(c) Yield of animal feeds (i.e., grain or pasture grass).

(d) Units of L/yr.

TABLE 2.2. Parameters Used for Calculation of Radiation Doses from Drinking Water and Aquatic Foods

Pathway	Mixing Ratio	Holdup (days) ^(a)	Consumption	Consumption Units
Fish	1.0	1.0	6.9 ^(b)	kg/yr
Drinking Water	1.0	1.0	438 ^(c)	L/yr

(a) Time between harvest and consumption.

(b) Average rate obtained from Regulatory Guide 1.109 (NRC 1977).

(c) Rate based on scenario assumption of 1.2 L/d.

TABLE 2.3. Radionuclides Considered in the ONSITE Disposal Environment

<u>Radionuclide</u>	<u>Radionuclide</u>	<u>Radionuclide</u>
H 3	Ag110M	Ra224
C 14	Ag110	Pb212
Na22	In111	Bi212
P 32	I 125	U 234
P 33	Sb125	U 235
S 35	Te125M	Th231
C136	Sb124	Pa231
K 40	I 129	Ac227
Ca45	I 131	Th227
Sc46	Xe131M	Fr223
Cr51	Cs134	Ra223
Mn54	Cs135	Np237
Fe55	Cs137	Pa233
Fe59	Ba137M	U 233
Co57	Ce141	Th229
Co60	Ce144	Ra225
Ni59	Pr144	Ac225
Ni63	Nd144	U 238
Zn65	Eu152	Th234
Se75	Eu154	Pa234M
Sr85	Tb160	Pa234
Sr89	Os185	Pu242
Y 89M	Os191	Np238
Sr90	Ir192	Pu238
Y 90	Hg203	Cm244
Nb94	Th230	Pu244
Mo93	Ra226	U 240
Mo99	Rn222	Pu240
Tc99M	Pb210	Pu241
Tc99	Bi210	Am241
Ru103	Po210	Cm243
Pd103	Th232	Pu243
Rh103M	Ra228	Am243
Ru106	Ac228	Np239
Rh106	Th228	Pu239

2.1.3 Onsite Disposal Scenario Descriptions

Five scenarios are identified for onsite disposal in Section 2.1.1. They are designed for use in assessing doses to intruders at onsite disposal sites with default site size of 1 ha. These scenarios are defined within the reference environment described in Section 2.1.2. Detailed descriptions of the scenarios, assumptions, and key parameters are given below.

1. External Exposure Scenario. An individual is assumed to work for 2000 h/yr in a 1-ha area previously used for onsite disposal. External exposure factor files are supplied to consider surface-soil contamination, buried wastes at depths of 0.5 m or 1.0 m, or entry into a room (or vault) that is used for waste storage or disposal. For soil contamination, the inventory is modified by a factor of 0.2 to account for dilution. Only total-body dose is calculated. The user selects the location of the waste (e.g., surface, buried, or stored) and supplies the waste inventory. The user may modify the amount of radioactive decay before exposure, the dilution of the waste (during exhumation activities), the reference site size, and the duration of exposure.
2. External Exposure Plus Inhalation Scenario. An individual is assumed to work for 2000 h/yr in a 1-ha area with surface-soil contamination resulting from a waste exhumation event. Air concentrations of radionuclides are calculated using a resuspension equation by Anspaugh et al. (1975). For the resuspension equation, the age of the contamination at the beginning of the scenario is assumed to be 0.0 and the top 1.0 centimeter of the contaminated surface soil is assumed to be available for resuspension. Doses to total body, bone, lungs, thyroid, and the lower large intestine (LLI) of the gastrointestinal (GI) tract are calculated. The dilution factor (accounting for exhumation activities) applied to the inventory is 0.2. The user provides the waste inventory. The user may modify the amount of radioactive decay before exposure, the duration of the exposure, the reference site size, and the inventory dilution factor. He or she may also optionally select a mass-loading equation and specify fewer organs. This scenario is similar to the intruder-construction scenario described in the Draft EIS for 10 CFR 61 (NRC 1981).
3. Agricultural Scenario. An individual is assumed to raise his entire diet in a 1-ha area of soil contaminated by the onsite disposal of radioactive wastes. The individual is assumed to be exposed 2000 h/yr by external exposure and by inhalation of resuspended radionuclides in soil. Again, the air concentration resulting from resuspension is calculated using the equation by Anspaugh et al. (1975) with parameters presented for Scenario 2. Doses to total body, bone, lungs, thyroid, and LLI are calculated. The user furnishes the waste inventory to which a dilution factor of 0.2 is applied. Modifications can be made to the amount of radioactive decay before exposure, the duration of the exposure, the fraction of the total diet grown on the site, the reference site size, and the dilution of the waste. As in the previous scenarios, the user may substitute the mass-loading model and specify fewer organs. This scenario is similar to the intruder-agriculture scenario described in the Draft EIS for 10 CFR 61 (NRC 1981).

4. Irrigation/Drinking-Water Scenario. An individual is assumed to use a water supply contaminated by radionuclides from an onsite disposal site for irrigation and/or drinking. The user is required to input the concentration of each radionuclide in the water supply. The exposed individual is assumed to irrigate his field at a rate of 150 L/m²/mo during a 6-mo growing season. The site is assumed to be irrigated with contaminated water for 10 years prior to the beginning of the scenario. The individual obtains his entire diet (or a fraction of it) from a 1-ha irrigated field, and drinks 1.2 L of water per day from a contaminated water source. In addition, he is assumed to be exposed 2000 h/yr by external exposure and inhalation of resuspended radionuclides that are deposited on the surface of the soil by the irrigation water. Doses to total body, bone, lungs, thyroid, and LLI are considered. Irrigation and drinking water may be from the same or separate water supplies. When providing the inventory, the user is asked for radionuclide concentration in drinking and irrigation water separately. Irrigation or drinking water can be individually simulated by entering zero concentrations for the other pathway. The user may modify the irrigation rate, the length of the irrigation season, the time of irrigation prior to the scenario, the fraction of diet grown with contaminated irrigation water, the consumption of drinking water, the times of exposure, the resuspension equation selection, the reference site size, and the organ selection.
5. User-Defined Scenario. The user may construct his own scenario by selecting exposure pathways and defining conditions associated with each pathway.

2.1.4 Mathematical Models

The equations described in this section are arranged to aid understanding of the model as a whole. Consequently, the equations contain both environment-defined and scenario-defined parameters as distinguished in Section 2.1.1. The origin of the parameters will be discussed when applicable for each equation.

The fundamental relationship for calculating radiation doses to people from any radionuclide exposure pathway is given in Equation (2.1) (Soldat, Robinson, and Baker 1974).

$$R_{ipr} = C_{ip} U_p D_{ipr} \quad (2.1)$$

where R_{ipr} = the radiation dose equivalent or committed radiation dose equivalent from radionuclide i via exposure pathway p to organ r (rem)

C_{ip} = concentration of radionuclide i in the media of exposure in pathway p (pCi/L water, pCi/kg food, or pCi/m³ air); for calculations involving airborne radionuclides, C_{ip} is replaced with the term χ_i , which represents the average airborne concentration of radionuclide i

U_p = usage parameter (exposure rate or intake rate) associated with exposure pathway p (h/yr, L/yr, or kg/yr)

D_{ipr} = annual dose equivalent factor or the committed effective dose equivalent factor for radionuclide i, exposure pathway p, and organ r to convert the concentration and usage parameters to the radiation dose equivalent or to the committed effective dose equivalent (mrem/pCi)

An analysis of radiation doses from separate exposure pathways requires a determination of the dose equivalent or committed effective dose equivalent factors, the radionuclide concentrations, and the exposure rate or intake rate associated with each exposure pathway. For external exposure, the concentration of radionuclides and the duration of exposure must be quantified. The following sections provide mathematical descriptions of the models used in the analysis of radiation doses using the IBM PC/XT/AT version of the ONSITE/MAXI1 software package.

2.1.4.1 Effective Dose Equivalent Factors

The IBM PC/XT/AT version of the ONSITE/MAXI1 computer program allows the user to select dose calculations based on the internal dosimetry models described by the International Commission on Radiological Protection (ICRP) in either Publication No. 2 (1959) or No. 30 (1979-1982). The ability to produce doses based on ICRP Publication No. 2 is included so that comparisons with the Regulatory Guide 1.109 (NRC 1977) methods can be obtained. The methods based on ICRP Publication No. 30 are included to produce dose estimates that are consistent with the newer dosimetry system and metabolic data. Details concerning these internal dosimetry methods are found in references by the ICRP (1959; 1979-1982).

The methods described by the ICRP in their Publication No. 30 are based on limiting the total risk of health effects rather than on controlling a "critical" organ risk. The dose equivalent, H, at a point in tissue is given by the ICRP (1977):

$$H = DQN \quad (2.2)$$

where H = the dose equivalent at a point in tissue

D = the absorbed dose

Q = the quality factor to allow for the effect on the detriment of the microscopic distribution of absorbed energy

N = the product of all other modifying factors that might account for the absorbed dose rate and fractionation.

In addition to the basic dose equivalent, the ICRP defined the committed dose

equivalent over 50 years of exposure as H_{50} , to a given organ or tissue from a single intake of radioactive material (ICRP 1977):

$$H_{50} = \int_{t_0}^{t_0 + 50y} H(t) dt \quad (2.3)$$

where H_{50} = the committed dose equivalent

t_0 = the time of intake.

$H(t)$ = the equivalent dose equivalent rate

For stochastic effects, the ICRP recommended a dose limitation system based on the principle that the risk to an individual should be equal whether the whole body is irradiated uniformly or whether there is non-uniform irradiation. This condition is met by the equation (ICRP 1977):

$$\sum_T w_T H_T \leq H_{wb,L} \quad (2.4)$$

where w_T = a weighting factor representing the proportion of the stochastic risk resulting from tissue (T) to the total risk when the body is irradiated uniformly

H_T = the annual dose equivalent in tissue (T)

$H_{wb,L}$ = the recommended annual dose-equivalent limit for uniform irradiation of the whole body.

For the dosimetry system described in ICRP Publication No. 26 (1977), the standard dose calculated is the weighted sum of individual tissue (or organ) committed dose equivalents known as the committed effective dose equivalent. This dose is estimated by the IBM PC/XT/AT version of the ONSITE/MAXI1 computer program using the recommendations of the ICRP (1977, 1979-1982). For the ICRP 30 dose calculations, the ONSITE/MAXI1 computer adds the calculated effective dose equivalent from ingestion and inhalation to the dose equivalent from external exposure to produce the annual effective dose equivalent.

2.1.4.2 Maximum Annual Organ Dose Calculations

The user of the IBM PC/XT/AT version of the ONSITE/MAXII computer program may optionally select to calculate doses using the methodology given in ICRP Publication No. 2 (1959). For this dosimetry system, the ONSITE/MAXII computer program calculates the maximum annual dose to individual organs. Calculation of the annual dose to an organ requires the dose equivalent from exposure during the year of interest plus that resulting from intake during previous years. The general expression for annual dose calculations is determined here by inspecting the annual dose equations for the first three years of continuous exposure. For the first year, the annual dose to an organ of reference is simply the summation of the radiation dose equivalents from all internal and external exposure pathways. For the second year, the annual dose is calculated by the following expression (Kennedy et al. 1979; Napier et al. 1984):

$$A_2 = R_2^* + (R_{1,2} - R_{1,1}) \quad (2.5)$$

where A_2 = the annual dose during the second year from all exposure pathways to the organ of reference, mrem

R_2^* = the radiation dose equivalent in the second year to the organ of reference from all internal and external exposure pathways from intake and exposure in the second year, mrem

$R_{1,2}$ = the committed dose equivalent to the organ of reference for the first two years from radionuclides internally deposited during intake from exposure pathways in the first year, mrem

$R_{1,1}$ = the radiation dose equivalent to the organ of reference for the first year from radionuclides internally deposited during intake from exposure pathways in the first year (no external component to the dose equivalent), mrem.

The expression in parentheses in Equation (2.5) represents the dose equivalent to the organ of reference from radionuclides deposited in that organ during the first year. It is the difference between the two-year committed dose from intake of radionuclides in the first year and the first year's dose from that same intake.

The mathematical expression for the annual dose to an organ of reference in the third year of continuous exposure is (Kennedy et al. 1979):

$$A_3 = R_3^* + (R_{1,3} - R_{1,2}) + (R_{2,2} - R_{2,1}) \quad (2.6)$$

where A_3 = the annual dose during the third year from all exposure pathways to the organ of reference, mrem

R_3^* = the radiation dose equivalent in the third year to the organ of reference from all internal and external exposure pathways from intake and exposure in the third year, mrem.

In Equation (2.6), the terms $R_{1,3}$, $R_{1,2}$, $R_{2,2}$ and $R_{2,1}$ are similar in form, each containing two subscripts. The first subscript identifies the year of intake or exposure after the start of continuous exposure, and the second specifies the number of years used in calculating the committed dose equivalent. The expression in the first parentheses represents the dose equivalent to the organ of reference in the third year from radionuclides deposited during the first year of continuous exposure (i.e., the difference between the three-year committed dose equivalent and the two-year committed dose equivalent). The quantity in the second parentheses is the dose equivalent in the third year to the organ of reference from radionuclides deposited during the second year of continuous exposure (i.e., the difference between the second-year committed dose equivalent and the first-year committed dose equivalent).

The general expression for calculating the annual dose to an organ of reference during any year after the start of continuous exposure is expressed as (Kennedy et al. 1979):

$$A_t = R_t^* + \sum_{i=1}^{t-1} R_{i,(t-i+1)} - R_{i,(t-i)} \quad (2.7)$$

where A_t = the annual dose during the year t from all exposure pathways to the organ of reference, mrem

R_t^* = the radiation dose equivalent in year t to the organ of reference from all internal and external exposure pathways from intake and exposure in the year t , mrem.

The summation term in Equation (2.7) represents the dose equivalent delivered to the organ of reference in year t from radionuclides deposited in the organ from intake in all previous years since the start of continuous exposure. This term is valid only for positive integer values of t . For t equal to 1, the summation term is taken to be zero.

The annual dose, A_t , to the organ of reference is calculated for each value of t from 1 to 50, and the maximum annual dose is determined by inspection. Experience with this method to date indicates 50 years to be a suitable maximum value of t ; however, higher maximum values are not precluded. Details about the methods of calculating the radionuclide concentrations in various media, C_{ip} in Equation (2.1), are given in Sections 2.1.4.3 through 2.1.4.7.

No special algorithms or numerical techniques are employed by the ONSITE/MAXI1 computer programs apart from those required to solve Equation (2.7). However, special formulations for some of the parameters in Equation (2.1) are available in the exposure scenario analysis. Other formulations are directly included in the calculation of the dose conversion factors used by MAXI1. The following sections contain discussions of optional and default equations that are incorporated into the ONSITE/MAXI1 software package.

A more complete description of the maximum annual dose, a comparison of maximum annual dose with committed dose equivalents, a comparison with the 10 CFR 61 disposal limits (NRC 1981), and a description of the time line used in the maximum annual dose calculations can be found in Kennedy et al. (1986).

2.1.4.3 Radionuclide Concentration in Terrestrial Food Products

For ingestion of farm products produced on a contaminated site, the radionuclide concentration in separate food products must be determined by accounting for root transfer from soil, dry deposition from air on leaves, wet deposition from irrigation water, or animal consumption of contaminated forage or feed. The annual diet for the maximally exposed individual and the holdup time between harvest and consumption must also be determined. The dose from any food pathway is given by Equation (2.1). For direct deposition from the air, Equation (2.8) is used to describe the deposition of airborne particulate radionuclides directly onto food products and onto the ground.

$$d_i^a = 86,400 \bar{\chi}_i v_{di} \quad (2.8)$$

where d_i^a = deposition rate or flux of radionuclide i from the air,
pCi/(m²-day)

86,400 = dimensional conversion factor, seconds/day

$\bar{\chi}_i$ = average air concentration of radionuclide i , estimated using either the mass-loading or resuspension factor as pCi/m³

v_{di} = deposition velocity of radionuclide i , m/second, assumed in MAXI1 to be 1×10^{-3} m/sec for all particles.

The MAXI1 computer program permits selection of two methods for calculating the average air concentration. These methods are mass-loading and resuspension analysis. The mass-loading method uses the product of the surface soil radionuclide concentration (in pCi/g of soil) and the average mass-loading of dust or particulate material in the atmosphere (in g/m³) to estimate the air concentration (in pCi/m³). In the absence of data for a particular site, a value of 1×10^{-4} g/m³ has been suggested for predictive purposes (EPA 1977; Anspaugh et al. 1975). This value is used in this report for the annual average mass-loading factor. Annual arithmetic averages around the United States vary from 9×10^{-6} to 7.9×10^{-5} g/m³ (Anspaugh et al. 1975).

For the resuspension method, the average airborne concentration is the product of a resuspension factor and the surface contamination level as shown in Equation (2.9).

$$\bar{\chi} = S_f S_A \quad (2.9)$$

where $\bar{\chi}$ = average airborne concentration, pCi/m³

S_f = resuspension factor, m⁻¹

S_A = surface radioactivity, pCi/m².

The MAXII computer program permits the use of a time-dependent resuspension factor (S_f) as given by Anspaugh et al. (1975) as:

$$S_f = 10^{-4} e^{-\lambda \sqrt{t}} + 10^{-9} \quad (2.10)$$

where S_f = resuspension factor, m⁻¹

10^{-4} = resuspension factor at time $t = 0$, m⁻¹

λ = effective decay constant controlling the availability of material for resuspension, 0.15 day^{-1/2}

t = time after deposition, days

10^{-9} = resuspension factor after 17 years, m⁻¹.

The second term in Equation (2.10) (10^{-9}) is added based on the assumption that there is no further measurable decrease in the resuspension factor after about 17 years, the longest period for which data are available.

For deposition on plant leaves or soil from irrigation, the deposition rate (d_i^I) in pCi/m²-day for radionuclide i from irrigation water onto the ground, is defined by Equation (2.11).

$$d_i^I = C_{iw} I \quad (2.11)$$

where d_i^I = deposition rate or flux of radionuclides applied with irrigation water, (pCi/m²-day)

C_{iw} = concentration of radionuclide i in the water used for irrigation, pCi/L

I = irrigation rate; the amount of water sprinkled on a unit area of field in one day, L/(m²-day).

The total concentration of radioactive material in vegetation resulting from both direct deposition onto plant foliage and uptake of radionuclides previously deposited in the soil is:

$$C_{iv} = \left\{ \frac{(d_i^a + d_i^I) r T_v [1 - \exp(-\lambda_{Ei} t_e)]}{y_v \lambda_{Ei}} + \frac{(d_i^a + d_i^I) f_t B_{vi} [1 - \exp(-\lambda_i t_b)]}{\rho \lambda_i} \right. \\ \left. + \frac{0.15 f_t C_{si} B_{vi}}{\rho} + \frac{f_w C_{ti} B_{vi}}{\rho} \right\} \exp(-\lambda_i t_h) \quad (2.12)$$

where C_{iv} = concentration of radionuclide i in the edible portion of the vegetation, pCi/kg

d_i = previously defined above [see Equation (2.11)], pCi/(m²-day)

d_i^a = previously defined [see Equation (2.8)], pCi/(m²-day)

r = fraction of deposited material retained on the vegetation (dimensionless), taken to be 0.25

T_v = factor for translocation of externally deposited radionuclides to the edible parts of the vegetation (dimensionless). For simplicity, this parameter is assumed to be independent of the radionuclide and is assigned values of 1 for leafy vegetables and fresh forage and 0.1 for all other produce, including grain

λ_i = radiological decay constant for radionuclide i , days⁻¹

λ_{Ei} = the effective removal constant for radionuclide i , days⁻¹;
 $\lambda_{Ei} = \lambda_i + \lambda_w$, where λ_w = weathering removal constant for vegetation, days⁻¹; taken to be (0.693/14) days⁻¹

t_e = time of exposure of aboveground vegetation to contamination during growing season, days

y_v = vegetation yield, kg (wet weight)/m²

f_t = fraction of the roots in the plow layer of soil (dimensionless)

B_{vi} = concentration factor for uptake of radionuclide i from the soil by vegetation v , pCi/kg (wet weight) per pCi/kg soil (wet)

t_b = time for buildup of radionuclides in the soil, days; assumed to be 10 years for irrigation

p = soil "surface density," kg (dry soil)/m²; a value of 224 kg/m² is used assuming the contaminated ground is plowed to a depth of 15 cm (Napier et al. 1980)

0.15 = plow layer, m

C_{si} = concentration of radionuclide i available for plant uptake from the waste contained in the plow layer (top 15 cm of soil), pCi/m³

f_w = fraction of the roots that penetrate the waste trenches (dimensionless)

C_{ti} = concentration of radionuclide i available for plant uptake from the subsurface waste zone, pCi/m³

ρ = bulk soil density of subsurface material, kg/m³

t_h = holdup time between harvest and food consumption; days

The first expression inside the braces of Equation (2.12) represents the radionuclide concentration resulting from direct deposition of resuspended material and from irrigation on foliage during the growing season. The second expression inside the braces represents the plant uptake from the soil and reflects the deposition from irrigation. The third and fourth expressions inside the braces represent uptake of radionuclides contained in the top 0.15 m of soil and below this layer, respectively. Specific values used for the parameters in Equation (2.12) are found in Napier et al. (1980).

Radionuclide concentrations in animal products such as meat, milk, and eggs are dependent on the amount of contaminated forage or feed eaten by the animal. This concentration is:

$$C_{ia} = S_{ia} C_{if} Q_f + C_{iaw} Q_{aw} \quad (2.13)$$

where C_{ia} = concentration of radionuclide i in the animal product, pCi/kg or pCi/L

S_{ia} = transfer coefficient of radionuclide i from daily intake of the animal to the edible portion of the animal product, pCi/L (milk) per pCi/day or pCi/kg (animal product) per pCi/day

C_{if} = concentration of radionuclide i in feed or forage, pCi/kg; calculated from Equation (2.12)

Q_f = animal consumption rate of contaminated feed or forage, kg/day

C_{iaw} = concentration of radionuclide i in the water consumed by animals, pCi/L; assumed to be the same as the irrigation water, C_{iw} [see Equation (2.11)]

Q_{aw} = consumption rate of the contaminated water by the animal, L/day.

Specific values of the parameters used in Equation (2.13) are given in Napier et al. (1980).

The dose, R_{Ir} (in mrem), to an organ of the exposed individual resulting from the ingestion of food products raised in the soil at a contaminated site is calculated using a modified version of Equation (2.1). This general relationship is:

$$R_{Ir} = U_p f_D \sum_{i=1}^n C_{ip} \cdot A_c^I \cdot D_{ipr} \quad (2.14)$$

where f_D = the fraction of the total diet grown on the site

A_c^I = the area correction factor for the ingestion pathway discussed in Section 2.1.4.8,

and where U_p , C_{ip} , and D_{ipr} are for ingestion and are generally defined in Equation (2.1).

2.1.4.4 Ingestion of Drinking Water

The dose, R_{wr} (in mrem), from ingestion of water containing radionuclides, is:

$$R_{wr} = U_w \sum_{i=1}^n C_{idw} \exp(-\lambda_i t_h) D_{ir} f_{dw} \quad (2.15)$$

where U_w = annual consumption of contaminated drinking water, L

C_{idw} = the concentration of radionuclide i in the drinking water (input by user), pCi/L

λ_i = radiological decay constant for radionuclide i , days⁻¹

t_h = transit time required for radionuclide to reach the point of exposure, days

D_{ir} = radiation dose equivalent factor for ingestion, mrem/pCi

f_{dw} = drinking water cleanup factor (for municipal water supplies).

2.1.4.5 Inhalation

Dose conversion factors for inhalation used in MAXI1 are obtained directly from ICRP Publication No. 30 (ICRP 1979-1982) or are calculated using the DACRIN computer program (Houston, Streng, and Watson 1974) and stored in the data files. The inhalation dose, R_{hr} (in mrem), is:

$$R_{hr} = VTt_m \sum_{i=1}^n \bar{\chi}_i \cdot A_c^I \cdot D_{ir} \quad (2.16)$$

where V = ventilation rate of exposed individual, m^3/sec

T = duration of exposure to the airborne radionuclide concentration, seconds.

t_m = modification factor applied to T to adjust time of exposure or ventilation rate of $2 \times 10^3 m^3/sec$ (ICRP 1975)

$\bar{\chi}_i$ = the annual average airborne concentration of radionuclide i , pCi/m^3

A_c^I = the area correction factor for inhalation and external exposure pathways as discussed in Section 2.1.4.8.

D_{ir} = radiation dose equivalent factor for inhalation from the DACRIN computer code (Houston, Streng, and Watson 1974), $mrem/pCi$

The following terms of Equation (2.16) are found in the MAXI1 computer code:

$$\bar{\chi}_i \quad t_m \quad A_c^I$$

The inhalation dose rate factors calculated by the DACRIN computer code (Houston, Streng, and Watson 1974) are included in a data library that can be addressed by MAXI1. The following terms in Equation (2.16) are included in those factors.

$$D_{ir} \quad V \quad T$$

2.1.4.6 External Radiation

Annual doses, R_{er} (in mrem), resulting from exposure to contaminated soil or in a reference room (or vault), are calculated using a modified version of Equation (2.1). The modified dose equation for external exposure is:

$$R_{er} = U_p \sum_{i=1}^n D_{ir} \cdot A_C^E \cdot C_{ip} \quad (2.17)$$

where A_C^E = the area correction factor for external exposure and discussed in Section 2.1.4.8,

and where U_p , D_{ir} , and C_{ip} are for external exposure and are generally defined in Equation (2.1).

Dose conversion factors for external exposure are available for several types of exposure conditions. These include surface-soil contamination (using either plane- or slab-source models), subsurface-soil contamination (using slab sources at depths of 0.5 and 1.0 m from the soil surface), and a finite disk source of contamination deposited on the floor or a wall in a waste-storage room or vault. These dose conversion factors are calculated for a whole-body dose (with a tissue depth of 5 cm) located at a point 1 m above the ground surface. The direct exposure rates encountered by the intruder for various contamination levels in a waste-storage room or vault are calculated using the model developed for decommissioning a reference room at a boiling water reactor (BWR) (Oak et al. 1980). All of the external dose equivalent factors are calculated for the radionuclides of concern using the ISOSHL D (Engel et al. 1966; Simmons et al. 1967) computer program.

When developing the external-exposure libraries used by the ONSITE/MAXI1 computer program, certain simplifying assumptions were made. Two primary assumptions are evaluated in additional sensitivity studies:

- The effect of waste form density is determined by comparing the external exposure factors, originally calculated for a waste form density of 1.8, with factors calculated for densities of 1.0, and 0.6 g/cm³.
- The effect of the slab-source thickness is determined by comparing the external exposure factors calculated for 1-m-thick and 3-m-thick slabs.

The sensitivity studies were performed using modified input parameters with the ISOSHL D computer program (Engel et al. 1966; Simmons et al. 1967). A summary of the results obtained is shown in Table 2.4 for a constant source strength of 1 Ci/m³ of selected radionuclides. These results show that for a constant source strength, the less the waste density, the greater the calculated dose rate. However, for each waste density there is little dependence on slab thickness.

Based on these results, the ONSITE/MAXI1 computer program permits the user to select the waste form density when performing external exposure calculations. The possible waste form densities that the user may select are 1.8 g/cm³ (the approximate density of soil), 1.0 g/cm³ (the density of water), or 0.6 g/cm³ (the approximate density of noncompacted trash waste forms). No corrections for slab thickness are included in the external exposure data libraries.

TABLE 2.4. External Dose Conversion Factors (mrem/h per Ci/m³) for Selected Waste Form Densities (ρ) and Slab Thicknesses with 0.0-m Overburden

Radionuclide	$\rho = 1.8 \text{ g/cm}^3$		$\rho = 1.0 \text{ g/cm}^3$		$\rho = 0.6 \text{ g/cm}^3$	
	Slab Thickness:		Slab Thickness:		Slab Thickness:	
	1 m	3 m	1 m	3 m	1 m	3 m
²² Na	514	514	964	966	1600	1630
⁵¹ Cr	12	12	28	28	470	471
⁵⁴ Mn	327	327	684	684	1140	1150
⁵⁷ Co	21	21	70	70	117	117
⁶⁰ Co	1000	1000	1930	1930	3200	3270
⁹⁰ Sr+D	2	2	6	6	9	9
¹³¹ I	133	133	323	323	539	541
¹³⁴ Cs	674	674	1500	1500	2470	2500
¹³⁷ Cs+D	241	241	573	573	935	942

2.1.4.7 Ingestion of Aquatic Foods

The concentration of a radionuclide in aquatic foods is directly related to the concentrations of the radionuclide in water. Equilibrium ratios between the two concentrations, called bioaccumulation factors, are taken from Soldat, Robinson, and Baker (1974). The dose, R_{afr} (in mrem), from consumption of aquatic food, f_i , containing radionuclide i is:

$$R_{afr} = U_{af} \sum_{i=1}^n C_{iw} \exp(-\lambda_i t_h) D_{ir} (B_{xi} + B_{yi} + B_{zi}) \quad (2.18)$$

where U_{af} = annual consumption of contaminated aquatic foods, kg
 C_{iw} = the concentration of radionuclide i in the water, pCi/L
 λ_i = radiological decay constant for radionuclide i , days⁻¹
 t_h = holdup time between harvest and food consumption, days.
 D_{ir} = radiation dose equivalent factor for ingestion, mrem/pCi
 B_{xi} , B_{yi} , B_{zi} = the bioaccumulation factor for radionuclide i , for:
 x = fish, y = invertebrates, and z = algae, pCi/kg per pCi/L

2.1.4.8 Area Correction Factors

Because of the large variability that may exist in the exposure conditions at any given site, we have defined correction factors that modify the default area exposure pathway assumptions provided in the scenario analysis.

For external exposure, a sensitivity study was conducted for various beta-gamma emitters to determine the exposure rate versus source area. The results of the calculations are shown in Figure 2.1. Since the curves in Figure 2.1 are parallel, there appears to be a uniform correction for reduced site area over a large range of source energies. We have therefore determined the ratio of the exposure rates (for small to large area sources) and plotted the results versus the source area as shown in Figure 2.2. This figure defines the area correction factors for the external exposure pathway, given in Equation (2.17) as the term A_C . We have approximated this curve in the MAXI1 computer program as the sum of four line segments as shown in Figure 2.3.

The default values used in the reference environment for the ONSITE/MAXI1 computer program are based on a minimum site area of 1 ha. To account for the limited exposure potential from smaller disposal areas, site area correction factors are required. For example, the amount of agricultural products raised on a site depends upon the intensity of the farming and the types of crops raised. A small site may produce a large fraction of the seasonal fruit and vegetable diet with intensive farming, but be unable to provide enough forage and grain to support a milk cow or other animals. Thus, while a large fraction of the seasonal fruit and vegetable diet may be raised on a small site, the total quantity raised may only equal a small fraction of the total annual diet.

Many of the experiments relating air and soil concentrations were performed on sites of limited size (i.e., sites with areas of 1 ha or less) (Sehmel 1974; Milham et al. 1976; Sehmel and Lloyd 1976). After careful consideration of the potential magnitude of the area correction for inhalation factors, it was determined that the area correction developed for the direct exposure pathway should be applied for the inhalation pathway (Kennedy et al. 1986). These area correction factors for direct exposure and inhalation are shown in Figure 2.3.

In determining area correction factors for the ingestion pathway to be used in the MAXI1 computer program, consideration is first given to the default pathway conditions and then to variable exposure conditions as a function of site area. For the default conditions, the individual's entire diet, as defined in Regulatory Guide 1.109 (NRC 1977), is assumed to be raised on the 1-ha site. This diet consists of fruits and vegetables and meat and animal products. The air concentrations used for the inhalation calculations are for resuspension of radionuclides from large areas of distributed-surface contamination.

For the ingestion pathway, the area correction factors are in the form of a step function as shown in Figure 2.4. This function assumes five steps of potential exposure versus site area ranging from small to large sites. The steps of total exposure are: 1) 10% for sites with areas less than 50 m², 2) 5% for sites with areas between 50 and 200 m², 3) 50% for sites with areas between 200 and 1,000 m², 4) 75% for sites with areas between 1,000 and 10,000 m², and 5) 100% for sites larger than 10,000 m² (or 1 ha).

FIGURE 2.1. Exposure Rate Versus Source Area

FIGURE 2.2. Exposure Rate Ratio Versus Fractional Hectare of Source Area

FIGURE 2.3. Area Correction Factors for External Exposure and the Inhalation Pathway

FIGURE 2.4. Area Correction Factors for the Ingestion Pathway

2.2 COMPUTER IMPLEMENTATION

Estimates of the maximum annual radiation doses resulting from the exposure scenarios described in Section 2.1.1 can be made using environment-specific information and computer codes contained in the ONSITE/MAXI1 software package. This version of the package contains two computer programs, ONSITE and MAXI1, as well as an extensive data base. This data base is discussed in detail in Section 2.3. The following sections contain computer system requirements, descriptions of the ONSITE/MAXI1 computer programs, an overview of software operation, capabilities, restrictions, and execution performance of the software.

2.2.1 Computer System Requirements

The current version of the ONSITE/MAXI1 software package was designed to execute on the IBM PC/XT/AT computer operating under IBM DOS 2.1 (or greater). The computer must be configured with a minimum of 512 kilobytes of random access memory and a hard disk for peripheral storage. Though not necessary for execution, a math coprocessor will greatly speed program execution.

The ONSITE/MAXI1 software package is available on dual-sided, double-density floppy disks formatted for the IBM PC/XT/AT computer.

2.2.2 Descriptions of Computer Programs

The ONSITE/MAXI1 software package contains the ONSITE and MAXI1 computer programs. ONSITE is an interactive user interface that allows the end-user to simply and efficiently create and use the radiation-exposure scenarios. MAXI1 is then used with the scenario information to calculate the maximum annual dose to an exposed individual from selected pathways. The following sections contain descriptions of each of the computer codes.

2.2.2.1 ONSITE Computer Program

ONSITE is an interactive computer program that allows the user to access or create radiation-exposure scenarios used to estimate the dose to human resulting from onsite disposal of radioactive wastes. The software solicits scenario information from the user, controls parameter modification, selects the appropriate data libraries for running MAXI1, and constructs the input file for MAXI1. ONSITE was designed for the novice user of the ONSITE/MAXI1 software package. ONSITE is the only computer program that the user needs to interact with because this interaction automatically produces results from MAXI1. The ONSITE program gives the user the option of changing any parameters of selected pathways used in the radiation-exposure scenarios. Each parameter is described in terms that should be meaningful to the end-user. The dimensional units and the upper and lower bounds of each parameter are displayed for each parameter. Each value entered by the user is tested against upper and lower limits when applicable. If the value is not accepted, the user is asked to re-enter the value. Default (or assumed maximum) values and conditions are activated by a null entry (e.g., simply pressing the <return> key on the terminal).

2.2.2.2 MAXI1 Computer Program

The computer program MAXI1 is used to calculate the maximum annual dose (based on the methodology in ICRP Publication No. 2) and the annual effective dose equivalent (based on the methodology in ICRP Publication No. 30) to an exposed individual from a large number of exposure pathways. Exposure pathways that can be modeled include 1) direct external exposure to contaminated soil or building surfaces, 2) inhalation of resuspended material or material that has blown in from an offsite source, and 3) ingestion of contaminated foods, drinking water, and aquatic foods. For the maximum annual dose, the time of the maximum dose to each organ of reference is calculated and the annual dose for that organ is reported.

For the maximum annual dose calculations, MAXI1 uses dose conversion factors from the DACRIN computer program (Houston, Streng, and Watson 1974) for estimating doses from inhalation of airborne radionuclides. The dose conversion factors from DACRIN are based on the International Commission on Radiological Protection's (ICRP) Task Group Lung Model (TGLM) (ICRP 1966). For the committed dose equivalent calculations, inhalation dose factors from ICRP Publication No. 30 (ICRP 1979-1982) are used.

MAXI1 calculates the maximum annual dose from ingestion pathways, for either food products or drinking water, based on the dosimetry model of ICRP Committee II as reported in ICRP Publication No. 2 (1959). In the previous version of the ONSITE/MAXI1 software package, ingestion dose factors were calculated by the MAXI2 and MAXI3 computer programs, stored in data files, and then used by MAXI1. In the current version of the program, dose calculations previously performed by MAXI2 and MAXI3 are incorporated into MAXI1. For committed dose equivalent calculations, ingestion dose factors from ICRP Publication No. 30 (ICRP 1979-1982) are used.

For external exposure, dose conversion factors from the ISOSHL (Engel et al. 1966; Simmons et al. 1967) are used by MAXI1. These factors relate the radionuclide source strength to the dose rate in tissue 1 m above an infinite plane or slab of contamination. External dose conversion factors are supplied for surface-soil contamination, and for slabs of buried contamination at depths of either 0.5 or 1.0 m. External dose conversion factors from an optional room exposure condition are also available. These factors are intended to model doses to an intruder who may enter a room (or vault) used for storage of radioactive wastes.

2.2.3 Operation of the ONSITE/MAXI1 Software Package

Section 3 contains a detailed discussion of the operation of the ONSITE/MAXI1 software package. A theoretical overview of software operation is presented here. In previous versions of the software package, three levels of operation were defined. In the current version of the package, usage has been simplified resulting in only two levels of operations. The first level is primarily for novice users and the second level is for experienced users. These levels of operation are described in this section.

The first level of operation user interacts primarily with the ONSITE computer program. The ONSITE program is used to select and establish parameters for a scenario. The user is assisted during scenario creation by a restricted set of parameters and restricted ranges of values for each parameter. The MAXI1 program is automatically executed at the termination of the ONSITE program. The second level of operation user should be familiar with the mathematical models and software package. This level of operation provides a shorthand method for preparing MAXI1 input. This version of the ONSITE computer program generates an annotated input file for the MAXI1 computer program. The second level of operation user edits the annotated input file for MAXI1 using a standard text editor and then executes the MAXI1 program.

2.2.4 Capabilities, Restrictions and Performance

The capabilities and inherent restrictions of the ONSITE/MAXI computer implementation are discussed in this section. Execution performance of the software package is also presented.

The user is restricted to a inventory of 20 radionuclides. This number includes both the radionuclides entered in the source term and those daughters that will be considered by MAXI1. A large memory version of the ONSITE/MAXI1 software package is available that can handle inventories of up to 50 radionuclides. However, this special version is only available on IBM/AT quad-density floppy disks.

The user is no longer able to specify the number of organs for which maximum annual dose calculations are made. Total body, bone, lung, thyroid, and the lower large intestine (LLI) are included in all cases.

When run on the IBM/AT computer with a math coprocessor installed and processed in batch mode, the set of six sample problems, to be described in Section 3 of this document, complete execution in 16 minutes, 34 seconds.

2.2.5 Software Package

Information regarding the availability of the software package associated with this NUREG report is available from:

U.S. Nuclear Regulatory Commission
Information Technology Services Support Center
Mail Stop P-808
Washington, DC 20555
Telephone: (301) 492-4160 or FTS 492-4160

2.3 DATA BASE

The current version of the data base contained in the ONSITE/MAXI1 software package is substantially different from that included with earlier versions of the package. Previously the MAXI2 and MAXI3 computer programs were used to calculate dose conversion factors that were stored in the data base and then accessed by MAXI1. In the current version of the software package, the

MAXI2 and MAXI3 programs have been incorporated into MAXI1 thus eliminating the need for four of the large data files in the data base.

An understanding of the detailed information that follows is not necessary for the successful execution of ONSITE/MAXI1. The intended audience are those interested in the organization and content of the data base and the second level of operation users.

2.3.1 Radionuclide Master List - RMDONS

RMDONS contains those radionuclides considered of importance for assessing the impact of the onsite disposal of wastes for which dose factors are available. RMDONS is used by the ONSITE program to ensure that only radionuclides from the master list are considered and that the user entries conform to the specified nomenclature. A listing of the radionuclides contained in RMDONS may be found in Appendix B. The format of the file is identical to that of RMDLIB. The radionuclide master list for ONSITE/MAXI1, RMDONS, is a subset of the radionuclide master library (RMDLIB) to be discussed in the following section.

2.3.2 Radionuclide Master Data Library - RMDLIB

The radionuclide master data library (RMDLIB) contains all radiological decay data used by MAXI1. The radionuclides are organized into decay chains ordered by atomic number under the radionuclides highest in the chain. Calculations of radioactive decay and daughter ingrowth are performed in the MAXI1 subroutine ACHAIN, using the decay chain data of RMDLIB and the decay equations of Bateman (1912). RMDLIB contains 245 entries.

The first record of the library contains 80 characters of descriptive information used as identification in the input data report printed by MAXI1. The balance of the data records have the following information:

Column 1	Alphabetic element symbol
Column 2	Atomic weight, also metastable (m) designation
Column 3	Radiological half-life, days
Column 4	Indicator of relative position in decay chain (0 is highest position)
Column 5	Indicator of precursor in decay chain (as identified in column 4 of the precursor)
Column 6	Branching ratio for primary precursor
Column 7	Indicator of alternate precursor in decay chain
Column 8	Branching ratio for alternate precursor
Column 9	Alternate specification of radionuclide (not used by ONSITE/MAXI1)
Column 10	Flag indicating whether radionuclide is a bone volume or bone surface seeker
Column 11	Translocation classification

Translocation refers to the rate at which radionuclides are transported by body fluids from the lungs to the blood and GI tract after inhalation (sometimes referred to as solubility class). For inhalation calculations, translocation

classifications are made for each organ based on the usage of the Task Group Lung Model (ICRP 1966). The translocation flags used in RMDLIB refer to the following classes as defined in ICRP (1966):

- D - Class D Materials. A maximum clearance half time of less than a day.
- W - Class W Materials. A maximum clearance half time ranging from a few days to a few months.
- Y - Class Y Materials. A maximum clearance half time of from six months to a few years.

The RMDLIB FORTRAN format is (A2, A6, E10.2, 2I2, F7.4, I2, F7.4, A30, 2A1). A listing of the material found in the library is located in Appendix B.

2.3.3 Organ Data Library - ORGLIB

The library ORGLIB contains data used by MAXI1 for calculations of doses to specific organs from ingested radionuclides using the dose methodology given in ICRP Publication No. 2 (1959). Data are arranged in sets by radionuclide. The sets are ordered to be compatible with the RMDLIB chain order. Data in each block are arranged by organ index. The organs for which data are potentially available are:

1 - Total body	9 - Adrenals	17 - Pancreas
2 - Body water	10 - Testes	18 - Heart
3 - Kidneys	11 - Ovaries	19 - GI tract
4 - Liver	12 - Skin	20 - Stomach
5 - Spleen	13 - Brain	21 - Small intestine
6 - Bone	14 - Muscle	22 - Upper large intestine
7 - Fat	15 - Prostate	23 - Lower large intestine
8 - Lungs	16 - Thyroid	

For most entries, data are included only for total body, bone, lungs, thyroid, and the lower large intestine. The data contained in each record of ORGLIB is as follows:

Column 1	Alphabetic element symbol
Column 2	Atomic weight and metastable designation (m)
Column 3	Organ index
Column 4	Biological half-time, days
Column 5	f_w , fraction of ingested radionuclide reaching the organ of interest
Column 6	f_2 , fraction from blood to organ of interest (not used by ONSITE/MAXI1)
Column 7,8,9	Effective energy absorbed per disintegration in adult organs, MeV. Columns 8 and 9 are only used for lungs.

The FORTRAN format of the organ data library ORGLIB is (A2, A6, I2, 6E8.2). Appendix B contains a listing of the material contained in ORGLIB.

2.3.4 Food Transfer Factor Library - FTRANS

The food transfer factor library, FTRANS, contains factors used in MAXI1 relating concentrations of elements in soil to concentrations in farm products grown on that soil, and relating concentrations in animal feed to concentrations in animal products. Plant concentration factors are taken from URCL-50163, Part IV (Ng et al. 1968) and supplemented with radionuclide data as explained in the Handbook of Radiological Protection, Part 1: Data, (Radioactivity Advisory Committee 1971). The literature yielded coefficients of transfer from feed to animal products for a limited number of radionuclides. For those radionuclides lacking data, comparisons were made with the behavior of chemically similar elements in man (ICRP 1959) and animals. In some instances, where other data are lacking, transfer coefficients are set to 9.9×10^{-4} . The most complete listing of transfer coefficients is that for milk (Soldat and Harr 1971). Some experimental data are available on the transfer of several radionuclides for chicken, eggs, and meat (Annenkov et al. 1974). Currently efforts are under way at Pacific Northwest Laboratory to update the food transfer library FTRANS.

Each record in FTRANS contains the following information:

Column 1	Alphabetic element symbol
Column 2	Elemental deposition velocity from air to ground, m/sec
Column 3	Food transfer coefficients for: plants (dimensionless, pCi per gram plant (wet)/pCi per gram soil (wet); milk (day/L); and eggs, beef, pork, and poultry (day/kg)

The FORTRAN format is (A2, 9F9.1). A listing of the material contained in the food transfer library FTRANS may be found on Appendix B.

2.3.5 Bioaccumulation Factor Library - BIOAC1

The bioaccumulation library, BIOAC1, contains the factors used by MAXI1 relating the concentration of radionuclides in aquatic biota to the concentration of the radionuclides in the water. These factors are taken from Thompson et al. (1972) and Freke (1965). There are separate factors for fresh and salt water. Also included are factors representing the fraction of chemical elements passing through conventional municipal water treatment plants. The library organization is as follows:

Column 1	Alphabetic element symbol
Column 2	Bioaccumulation factors for fish, crustacea, molluscs, and algae for salt water (pCi/kg per pCi/L)
Column 3	Bioaccumulation factors for fish, crustacea, molluscs, and algae for fresh water (pCi/kg per pCi/L)
Column 4	Drinking water clean-up factor (dimensionless)

The FORTRAN format is (A2, 9F9.1). Appendix C contains a listing of the material found in the BIOAC1 aquatic bioaccumulation factor library.

2.3.6 External Exposure Dose Rate Factors - Waste Modeled as a Plane Source

The file assigned to logical unit 2 contains external dose rate factors for waste modelled as a plane source. The dose rate factors are for 1 pCi of radionuclide per m² of soil surface. These factors relate the radionuclide strength to the dose rate in tissue 1 m above the plane. Three files, PLANEA, PLANE B, and PLANE C are available based on assumed waste density. The file names, waste densities, and waste configuration description are included in Table 2.5 for easy reference.

The external exposure dose rate factors were created by the ISOSHL D (Engel, Greenberg and Hendrickson 1966; Simmons et al. 1967) computer program. Table 2.6 summarizes the ISOSHL D parameter values used to approximate a plane source of contamination at the soil surface.

The organization and FORTRAN formats of these files are as follows:

Record 1	Descriptive title, (A80).
Record 2	Blank
Remainder of file	For each isotope (A2, A6, E9.1):
	- Element symbol and atomic number as in master radionuclide library
	- External exposure dose rate factor

Listings of the files PLANE A, PLANE B, and PLANE C are included in Appendix B.

TABLE 2.5. Dose Rate Factor Files for External Exposure

File Name	Logical Unit Assignment	Waste Density (g/cm ³)	Description
PLANE A.DAT	2	1.8	Infinite plane of soil contamination, waste thickness of 15 cm
PLANE B.DAT	2	1.0	
PLANE C.DAT	2	0.6	
VOLSA.DAT	7	1.8	Infinite surface slab source, waste extends to a depth of 1 m
VOLSB.DAT	7	1.0	
VOLSC.DAT	7	0.6	
BURHFA.DAT	7	1.8	Infinite slab source, buried in soil with an overburden depth of 0.5 m, waste thickness of 1 m
BURHFB.DAT	7	1.0	
BURHFC.DAT	7	0.6	
BUR1A.DAT	7	1.8	Infinite slab source, buried in soil with an overburden depth of 1 m, waste thickness of 1 m
BUR1B.DAT	7	1.0	
BUR1C.DAT	7	0.6	
STOREDA	7	1.8	Rectangular slab source, 10 m x 3 m, waste thickness 1 m
STOREDB	7	1.0	
STOREDC	7	0.6	

TABLE 2.6. ISOSHLD Parameter Values Used for External Exposure Dose Rate Factors

ISOSHLD Parameter	Plane Source At Surface	Slab Source			Stored Waste
		At Surface	0.5-m Overburden	1.0-m Overburden	
IGEOM	5	5	5	5	10
ANGL (degrees)	90	90	90	90	90
X (cm)	115	200	250	300	400
Y (cm)					300
SLTH (cm)					1000
NSHLD	3	3	4	4	3
SHIELD 1:					
T(1) (cm)	15	100	100	100	100
Material	(a)	(a)	(a)	(a)	(a)
Density (g/cm ³)	(a)	(a)	(a)	(a)	(a)
SHIELD 2:					
T(2) (cm)	95	95	50	100	295
Material	air	air	concrete ^(b)	concrete ^(b)	air
Density	0.00129	0.00129	1.8	1.8	0.00129
SHIELD 3:					
T(3) (cm)	5	5	95	95	5
Material	skin	skin	air	air	skin
Density	1	1	0.00129	0.00129	1
SHIELD 4:					
T(4) (cm)			5	5	
Material			skin	skin	
Density			1	1	
WEIGHT (Ci)	1.0×10^{-6}	1.0×10^{-6}	1.0×10^{-6}	1.0×10^{-6}	30
NTHETA					6
NPSI					5
DELR					0.2

(a) External dose-rate factors were generated for the following waste densities:

- 1) 1.8 g/cm³ (material: concrete)
- 2) 1.0 g/cm³ (material: water)
- 3) 0.6 g/cm³ (materials: 0.5 g/cm³ silica + 0.1 g/cm³ carbon)

(b) The electron density of soil is approximated by that of concrete.

2.3.7 External Exposure Dose Rate Factors - Waste Modeled as a Slab Source

The file assigned to logical unit 7 contains external dose rate factors for waste modeled as a plane source. The dose rate factors are for 1 pCi of radionuclide per m^3 of waste. These factors relate the radionuclide strength to the dose rate in tissue 1 m away. Files are available to describe four different waste configurations: a slab at the soil surface; slabs with 0.5-m and 1.0-m overburden, respectively; and a rectangular slab source. The rectangular slab source approximates waste stored above ground. One of three waste densities may be assumed for each waste configuration. The file names, waste densities, and waste configuration descriptions are included in Table 2.5 for easy reference.

The external exposure dose rate factors were created by the computer program ISOSHL (Engel, Greenberg and Hendrickson 1966; Simmons et al. 1967). Table 2.6 summarizes the ISOSHL parameter values used to approximate a slab source of contamination at or on the soil surface or with a soil overburden.

The organization and FORTRAN formats of these files are as follows:

Record 1	Descriptive title, (A80).
Record 2	Blank
Remainder of file	For each isotope (A2, A6, E9.1): <ul style="list-style-type: none">- Element symbol and atomic number as in master radionuclide library- External exposure dose rate factor

Listings of these files are found in Appendix B.

2.3.8 Inhalation Dose Rate Factors - FILE23

The file named FILE23 contains inhalation dose rate factors for 1 pCi/ m^3 of air. The file is arranged into sets of records for each isotope. Each isotope set contains three solubility class subsets. Each solubility class subset contains a variable number of records, one record per year. Each record contains data on total body, bone, lung, thyroid, and the lower large intestine. The file organization and FORTRAN formats of FILE23 are as follows:

Record 1	Descriptive title (A80)
Record 2	Number of radionuclides in library, (I3)
Record 3	Master index of organs, as specified for ORGLIB (5I5)

This set of records follows for each radionuclide:

Line A	Element symbol as in the master radionuclide library; Atomic number as in the master radionuclide library; No. of years data for Translocation Class D No. of years data for Translocation Class W No. of years data for Translocation Class Y (A2, A6, 2X, 3I5).
Next subset	For Translocation Class D, one record contains inhalation dose rate factors for five organs; one record per year (10X, 5E10.2).
Next subset	For Translocation Class W, one record contains inhalation dose rate factors for five organs; one record per year (10X, 5E10.2).
Next subset	For Translocation Class Y, one record contains inhalation dose rate factors for five organs; one record per year (10X, 5E10.2).

The file contains dose rate factors of 117 radionuclides for five organs for the assumed translocation class and a varying number of years. Dose rate factors are based on a breathing rate of 230 cc/sec. FILE23 is created by a special version of the computer code DACRIN (Houston, Streng, Watson, 1974). A complete listing of FILE23 is included in Appendix B.

2.3.9 Dose Factors - Library LB30SVBQ

The library LB30SVBQ contains committed dose equivalent factors for target organs or tissues in units of Sv/Bq provided in ICRP Publication No. 30 (ICRP 1979-1983). The organization and FORTRAN format of the library is as follows:

Line 1 Descriptive title (A80)

Data sets of the following records for each radionuclide:

Record 1	Element symbol, mass number plus metastable specification, number of organs included in this data set, alternate name for radionuclide (A2, 1X, A6, 1X, I2, 11X, A20)
Record 2	Fraction of material absorbed into blood from gut (f_1) for: oral 1, oral 2, Translocation classes D, W, and Y (3X, 5(F7.1, 1X)

A listing of the material in LB30SVBQ is included in Appendix B.

REFERENCES

- Annenkov, I. K., et al. 1974. The Radiobiology and Radioecology of Farm Animals. AEC-TR-7523, U.S. Atomic Energy Commission, Washington, D.C.
- Anspaugh, L. R., J. H. Shinn, P. L. Phelps and N. C. Kennedy. 1975. "Resuspension and Redistribution of Plutonium in Soils." Health Phys. 29:571-582.
- Bateman, H. 1910. "Solution of a System of Differential Equations Occurring in the Theory of Radio-active Transformations." Proc. Cambridge Phil. Soc., 15:423-427.
- Engel, R. L., J. Greenborg, and M. M. Hendrickson. 1966. ISOSHLD - A Computer Code for General Purpose Isotope Shielding Analysis. BNWL-236, Pacific Northwest Laboratory, Richland, Washington.
- Freke, A. M. 1965. "A Model for the Approximate Calculation of Safe Rates of Discharge of Radioactive Wastes into Marine Environments." Health Physics, 13:743.
- Houston, J. R., D. L. Streng and E. C. Watson. 1974. DACRIN - A Computer Program for Calculating Organ Dose from Acute or Chronic Radionuclide Inhalation. BNWL-B-389, Pacific Northwest Laboratory, Richland, Washington.
- International Commission on Radiological Protection (ICRP). 1959. Report of ICRP Committee II on Permissible Dose for Internal Radiation. ICRP Publication No. 2, Pergamon Press, Elmsford, New York.
- International Commission on Radiological Protection (ICRP). 1977. Recommendations of the International Commission on Radiological Protection. ICRP Publication No. 26, Pergamon Press, Elmsford, New York.
- International Commission on Radiological Protection (ICRP). 1979-1982. Limits for Intakes of Radionuclides by Workers. ICRP Publication No. 30, Parts 1, 2, and 3 (and supplements). Pergamon Press, Elmsford, New York.
- International Commission on Radiological Protection (ICRP). 1966. "Deposition and Retention Models for Internal Dosimetry of the Human Respiratory Tract." Health Phys. 12:173-207.
- Kennedy, W. E., Jr., E. C. Watson, G. R. Hoenes, and B. A. Napier. 1979. "A Method for Determining Acceptable Residual Radioactive Contamination Levels." Paper presented at the 24th Annual Meeting of the Health Physics Society, July 8-13, 1979, Philadelphia, Pennsylvania.
- Kennedy, W. E., Jr., R. A. Peloquin, B. A. Napier and S. M. Neuder. 1986. Intruder Dose Pathway Analysis for the Onsite Disposal of Radioactive Wastes: The ONSITE/MAXII Computer Program. NUREG/CR-3620 Supplement 1, National Technical Information Service, Springfield, Virginia.

- Milham, R. C., J. F. Schubert, J. R. Watts, A. L. Boni, and J. C. Corey. 1974. "Measured Plutonium Resuspension and Resulting Dose from Agricultural Operations on an Old Field at the Savannah River Plant in the Southeastern United States." In Proceedings of an IAEA/USERDA Symposium on Transuranium Nuclides in the Environment, E. I. du Pont de Nemours & Co., Aiken, South Carolina.
- Napier, B. A., R. L. Roswell, W. E. Kennedy, Jr. and D. L. Streng. 1980. ARRRG and FOOD - Computer Programs for Calculating Radiation Dose to Man from Radionuclides in the Environment. PNL-3180, Pacific Northwest Laboratory, Richland, Washington.
- Napier, B. A. 1981. Standardized Input for Hanford Environmental Impact Statements - Part I. PNL-3509, Part 1, Pacific Northwest Laboratory, Richland, Washington.
- Napier, B. A., R. A. Peloquin, W. E. Kennedy, Jr. and S. M. Neuder. 1984. Intruder Dose Pathway Analysis for the Onsite Disposal of Radioactive Wastes: The ONSITE/MAXII Computer Program. NUREG/CR-3620, National Technical Information Service, Springfield, Virginia.
- Ng, Y. C., et al. 1968. Prediction of the Maximum Dosage to Man from the Fallout of Nuclear Devices - IV, Handbook for Estimating the Maximum Internal Dose from Radionuclides Released to the Biosphere. Report UCRL-50163, prepared for the U.S. Atomic Energy Commission by Lawrence Livermore Laboratory, University of California, Livermore, California.
- Oak, H. D., G. M. Holter, W. E. Kennedy, Jr., and G. J. Konzek. 1980. Technology, Safety and Costs of Decommissioning a Reference Boiling-Water Reactor Power Station. NUREG/CR-0672, Vol. 1 and 3, prepared for the U.S. Nuclear Regulatory Commission by Pacific Northwest Laboratory, Richland, Washington.
- Radioactivity Advisory Committee (H. J. Dunster, Chairman). 1971. Handbook of Radiological Protection, Part I: Data. Department of Employment, Department of Health and Social Security, Ministry of Health and Social Services, Northern Ireland; Number SBN 11 360079 8; Her Majesty's Stationery Office, London, England.
- Sehmel, G. A. 1974. "Particle Resuspension from an Asphalt Road." In Atmospheric-Surface Exchange of Particulate and Gaseous Pollutants, pp. 862-880. CONF-740921, National Technical Information Service, Springfield, Virginia.
- Sehmel, G. A., and F. D. Lloyd. 1976. "Resuspension Rates from a Circular Field Source." In Pacific Northwest Annual Report for 1975 to the DOE Assistant Secretary for the Environment, Part 3, Atmospheric Sciences, pp. 96-98. BNWL-2000, Pacific Northwest Laboratory, Richland, Washington.
- Simmons, G. L., et al. 1967. ISOSHLI II Code Revision to Include Calculation of Dose Rate from Shielded Bremsstrahlung Sources. BNWL-236, Supplement 1, Pacific Northwest Laboratory, Richland, Washington.

- Soldat, J. K., and R. D. Harr. 1971. "Radiation Dose Model" in HERMES - A Digital Computer Code for Estimating Regional Radiological Effects from the Nuclear Power Industry (J. F. Fletcher and W. L. Dotson, compilers). Report HEDL-TME-71-68 prepared for the U.S. Atomic Energy Commission by Hanford Engineering Development Laboratory, Richland, Washington.
- Soldat, J. K., N. M. Robinson and D. A. Baker. 1974. Models and Computer Codes for Evaluating Environmental Radiation Doses. Report BNWL-1754 prepared for the U.S. Atomic Energy Commission by Pacific Northwest Laboratory, Richland, Washington.
- Thompson, S. E., C. A. Burton, D. J. Quinn and Y. C. Ng. 1972. Concentration Factors of Chemical Elements in Edible Aquatic Organisms. Report UCRL-50564 Rev. 1 prepared for the U.S. Atomic Energy Commission by University of California, Lawrence Livermore Laboratory, Livermore, California.
- U.S. Environmental Protection Agency (EPA). 1977. Proposed Guidance on Dose Limits for Persons Exposed to Transuranium Elements in the General Environment. EPA 520/4-77-016, U.S. Environmental Protection Agency, Washington, D.C.
- U.S. Nuclear Regulatory Commission (NRC). 1977. Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I. Regulatory Guide 1.109, Rev. 1, U.S. Nuclear Regulatory Commission, Washington, D.C.
- U.S. Nuclear Regulatory Commission (NRC). 1981. Draft Environmental Impact Statement on 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste." NUREG-0782, Vols. 1-4, U.S. Nuclear Regulatory Commission, Washington, D.C.
- U.S. Nuclear Regulatory Commission (NRC). 1982. Final Environmental Impact Statement on 10 CFR Part 61 "Licensing Requirements for Land Disposal of Radioactive Waste." NUREG-0945, U.S. Nuclear Regulatory Commission, Washington, D.C.

3.0 PROCEDURES

User instructions and technical details on use of the ONSITE/MAXI1 software package are presented in this section. Instructions are given for installation of the software package on the IBM PC/XT/AT^(a) and for user interaction with both of the computer programs. In this section, program commands shown in boldface upper case should be entered exactly as shown and boldface lower case commands are examples of user-specific input. Six sample problems are included with discussions of the hand calculations performed to verify the correct operation of the computer program. Explanations are given where results differ from those presented in earlier volumes of this series. Detailed information on input parameters is included for reference. Program-generated error messages and corresponding corrective actions for the ONSITE and MAXI1 computer programs are also provided.

Two levels of operation have been defined for the IBM PC/XT/AT version of ONSITE/MAXI1. As with the previous versions of ONSITE/MAXI1 (Napier et al. 1984; Kennedy et al. 1986), the first level of operation is intended for the user who interacts primarily with the ONSITE computer program to create an annotated input file for the MAXI1 computer program. ONSITE is an interactive program that instructs and guides the user in the creation of an environment or scenario. As a user becomes more familiar with the mathematical models and the software package, he or she may progress to the second level of operation. The second level of operation allows the user to edit the annotated input file for MAXI1 using a standard text editor and provides the commands to execute MAXI1.

Previous volumes in this series have focused on the first level of operation. This volume will focus on the second level of operation of the ONSITE/MAXI1 software package because this level is better suited for operations on an IBM PC/XT/AT.

The following conventions are used in this manual to distinguish exact user input from instructions and from computer program displays.

boldface	Boldface print designates information entered at the terminal by the user. NOTE: In the appendices, information entered by the user is underlined.
UPPER CASE LETTERS	When upper case letters in boldface type are encountered, the user should type in the boldface letters exactly as shown.
lower case letters	When lower case letters are encountered in boldface type, the user should substitute unique identifiers.

(a) IBM PC/XT/AT is a trademark of International Business Machines Corporation, Boca Raton, Florida.

3.1 USER INSTRUCTIONS

The ONSITE/MAXI1 software package may be installed on an IBM PC/XT/AT computer, or a compatible computer, with 512 kilobytes of random-access memory and 10 megabytes of online-storage (i.e., hard disk) operating under IBM Disk Operating System (DOS) Version 2.1 or greater (IBM 1983, 1985). The ONSITE/MAXI1 software package is distributed on a set of four IBM DOS-formatted dual-density floppy disks. This section contains instructions for installing the software on a hard disk, as well as instructions for both levels of operation of the ONSITE/MAXI1 software package.

3.1.1 Installing ONSITE/MAXI1 on a Hard Disk

For the ONSITE/MAXI1 software package to function properly, the following commands must be in the **CONFIG.SYS** file in the root directory of the disk drive which is used to boot the system:

```
FILES=20  
BUFFERS=24
```

Refer to the IBM DOS reference manual (IBM 1983, 1985) for details on installing these commands.

The following instructions are suggestions. Those familiar with the IBM disk operating system may define alternate configurations. However, the software was created to function within and has been tested under the following configuration. C: will be the assumed specification for the hard disk in the following instructions.

To install the ONSITE/MAXI1 software package, ensure that you are in the root directory of the hard disk and create two subdirectories with the following commands:

```
C:\  
MD \MAXI  
MD \MUSE
```

The subdirectory **MAXI1** will be the repository of the computer programs, data base and file buffers included in the ONSITE/MAXI1 software package. **MUSE** will be a storage area for user application input and report files.

Place the distribution disk labeled **ONSITE/MAXI1 Disk #1** into the disk drive specified as **A:** and type in the following commands:

```
C:\  
CD \MAXI  
COPY A:*.*
```

Place the distribution disk labeled **ONSITE/MAXI1 Disk #2** into disk drive A: and type in the following:

```
COPY A:*.*
```

Place the distribution disk labeled **ONSITE/MAXI1 Disk #3** into disk drive A: and type in the following:

```
COPY A:*.*
```

Place the distribution disk labeled **ONSITE/MAXI1 Disk #4** into disk drive A: and type:

```
COPY A: LV30.SVBQ.DAT  
CD \MUSE  
COPY A: SAMPLE *.*
```

3.1.2 Interaction with ONSITE: The First Level of Operation

To establish and execute a scenario in the first level of operation, the user need only type the following commands:

```
CD \MAXI  
ONSITE
```

ONSITE is an interactive program that first introduces itself and displays general instructions on use of the program. A menu describing the available scenarios is also displayed. The five scenarios are:

- (1) External Exposure Scenario (including Stored Waste Sub-Set)
- (2) External Exposure Plus Inhalation Scenario
- (3) Agricultural Scenarios
- (4) Irrigation/Drinking-Water Scenario
- (5) User-Defined Scenario

Additional information on use of ONSITE has been given extensive coverage in earlier volumes of this series (Napier et al. 1984; Kennedy et al. 1986) and is not included here.

ONSITE creates an input file for MAXI1 based on user response to questions and requests a unique filename to store the scenario parameters. For illustrative purposes, let us assume that the user wishes to store the scenario parameter values under the name "myjob." The user would enter:

```
myjob
```

when prompted by the ONSITE program. ONSITE would then create a file named "myjob.IN." Files are stored in the MUSE subdirectory unless a subdirectory path is included when the file name is entered. This MAXI1 input file that was created by ONSITE may be viewed or modified with a standard text editor.

Upon completion of the ONSITE program, the user may execute the MAXI1 program by entering the following command:

```
COPY \MUSE\myjob.IN MAXI.IN  
MAXI
```

where **myjob** is the user-supplied scenario name.

MAXI1 output reports are stored in a file buffer named **MAXI.OUT**. The contents of **MAXI.OUT** will be overwritten during the next execution of the MAXI1 program. Consequently, the user may wish to save the execution results under a unique name as follows:

```
COPY MAXI.OUT \MUSE\myjob.OUT
```

where **myjob** relates the scenario generated by ONSITE and the MAXI1 results. You may use IBM disk operating system commands to view or print the MAXI1 output file.

3.1.3 Interaction with the MAXI1 Input File: The Second Level of Operation

The ONSITE computer program creates an input file for the MAXI1 computer program based on user responses to questions. Let us assume that you as the user have created several scenarios with the help of ONSITE and that you now wish to modify a scenario. If you have reached the point where you ask, "But do I have to answer all those ONSITE questions again?"; you are ready for the second level of operation. In the second level of operation, the user may create and modify scenarios and environments by modifying MAXI1 input files with a standard text editor. When working with the text editor to change MAXI1 input files, always bear in mind the following:

- The editor must be a standard text editor, not a document processor.
- Always use the editor's "typeover" or "no insert" mode.
- When adding lines to the input file (for the inventory, terrestrial foods, and drinking water/aquatic foods data sets only), be careful that the specified number of entries in the data set equals the number of lines in that data set.

When ONSITE requested a filename for your selected scenario, the program generated a file named **filename.IN**, where "filename" indicates the eight-character unique name you supplied. Select a file associated with a scenario similar to the scenario you wish to create and copy the existing file providing a unique name for the new file as follows:

```
COPY oldfile.IN newfile.IN
```

and then edit the file **newfile.IN** with a standard text editor.

Turn to the sample problems in the next section of this volume for an example of the MAXI1 input file format. The MAXI1 input format has been standardized to simplify scenario and environment parameter changes. The file has been annotated to allow the user to make changes without referencing the manual and to acquaint the user with the program names associated with parameters.

The MAXI1 program uses a free format to read the majority of the input file; consequently, the user need not be concerned with column placement and decimal points. Only three sections of the input file vary from this pattern. These three sections contain the inventory data set, the terrestrial foods data set, and the drinking water/aquatic foods data set. In each of these sections, entries must appear in specified columns. To simplify input, column headings are provided; the user is responsible for ensuring that numeric entries are right-justified and character entries are left-justified in these columns. These three sections are also the only places where the input file varies in length. These three sections vary according to the number of entries in each corresponding data set. The value of the parameter on the line preceding each of these sections indicates the number of lines to be read by the MAXI1 program. For example, in the first sample problem under the data set "INVENTORY," the "Number of radionuclides in inventory" entry is set to one. Consequently, the MAXI1 program expects to read one line from the input file containing information for one radionuclide, in this case ⁶⁰Co.

After editing the file, copy your newly created input file into the MAXI1 input file buffer named MAXI.IN located in the MAXI subdirectory, and execute MAXI1 with the following commands:

```
CD \MAXI
COPY \MUSE\newfile.IN MAXI.IN
MAXI
COPY MAXI.OUT \MUSE\newfile.OUT
```

The last command copies your output from the MAXI1 output file buffer named MAXI.OUT to a name associated with your input file. You may then use IBM disk operating system commands to view or print your output file.

3.1.4 Batch Mode Processing of ONSITE/MAXI1

It may be convenient to process a series of MAXI1 executions in batch mode. Using IBM DOS commands, the batch commands for executing the sample problems are as follows:

```
REM MAXI1 Sample Problem Execution File
REM -----
REM
c:
CD \MAXI
COPY \MUSE\SAMPLE1.IN MAXI.IN
MAXI
COPY MAXI.OUT \MUSE\SAMPLE1.OUT
```

```

REM
COPY \MUSE\SAMPLE2.IN MAXI.IN
MAXI
COPY MAXI.OUT \MUSE\SAMPLE2.OUT
REM
COPY \MUSE\SAMPLE3.IN MAXI.IN
MAXI
COPY MAXI.OUT \MUSE\SAMPLE3.OUT
REM
COPY \MUSE\SAMPLE4.IN MAXI.IN
MAXI
COPY MAXI.OUT \MUSE\SAMPLE4.OUT
REM
COPY \MUSE\SAMPLE5.IN MAXI.IN
MAXI
COPY MAXI.OUT \MUSE\SAMPLE5.OUT
REM
COPY \MUSE\SAMPLE6.IN MAXI.IN
MAXI
COPY MAXI.OUT \MUSE\SAMPLE6.OUT
REM -----

```

The above command sequence is provided in the file **SAMPLE.BAT** on the distribution floppy disks.

3.2 SAMPLE PROBLEMS

Six sample problems are presented and discussed to assist the user in various types of executions. An attempt has been made to cover a typical range of scenarios for which the code package was intended. The complete set of input and output for each of the sample problems is listed. Input specific to the second level of operation is shown for each of the sample problems. Changes from the previous sample problem are ~~shaded~~ on each of the input files to assist the user in understanding the second level of operation of the ONSITE/MAXI1 software package. A complete discussion of input parameters used in these sample problems is presented in Section 3.3.

The results of the sample problems documented in Napier et al. (1984) and Kennedy et al. (1986) were verified by hand using the equations in Section 2. The sample problems presented in this section are the same as those presented in Napier et al. (1984) and Kennedy et al. (1986), with the exception that a breathing rate₃ of 270 cm³/sec (ICRP 1975) as opposed to the previous breathing rate of 230 cm³/sec, is assumed for consistency with ICRP Publication No. 30. The version of the ONSITE/MAXI1 software package presented in this document uses the same methodology (with the addition of ICRP Publication No. 30 methods) and data as earlier versions of the software package documented by Napier et al. (1984) and Kennedy et al. (1986) with the exception of the handling of inhalation translocation class (sometimes referred to as solubility class). The earlier versions of MAXI allowed assignment of different classes to each organ. For consistency with ICRP Publication No. 30 (ICRP 1979-1982), translocation

class was assumed to be the same across all organs for each radionuclide. In some cases, the assumed translocation classification was also changed. Results of the sample problems in this document are the same as those in Napier et al. (1984) and Kennedy et al. (1986) when inhalation doses are adjusted by the ratio of the prior to current breathing rates, 230/270.

3.2.1 Sample Problem One

The first sample problem demonstrates the external exposure scenario. For this sample problem, a licensee is assumed to dispose of 500 m³ of radioactive waste in a burial area on site. The waste is assumed to contain an average of 0.1 Ci/m³ of ⁶⁰Co buried to a depth of 0.5 m over a 1-ha site. The desired result from the sample problem is the dose to an intruder 10 years after the wastes are buried. The MAXII input file for Sample Problem One is shown in Figure 3.1.

The output resulting from this sample problem is shown in Figure 3.2. The calculated maximum annual total-body dose to the intruder resulting from the scenario in this sample problem is about 0.04 rem. The results of the radioactive decay, soil concentration, and total-body dose (for the external exposure pathway) calculations were verified by hand using the equations in Section 2.

MAXI Input File
SAMPLE1.IN / MAXI Sample Problem One

Filename/Title on next line:

```

DO YOU WISH TO CONSIDER:
1      External exposure and root penetration          IEXT
      for waste modeled as a slab (volume) source? (0-no 1-yes)
0      External exposure to surface contamination      ISUR
      modeled as a plane source? (0-no 1-yes)
0      Inhalation of resuspended material? (0-no 1-yes) INHA
0      Farm product ingestion? (0-no 1-yes)           IFOD
0      Aquatic foods ingestion? (0-no 1-yes)          IARG
0      Drinking water ingestion? (0-no 1-yes)          IWAT
0      Offsite atmospheric source? (0-no, 1-yes)       IAIR
0      ICRP-26/30 as well as ICRP-2 methodology? (0-no 1-yes) IEDE
0      Decay of air release source term? (0-no 1-yes) IDKAIR
0      Decay of water release source term? (0-no 1-yes) IDKWAT
0      Use the One-Year-of-Exposure Model? (0-no 1-yes) INTRUD

MONITORING AND OUTPUT OPTIONS
0      Level of detail in reports (0-least to 3)       IOUT
.F.    Monitor and print hand calculation report      DEBUG(4)

NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:
10     Scenario begins:                               IT1
59     Scenario ends:                                 IT2

INVENTORY:
4      Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci) INUT
1      Soil source units (0- m**2 1- m**3 2- kg)        M3M2
1      Number of radionuclides in inventory:           NIN

      Release      Irrigation      Drinking      Atmospheric      E
      Terms      Soil Source      /Aquatic      Water      Release      A
      -----      (per unit)      (per L)      (per L)      (per yr)      Q
      C060              0.10                      QI
                                      QJ
                                      QK

INVENTORY MODIFICATION FACTORS: (multipliers)
0.2    Surface inventory modification factor:          SRDIL
1.0    Irrigation/aquatic inventory modification factor: DILF
1.0    Size of site (fractional ha):                   FRSIZ
1.0    Fraction of total diet grown on site:           RPF2

EXTERNAL/INHALATION EXPOSURE:
2000.0 Hours of external exposure to contamination (h/yr): HREXT
0.0     Hours of inhalation of airborne contamination (h/yr): HRINH
PLANEA.DAT Ext. exp. dose rate factors (plane source) filename: PLANAM
BURHFA.DAT Ext. exp. dose rate factors (volume source) filename: VOLNAM
270.0     Breathing rate (cm**3/sec):                 BRATE

```

FIGURE 3.1. Sample Problem One Input

SELECT RESUSPENSION MODEL:

0	0-Anspaugh	1-Mass Loading	IRES
0.	Age of contamination (yr)	Soil density (g/m**3)	AGE/DEN
1.0	Top soil available (cm)	Mass loading factor (g/m**3)	XDPTIN/XMLF

SPECIAL PURPOSE PARAMETERS:

0	No. of years contamination blew onto the site prior to the beginning of the scenario:	IBLOW
0.0	Chi/q value at the site:	XQSITE
1	Use drinking water cleanup factors (0-no, 1-yes)	ICLNUP
1	Use Reg. Guide 1.109 H-3, C-14 plant/soil uptake factors	I1109

AGRICULTURAL PARAMETERS:

1.0	Fraction of roots in upper soil:	RF1
0.0	Fraction of roots in deeply buried waste:	RF2
0.0	Ratio of ext. contamination in surface/subsurface soil:	RPF1
6	Months per year irrigated:	IMO
150.0	Irrigation rate (L/m**2/mo):	RIRR
0	Years of irrigation w/ contaminated water prior to the beginning of the dose calculation period:	IRR
10	Number of food types: (1-15)	NFT

FOOD TYPE INDEX	FOOD TYPE	GROWING PERIOD (days)	YIELD (kg/m**3)	HOLDUP (days)	CONSUMP- TION (kg/yr)	TRANS- LOCATION FACTOR	KFDTYP --- GRWP YELD HLDUP CON TRANS
1	LEAFY VEG.	90.	1.5	1.0	9.5	1.0	HLDUP
2	O.A.G.VEG.	60.	.70	1.0	9.5	.10	CON
4	OT.RT.VEG.	90.	4.0	10.	76.	.10	TRANS
7	ORCH.FRUIT	90.	2.0	10.	42.	.10	
9	OT.GRAIN	90.	1.0	1.0	51.	.10	
10	EGGS	90.	.84	1.0	19.	.10	
11	MILK	30.	1.3	1.0	1.10E+02	1.0	
12	BEEF	90.	.84	15.	39.	.10	
13	PORK	90.	.84	15.	29.	.10	
14	POULTRY	90.	.84	1.0	8.5	.10	

DRINKING WATER/AQUATIC FOOD PARAMETERS:

2	Number of water/food types: (1-5)	NPT
---	-----------------------------------	-----

TYPE INDEX	FOOD TYPE	HOLDUP (days)	CONSUMPTION (kg/yr)	KPTHWY --- HLDUP2 USAG
1	FISH	1.0	6.9	
5	DRINK WATER	1.0	438.0	

FIGURE 3.1 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE1.IN / MAXI Sample Problem One

Executed on: 10/ 2/1986 at 14:56:11

Page 1

PATHWAYS/OPTIONS CONSIDERED:

External exposure/root penetration for waste modeled as slab (volume) source

TITLES OF LIBRARY FILES ACCESSED:

10: RMDLIB - Radionuclide Master Library (24-Sep-86 RAP)

27: OVERBURDEN: 0.5M, SOURCE: 1.0M (DEN: CONCRETE/1.8) MR/HR 8-Jul-86 RAP

NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:

Scenario begins: 10

Scenario ends: 59

INVENTORY:

Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci) 4

Soil source units: (0- m**2 1- m**3 2- kg) 1

Number of radionuclides in inventory: 1

Release Terms	Soil Source (per m**3)	Irrigation /Aquatic (per L)	Drinking Water (per L)	Atmospheric Release (per m3)
-----	-----	-----	-----	-----
C060	1.0E+11	.0E+00	.0E+00	.0E+00

INVENTORY MODIFICATION FACTORS: (multipliers)

Surface inventory dilution factor: .2

Irrigation/aquatic inventory modification factor: 1.

Size of site (fractional ha): 1.0E+00

FIGURE 3.2. Sample Problem One Output

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE1.IN / MAXI Sample Problem One

Executed on: 10/ 2/1986 at 14:56:11

Page 2

EXTERNAL/INHALATION EXPOSURE:

Hours of external exposure to contamination (h/yr): 2.0E+03

RESUSPENSION PARAMETERS:

Model used: Anspaugh
Average age of contamination on ground at Time Zero (yr): .0
Top soil available for resuspension (cm): 1.

Input prepared by: Karina L. Schmitt Date: Oct 2, '86
Input checked by: G. E. Kennedy, Jr. Date: 10/2/86

*****PLEASE NOTE ANY SPECIAL CONSIDERATIONS IN THIS SPACE*****
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *

CALCULATED VALUES:

Ingestion area correction factor: 1.0
External/inhalation area correction factor: 1.0
Inhalation exposure modification factor: .00
External exposure modification factor: .23

FIGURE 3.2 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE1.IN / MAXI Sample Problem One

Executed on: 10/ 2/1986 at 14:56:11

Page 3

SOIL, AIR, AND WATER CONCENTRATION SUMMARY FOR YEAR: 10

Radio-nuclide	Surface Soil pCi/m2	Deep Soil pCi/m3	Air pCi/m3	Irrigation pCi/L	Drink Water pCi/L
CO 60	.0E+00	5.4E+09	.0E+00	.0E+00	.0E+00

SOIL, AIR, AND WATER CONCENTRATION SUMMARY FOR YEAR: 59

Radio-nuclide	Surface Soil pCi/m2	Deep Soil pCi/m3	Air pCi/m3	Irrigation pCi/L	Drink Water pCi/L
CO 60	.0E+00	8.4E+06	.0E+00	.0E+00	.0E+00

FIGURE 3.2 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE1.IN / MAXI Sample Problem One

Executed on: 10/ 2/1986 at 14:56:11

Page 4

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 10 FOR TOTAL BODY-----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	4.0E-02	100	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
4.0E-02	.0E+00	0	.0E+00	0	4.0E-02	100	.0E+00	0	.0E+00	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 10 FOR BONE -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	4.0E-02	100	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
4.0E-02	.0E+00	0	.0E+00	0	4.0E-02	100	.0E+00	0	.0E+00	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 10 FOR LUNGS -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	4.0E-02	100	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
4.0E-02	.0E+00	0	.0E+00	0	4.0E-02	100	.0E+00	0	.0E+00	0

FIGURE 3.2 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE1.IN / MAXI Sample Problem One

Executed on: 10/ 2/1986 at 14:56:11

Page 5

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 10 FOR THYROID -----

RADIO- NUCLIDE	EXPOSURE PATHWAY							
	INGESTION REM	%	INHALATION REM	%	EXTERNAL REM	%	AQUATIC FOOD REM	DRINK WATER REM
C060	.0E+00	0	.0E+00	0	4.0E-02	100	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD	DRINK WATER
4.0E-02	.0E+00	0	.0E+00	0	4.0E-02	100	.0E+00	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 10 FOR LLI -----

RADIO- NUCLIDE	EXPOSURE PATHWAY							
	INGESTION REM	%	INHALATION REM	%	EXTERNAL REM	%	AQUATIC FOOD REM	DRINK WATER REM
C060	.0E+00	0	.0E+00	0	4.0E-02	100	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD	DRINK WATER
4.0E-02	.0E+00	0	.0E+00	0	4.0E-02	100	.0E+00	0

FIGURE 3.2 (Contd)

3.2.2 Sample Problem Two

The second sample problem demonstrates the external exposure plus inhalation scenario. For this sample problem, a licensee is assumed to dispose of 500 m³ of waste onsite containing 0.1 Ci/m³ of ⁶⁰Co and 0.01 Ci/m³ of ⁹⁰Sr. The wastes are buried near the soil surface with no soil overburden. The wastes are assumed to contaminate a 1-ha site. Default conditions for resuspension are assumed except that the intruder is assumed to be exposed for 3000 h/yr instead of 2000 h/yr. The desired result from Sample Problem Two is the dose to the intruder 10 years after the wastes are buried. The MAXI1 input file for Sample Problem Two is shown in Figure 3.3. Changes from the previous sample problem are shaded on the Sample Problem Two input file to assist the user in understanding the second level of operation of the ONSITE/MAXI1 software package.

The output resulting for this sample is shown in Figure 3.4. The maximum annual doses from the scenario in this sample problem are about 16 rem to total body, 24 rem to bone, 31 rem to lung, 16 rem to thyroid, and 17 rem to GI(LLI). The results of the radioactive decay, soil and air concentration, and organ dose (for the external exposure and inhalation pathways) calculations were verified by hand using the equations in Section 2.

MAXI Input File:
SAMPLE2.IN / MAXI Sample Problem Two

Filename/Title on next line:

```

DO YOU WISH TO CONSIDER:
1      External exposure and root penetration           IEXT
      for waste modeled as a slab (volume) source? (0-no 1-yes)
0      External exposure to surface contamination       ISUR
      modeled as a plane source? (0-no 1-yes)
1      Inhalation of resuspended material? (0-no 1-yes) INHA
0      Farm product ingestion? (0-no 1-yes)            IFOD
0      Aquatic foods ingestion? (0-no 1-yes)           IARG
0      Drinking water ingestion? (0-no 1-yes)          IWAT
0      Offsite atmospheric source? (0-no 1-yes)        IAIR
0      ICRP-26/30 as well as ICRP-2 methodology? (0-no 1-yes) IEDE
0      Decay of air release source term? (0-no 1-yes)  IDKAIR
0      Decay of water release source term? (0-no 1-yes) IDKWAT
0      Use the One-Year-of-Exposure Model? (0-no 1-yes) INTRUD

MONITORING AND OUTPUT OPTIONS
0      Level of detail in reports (0-least to 3)        IOUT
.F.    Monitor and print hand calculation report        DEBUG(4)

NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:
10     Scenario begins:                                IT1
59     Scenario ends:                                  IT2

INVENTORY:
4      Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci) INUT
1      Soil source units (0- m**2 1- m**3 2- kg)         M3M2
2      Number of radionuclides in inventory:            NIN

      Release      Irrigation      Drinking      Atmospheric      E
      Terms      Soil Source      /Aquatic      Water      Release      A
              (per unit)      (per L)      (per L)      (per yr)      Q
      -----
      CO60              0.10
      SR90              0.01
                                   QJ
                                   QK

INVENTORY MODIFICATION FACTORS: (multipliers)
0.2    Surface inventory modification factor:          SRDIL
1.0    Irrigation/aquatic inventory modification factor: DILF
1.0    Size of site (fractional ha):                  FRSIZ
1.0    Fraction of total diet grown on site:          RPF2

EXTERNAL/INHALATION EXPOSURE:
3000.0 Hours of external exposure to contamination (h/yr): HREXT
3000.0 Hours of inhalation of airborne contamination (h/yr): HRINH
PLANEA.DAT Ext. exp. dose rate factors (plane source) filename: PLANAM
VOLSA.DAT Ext. exp. dose rate factors (volume source) filename: VOLNAM
270.0 Breathing rate (cm**3/sec): BRATE

```

FIGURE 3.3. Sample Problem Two Input

SELECT RESUSPENSION MODEL:

0	0-Anspaugh	1-Mass Loading	IRES
0.	Age of contamination (yr)	Soil density (g/m**3)	AGE/DEN
1.0	Top soil available (cm)	Mass loading factor (g/m**3)	XDPTIN/XMLF

SPECIAL PURPOSE PARAMETERS:

0	No. of years contamination blew onto the site prior to the beginning of the scenario:	IBLOW
0.0	Chi/q value at the site:	XQSITE
1	Use drinking water cleanup factors (0-no, 1-yes)	ICLNUP
1	Use Reg. Guide 1.109 H-3, C-14 plant/soil uptake factors	I1109

AGRICULTURAL PARAMETERS:

1.0	Fraction of roots in upper soil:	RF1
0.0	Fraction of roots in deeply buried waste:	RF2
1.0	Ratio of ext. contamination in surface/subsurface soil:	RPF1
6	Months per year irrigated:	IMO
150.0	Irrigation rate (L/m**2/mo):	RIRR
0	Years of irrigation w/ contaminated water prior to the beginning of the dose calculation period:	IRR
10	Number of food types: (1-15)	NFT

FOOD TYPE INDEX	FOOD TYPE	GROWING PERIOD (days)	YIELD (kg/m**3)	HOLDUP (days)	CONSUMP- TION (kg/yr)	TRANS- LOCATION FACTOR	KFDTYP --- GRWP YELD HLDUP CON TRANS
1	LEAFY VEG.	90.	1.5	1.0	9.5	1.0	
2	O.A.G.VEG.	60.	.70	1.0	9.5	.10	
4	OT.RT.VEG.	90.	4.0	10.	76.	.10	
7	ORCH.FRUIT	90.	2.0	10.	42.	.10	
9	OT.GRAIN	90.	1.0	1.0	51.	.10	
10	EGGS	90.	.84	1.0	19.	.10	
11	MILK	30.	1.3	1.0	1.10E+02	1.0	
12	BEEF	90.	.84	15.	39.	.10	
13	PORK	90.	.84	15.	29.	.10	
14	POULTRY	90.	.84	1.0	8.5	.10	

DRINKING WATER/AQUATIC FOOD PARAMETERS:

2	Number of water/food types: (1-5)	NPT
---	-----------------------------------	-----

TYPE INDEX	FOOD TYPE	HOLDUP (days)	CONSUMPTION (kg/yr)	KPTHWY --- HLDUP2 USAG
1	FISH	1.0	6.9	
5	DRINK WATER	1.0	438.0	

FIGURE 3.3 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE2.IN / MAXI Sample Problem Two

Executed on: 10/ 2/1986 at 14:56:41

Page 1

PATHWAYS/OPTIONS CONSIDERED:

External exposure/root penetration for waste modeled as slab (volume) source
Inhalation of resuspended material

TITLES OF LIBRARY FILES ACCESSED:

10: RMDLIB - Radionuclide Master Library (24-Sep-86 RAP)
23: DACRIN (DIFDOS) DOSE INCREMENT FILE ONSITE/MAXI 26-Aug-86 RAP
27: OVERBURDEN: 0.0M, SOURCE: 1.0 M (DEN: CONCRETE/1.8): MR/HR 8-Jul-86 RAP

NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:

Scenario begins: 10
Scenario ends: 59

INVENTORY:

Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci) 4
Soil source units: (0- m**2 1- m**3 2- kg) 1
Number of radionuclides in inventory: 2

Release Terms	Soil Source (per m**3)	Irrigation /Aquatic (per L)	Drinking Water (per L)	Atmospheric Release (per m3)
-----	-----	-----	-----	-----
CO60	1.0E+11	.0E+00	.0E+00	.0E+00
SR90	1.0E+10	.0E+00	.0E+00	.0E+00
Y 90	.0E+00	.0E+00	.0E+00	.0E+00

INVENTORY MODIFICATION FACTORS: (multipliers)

Surface inventory dilution factor: .2
Irrigation/aquatic inventory modification factor: 1.
Size of site (fractional ha): 1.0E+00

FIGURE 3.4. Sample Problem Two Output

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE2.IN / MAXI Sample Problem Two

Executed on: 10/ 2/1986 at 14:56:41

Page 2

EXTERNAL/INHALATION EXPOSURE:

Hours of external exposure to contamination (h/yr): 3.0E+03
Hours of inhalation of airborne contamination (h/yr): 3.0E+03

RESUSPENSION PARAMETERS:

Model used: Anspaugh
Average age of contamination on ground at Time Zero(yr): .0
Top soil available for resuspension (cm): 1.

Input prepared by: Robert A. Schaefer Date: Oct 2, '86
Input checked by: W. E. Kennedy, Jr. Date: 10/2/86

*****PLEASE NOTE ANY SPECIAL CONSIDERATIONS IN THIS SPACE*****
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *

CALCULATED VALUES:

Ingestion area correction factor: 1.0
External/inhalation area correction factor: 1.0
Inhalation exposure modification factor: .34
External exposure modification factor: .34

FIGURE 3.4 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE2.IN / MAXI Sample Problem Two

Executed on: 10/ 2/1986 at 14:56:41

Page 3

SOIL, AIR, AND WATER CONCENTRATION SUMMARY FOR YEAR: 10

Radio-nuclide	Surface Soil pCi/m2	Deep Soil pCi/m3	Air pCi/m3	Irrigation pCi/L	Drink Water pCi/L
CO 60	8.0E+08	5.4E+09	5.4E+03	.0E+00	.0E+00
SR 90	2.4E+08	1.6E+09	1.6E+03	.0E+00	.0E+00
Y 90	2.4E+08	1.6E+09	1.6E+03	.0E+00	.0E+00

SOIL, AIR, AND WATER CONCENTRATION SUMMARY FOR YEAR: 59

Radio-nuclide	Surface Soil pCi/m2	Deep Soil pCi/m3	Air pCi/m3	Irrigation pCi/L	Drink Water pCi/L
CO 60	1.3E+06	8.4E+06	8.4E-05	.0E+00	.0E+00
SR 90	7.1E+07	4.8E+08	4.8E-03	.0E+00	.0E+00
Y 90	7.1E+07	4.8E+08	4.8E-03	.0E+00	.0E+00

FIGURE 3.4 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE2.IN / MAXI Sample Problem Two

Executed on: 10/ 2/1986 at 14:56:41

Page 4

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 10 FOR TOTAL BODY-----

RADIO- NUCLIDE	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	3.4E-02	9	1.6E+01	99	.0E+00	0	.0E+00	0
SR90	.0E+00	0	3.4E-01	90	1.4E-04	0	.0E+00	0	.0E+00	0
Y 90	.0E+00	0	4.3E-05	0	9.9E-03	0	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
1.6E+01	.0E+00	0	3.7E-01	2	1.6E+01	97	.0E+00	0	.0E+00	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 11 FOR BONE -----

RADIO- NUCLIDE	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	1.4E+01	99	.0E+00	0	.0E+00	0
SR90	.0E+00	0	9.7E+00	99	1.4E-04	0	.0E+00	0	.0E+00	0
Y 90	.0E+00	0	1.1E-04	0	9.6E-03	0	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
2.4E+01	.0E+00	0	9.7E+00	40	1.4E+01	59	.0E+00	0	.0E+00	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 11 FOR LUNGS -----

RADIO- NUCLIDE	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	1.7E+01	99	1.4E+01	99	.0E+00	0	.0E+00	0
SR90	.0E+00	0	3.0E-03	0	1.4E-04	0	.0E+00	0	.0E+00	0
Y 90	.0E+00	0	8.5E-03	0	9.6E-03	0	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
3.1E+01	.0E+00	0	1.7E+01	54	1.4E+01	45	.0E+00	0	.0E+00	0

FIGURE 3.4 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE2.IN / MAXI Sample Problem Two

Executed on: 10/ 2/1986 at 14:56:41

Page 5

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 10 FOR THYROID -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	1.6E+01	99	.0E+00	0	.0E+00	0
SR90	.0E+00	0	.0E+00	0	1.4E-04	0	.0E+00	0	.0E+00	0
Y 90	.0E+00	0	.0E+00	0	9.9E-03	0	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
1.6E+01	.0E+00	0	.0E+00	0	1.6E+01	100	.0E+00	0	.0E+00	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 10 FOR LLI -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	3.2E-01	56	1.6E+01	99	.0E+00	0	.0E+00	0
SR90	.0E+00	0	5.2E-02	9	1.4E-04	0	.0E+00	0	.0E+00	0
Y 90	.0E+00	0	2.0E-01	34	9.9E-03	0	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
1.7E+01	.0E+00	0	5.7E-01	3	1.6E+01	96	.0E+00	0	.0E+00	0

FIGURE 3.4 (Contd)

3.2.3 Sample Problem Three

The third sample demonstrates the agricultural exposure scenario. For this problem, a licensee is assumed to dispose of 50 m³ of waste containing 0.1 Ci/m³ of each of ⁶⁰Co and ¹³⁷Cs, and 0.01 Ci/m³ of ⁹⁰Sr. Default conditions are assumed except that only 0.05 ha is assumed to be contaminated by the disposal of wastes. The desired result from Sample Problem Three is the dose to the intruder 10 years after the wastes are buried. This sample problem has been expanded in this version of the ONSITE/MAXI1 software package. Both the maximum annual dose (ICRP 1959) and the annual effective dose equivalent, AEDE, (ICRP 1977; ICRP 1979-1982) are to be calculated. The MAXI1 input file for Sample Problem Three is shown in Figure 3.5. Changes from the previous sample problem are shaded on the Sample Problem Three input file to assist the user in understanding the second level of software operation.

The output resulting for this sample problem is shown in Figure 3.6. The calculated maximum annual doses from the scenario in this sample problem are about 22 rem to total body, 56 rem to bone, 18 rem to lungs, 13 rem to thyroid, and 17 rem to GI(LLI). Doses to total body, and bone are controlled by ingestion of farm crops, while the doses to lungs, thyroid, and GI(LLI) are controlled by external exposure. The annual external dose was 13 rem, and the internal effective dose equivalent was 16 rem. Thus, the annual effective dose equivalent was 29 rem. Results of the following calculations were verified by hand using the equations in Section 2: radioactive decay; soil and air concentration; external dose, inhalation dose, and ingestion dose from consumption of leafy vegetables for both the maximum annual and annual effective dose equivalent.

MAXI Input File
SAMPLE3.IN / MAXI Sample Problem Three

Filename/Title on next line:

```

DO YOU WISH TO CONSIDER:
0      External exposure and root penetration                IEXT
      for waste modeled as a slab (volume) source? (0-no 1-yes)
1      External exposure to surface contamination            ISUR
      modeled as a plane source? (0-no 1-yes)
1      Inhalation of resuspended material? (0-no 1-yes)      INHA
1      Farm product ingestion? (0-no 1-yes)                  IFOD
0      Aquatic foods ingestion? (0-no 1-yes)                 IARG
0      Drinking water ingestion? (0-no 1-yes)                IWAT
0      Offsite atmospheric source? (0-no 1-yes)              IAIR
1      ICRP-26/30 as well as ICRP-2 methodology? (0-no 1-yes) IEDE
0      Decay of air release source term? (0-no 1-yes)        IDKAIR
0      Decay of water release source term? (0-no 1-yes)       IDKWAT
0      Use the One-Year-of-Exposure Model? (0-no 1-yes)       INTRUD

MONITORING AND OUTPUT OPTIONS
2      Level of detail in reports (0-least to 3)              IOUT
.F.    Monitor and print hand calculation report              DEBUG(4)

NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:
10     Scenario begins:                                       IT1
59     Scenario ends:                                         IT2

INVENTORY:
4      Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci)     INUT
1      Soil source units (0- m**2 1- m**3 2- kg)               M3M2
3      Number of radionuclides in inventory:                   NIN

      Release      Soil Source      Irrigation      Drinking      Atmospheric      E
      Terms        (per unit)      /Aquatic      Water          Release          A
      -----      -
      CO60          0.10
      SR90          0.01
      CS137         0.10
      -----      -
      QI
      QJ
      QK

INVENTORY MODIFICATION FACTORS: (multipliers)
0.2    Surface inventory modification factor:                 SRDIL
1.0    Irrigation/aquatic inventory modification factor:       DILF
0.05   Size of site (fractional ha):                           FRSIZ
1.0    Fraction of total diet grown on site:                   RPF2

EXTERNAL/INHALATION EXPOSURE:
2000.0 Hours of external exposure to contamination (h/yr):     HREXT
2000.0 Hours of inhalation of airborne contamination (h/yr):    HRINH
PLANEA.DAT Ext. exp. dose rate factors (plane source) filename:  PLANAM
BURHFA.DAT Ext. exp. dose rate factors (volume source) filename: VOLNAM
270.0      Breathing rate (cm**3/sec):                          BRATE

```

FIGURE 3.5. Sample Problem Three Input

SELECT RESUSPENSION MODEL:

0 0-Anspaugh 1-Mass Loading IRES

0. Age of contamination (yr) Soil density (g/m**3) AGE/DEN

1.0 Top soil available (cm) Mass loading factor (g/m**3) XDPTIN/XMLF

SPECIAL PURPOSE PARAMETERS:

0 No. of years contamination blew onto the site prior to the beginning of the scenario: IBLow

0.0 Chi/q value at the site: XQSITE

1 Use drinking water cleanup factors (0-no, 1-yes) ICLNUP

1 Use Reg. Guide 1.109 H-3, C-14 plant/soil uptake factors I1109

AGRICULTURAL PARAMETERS:

1.0 Fraction of roots in upper soil: RF1

0.0 Fraction of roots in deeply buried waste: RF2

1.0 Ratio of ext. contamination in surface/subsurface soil: RPF1

6 Months per year irrigated: IMO

150.0 Irrigation rate (L/m**2/mo): RIRR

0 Years of irrigation w/ contaminated water prior to the beginning of the dose calculation period: IRR

10 Number of food types: (1-15) NFT

FOOD TYPE INDEX	FOOD TYPE	GROWING PERIOD (days)	YIELD (kg/m**3)	HOLDUP (days)	CONSUMPTION (kg/yr)	TRANS-LOCATION FACTOR	KFDTYP --- GRWP YELD HLDUP CON TRANS
1	LEAFY VEG.	90.	1.5	1.0	9.5	1.0	HLDUP
2	O.A.G.VEG.	60.	.70	1.0	9.5	.10	CON
4	OT.RT.VEG.	90.	4.0	10.	76.	.10	TRANS
7	ORCH.FRUIT	90.	2.0	10.	42.	.10	
9	OT.GRAIN	90.	1.0	1.0	51.	.10	
10	EGGS	90.	.84	1.0	19.	.10	
11	MILK	30.	1.3	1.0	1.10E+02	1.0	
12	BEEF	90.	.84	15.	39.	.10	
13	PORK	90.	.84	15.	29.	.10	
14	POULTRY	90.	.84	1.0	8.5	.10	

DRINKING WATER/AQUATIC FOOD PARAMETERS:

2 Number of water/food types: (1-5) NPT

TYPE INDEX	FOOD TYPE	HOLDUP (days)	CONSUMPTION (kg/yr)	KPTHWY --- HLDUP2 USAG
1	FISH	1.0	6.9	
5	DRINK WATER	1.0	438.0	

FIGURE 3.5 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-B6)

Case title: SAMPLE3.IN / MAXI Sample Problem Three

Executed on: 10/28/1986 at 16:33:46

Page 1

PATHWAYS/OPTIONS CONSIDERED:

External exposure to surface contamination modeled as a plane source
Inhalation of resuspended material
Farm product ingestion
Committed effective dose equivalent (CEDE) calculation

TITLES OF LIBRARY FILES ACCESSED:

10: RMDLIB - Radionuclide Master Library (24-Sep-86 RAP)
11: ORGAN DATA LIBRARY UPDATED BY RA PELOQUIN 8-Jul-86
12: FOOD TRANSFER COEFFICIENT LIBRARY (RAP/WTF 04-APR-86 C1 Update)
13: Committed Dose Equivalents (Sv/Bq) ICRP Publication 30 (28-Oct-86 RAP)
22: OVERBURDEN: 0.0M, SOURCE: 0.15 M (DEN: CONCRETE/1.8): MR/HR 8-Jul-86 RAP
23: DACRIN (DIFDOS) DOSE INCREMENT FILE ONSITE/MAXI 26-Aug-86 RAP

NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:

Scenario begins: 10
Scenario ends: 59

INVENTORY:

Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci) 4
Soil source units: (0- m**2 1- m**3 2- kg) 1
Number of radionuclides in inventory: 3

Release Terms	Soil Source (per m**3)	Irrigation /Aquatic (per L)	Drinking Water (per L)	Atmospheric Release (per m3)
C060	1.0E+11	.0E+00	.0E+00	.0E+00
SR90	1.0E+10	.0E+00	.0E+00	.0E+00
Y 90	.0E+00	.0E+00	.0E+00	.0E+00
CS137	1.0E+11	.0E+00	.0E+00	.0E+00
BA137M	.0E+00	.0E+00	.0E+00	.0E+00

INVENTORY MODIFICATION FACTORS: (multipliers)

Surface inventory dilution factor: .2
Irrigation/aquatic inventory modification factor: 1.
Size of site (fractional ha): 5.0E-02
Fraction of total diet grown on site: 1.

FIGURE 3.6. Sample Problem Three Output

 ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
 (MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE3.IN / MAXI Sample Problem Three

Executed on: 10/28/1986 at 16:33:46

Page 2

EXTERNAL/INHALATION EXPOSURE:

Hours of external exposure to contamination (h/yr): 2.0E+03
 Hours of inhalation of airborne contamination (h/yr): 2.0E+03
 Breathing rate (cm**3/sec): 2.7E+02

RESUSPENSION PARAMETERS:

Model used: Anspaugh
 Average age of contamination on ground at Time Zero(yr): .0
 Top soil available for resuspension (cm): 1.

AGRICULTURAL PARAMETERS:

Fraction of roots in upper soil: 1.00
 Fraction of roots in deeply buried waste: .000
 Ratio of ext. contamination in surface/subsurface soil: 1.00
 Months per year irrigated: 6
 Irrigation rate (L/m**2/mo): 1.5E+02
 Years of irrigation w/ contaminated water prior to the
 beginning of the dose calculation period: 0
 Number of food types: 10

FOOD TYPE INDEX	FOOD TYPE	GROWING PERIOD (days)	YIELD (kg/m**3)	HOLDUP (days)	CONSUMP- TION (kg/yr)	TRANS- LOCATION FACTOR
1	LEAFY VEG.	90.	1.50	1.	9.5	1.00
2	O.A.G.VEG.	60.	.70	1.	9.5	.10
4	OT.RT.VEG.	90.	4.00	10.	76.0	.10
7	ORCH.FRUIT	90.	2.00	10.	42.0	.10
9	OT.GRAIN	90.	1.00	1.	51.0	.10
10	EGGS	90.	.84	1.	19.0	.10
11	MILK	30.	1.30	1.	110.0	1.00
12	BEEF	90.	.84	15.	39.0	.10
13	PORK	90.	.84	15.	29.0	.10
14	POULTRY	90.	.84	1.	8.5	.10

FIGURE 3.6 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE3.IN / MAXI Sample Problem Three

Executed on: 10/28/1986 at 16:33:46

Page 3

Input prepared by: *John A. Delozani* Date: 5-Nov-86
Input checked by: *John A. Delozani* Date: 5-NOV-86

*****PLEASE NOTE ANY SPECIAL CONSIDERATIONS IN THIS SPACE*****
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *
* * * * *

CALCULATED VALUES:

Ingestion area correction factor:	.50
External/inhalation area correction factor:	.81
Inhalation exposure modification factor:	.23
External exposure modification factor:	.23

FIGURE 3.6 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE3.IN / MAXI Sample Problem Three

Executed on: 10/28/1986 at 16:33:46

Page 4

SOIL, AIR, AND WATER CONCENTRATION SUMMARY FOR YEAR: 10

Radio-nuclide	Surface Soil pCi/m2	Deep Soil pCi/m3	Air pCi/m3	Irrigation pCi/L	Drink Water pCi/L
CO 60	8.0E+08	.0E+00	5.4E+03	.0E+00	.0E+00
SR 90	2.4E+08	.0E+00	1.6E+03	.0E+00	.0E+00
Y 90	2.4E+08	.0E+00	1.6E+03	.0E+00	.0E+00
CS 137	2.4E+09	.0E+00	1.6E+04	.0E+00	.0E+00
BA 137M	2.3E+09	.0E+00	1.5E+04	.0E+00	.0E+00

SOIL, AIR, AND WATER CONCENTRATION SUMMARY FOR YEAR: 59

Radio-nuclide	Surface Soil pCi/m2	Deep Soil pCi/m3	Air pCi/m3	Irrigation pCi/L	Drink Water pCi/L
CO 60	1.3E+06	.0E+00	8.4E-05	.0E+00	.0E+00
SR 90	7.1E+07	.0E+00	4.8E-03	.0E+00	.0E+00
Y 90	7.1E+07	.0E+00	4.8E-03	.0E+00	.0E+00
CS 137	7.7E+08	.0E+00	5.1E-02	.0E+00	.0E+00
BA 137M	7.3E+08	.0E+00	4.9E-02	.0E+00	.0E+00

FIGURE 3.6 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE3.IN / MAXI Sample Problem Three

Executed on: 10/28/1986 at 16:33:46

Page 5

Annual Effective Dose Equivalent (AEDE): 2.9E+01

Maximum Annual Dose (ICRP-2):

To Organ:	TOTAL BODY	at Year	10	2.2E+01
To Organ:	BONE	at Year	27	5.6E+01
To Organ:	LUNGS	at Year	11	1.8E+01
To Organ:	THYROID	at Year	10	1.3E+01
To Organ:	LLI	at Year	10	1.7E+01

FIGURE 3.6 (Contd)

 ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
 (MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE3.IN / MAXI Sample Problem Three

Executed on: 10/28/1986 at 16:33:46

Page 6

DOSES FROM 1 YEAR OF EXPOSURE

Organ	Committed Dose Equivalent	Weighing Factors	Weighted Dose Equivalent
Gonads	1.0E+01	2.5E-01	2.5E+00
Breast	8.4E+00	1.5E-01	1.3E+00
R Marrow	3.2E+01	1.2E-01	3.9E+00
Lungs	2.0E+01	1.2E-01	2.4E+00
Thyroid	8.9E+00	3.0E-02	2.7E-01
Bone Surf	6.0E+01	3.0E-02	1.8E+00
Remainder 3	3.2E+01	6.0E-02	1.9E+00
LLI Wall	1.1E+01	6.0E-02	6.5E-01
ULI Wall	1.0E+01	6.0E-02	6.2E-01
SI Wall	1.0E+01	6.0E-02	6.0E-01
Remainder 1	9.7E+00	6.0E-02	5.8E-01
Effective Dose Equivalent			1.6E+01
External Dose			1.3E+01
Annual Effective Dose Equivalent			2.9E+01

FIGURE 3.6 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE3.IN / MAXI Sample Problem Three

Executed on: 10/28/1986 at 16:33:46

Page 7

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 10 FOR TOTAL BODY-----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
CO60	1.1E-01	1	1.1E-02	2	7.4E+00	58	.0E+00	0	.0E+00	0
SR90	1.3E+00	14	1.1E-01	26	7.6E-05	0	.0E+00	0	.0E+00	0
Y 90	1.6E-07	0	1.4E-05	0	4.8E-03	0	.0E+00	0	.0E+00	0
CS137	7.3E+00	84	2.9E-01	70	1.0E-03	0	.0E+00	0	.0E+00	0
BA137M	.0E+00	0	4.0E-07	0	5.3E+00	41	.0E+00	0	.0E+00	0
TOTAL	8.7E+00	39	4.2E-01	1	1.3E+01	58	.0E+00	0	.0E+00	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 27 FOR BONE -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
CO60	.0E+00	0	.0E+00	0	7.9E-01	17	.0E+00	0	.0E+00	0
SR90	5.0E+01	99	8.5E-01	99	5.0E-05	0	.0E+00	0	.0E+00	0
Y 90	5.3E-07	0	6.1E-09	0	3.2E-03	0	.0E+00	0	.0E+00	0
CS137	1.9E-01	0	1.0E-05	0	7.1E-04	0	.0E+00	0	.0E+00	0
BA137M	.0E+00	0	3.5E-11	0	3.6E+00	81	.0E+00	0	.0E+00	0
TOTAL	5.1E+01	90	8.5E-01	1	4.4E+00	7	.0E+00	0	.0E+00	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 11 FOR LUNGS -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
CO60	.0E+00	0	5.6E+00	99	6.5E+00	55	.0E+00	0	.0E+00	0
SR90	.0E+00	0	9.8E-04	0	7.4E-05	0	.0E+00	0	.0E+00	0
Y 90	.0E+00	0	2.8E-03	0	4.7E-03	0	.0E+00	0	.0E+00	0
CS137	9.1E-01	100	5.2E-02	0	1.0E-03	0	.0E+00	0	.0E+00	0
BA137M	.0E+00	0	5.5E-06	0	5.2E+00	44	.0E+00	0	.0E+00	0
TOTAL	9.1E-01	5	5.6E+00	30	1.2E+01	64	.0E+00	0	.0E+00	0

FIGURE 3.6 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE3.IN / MAXI Sample Problem Three

Executed on: 10/28/1986 at 16:33:46

Page 8

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 10 FOR THYROID -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	7.4E+00	58	.0E+00	0	.0E+00	0
SR90	.0E+00	0	.0E+00	0	7.6E-05	0	.0E+00	0	.0E+00	0
Y 90	.0E+00	0	.0E+00	0	4.8E-03	0	.0E+00	0	.0E+00	0
CS137	.0E+00	0	.0E+00	0	1.0E-03	0	.0E+00	0	.0E+00	0
BA137M	.0E+00	0	.0E+00	0	5.3E+00	41	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
1.3E+01	.0E+00	0	.0E+00	0	1.3E+01	100	.0E+00	0	.0E+00	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 10 FOR LLI -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	1.1E+00	29	1.1E-01	55	7.4E+00	58	.0E+00	0	.0E+00	0
SR90	2.2E+00	58	1.7E-02	8	7.6E-05	0	.0E+00	0	.0E+00	0
Y 90	7.3E-02	1	6.5E-02	33	4.8E-03	0	.0E+00	0	.0E+00	0
CS137	4.0E-01	10	5.5E-03	2	1.0E-03	0	.0E+00	0	.0E+00	0
BA137M	.0E+00	0	.0E+00	0	5.3E+00	41	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
1.7E+01	3.8E+00	22	2.0E-01	1	1.3E+01	76	.0E+00	0	.0E+00	0

FIGURE 3.6 (Contd)

3.2.4 Sample Problem Four

The fourth sample problem demonstrates the irrigation/drinking-water scenario. For this problem, a licensee is assumed to dispose of wastes that result in ^{60}Co , ^{129}I , ^{90}Sr , and ^{238}U in an offsite well. The water concentrations are 10 pCi/L of each radionuclide. In addition, an offsite river-water concentration of 0.1 pCi/L of each of these radionuclides is assumed. The individual is assumed to use the well water for drinking and the river water for irrigation. The purpose of this sample problem is to determine the doses to this individual from using these contaminated water sources. This sample problem has been expanded in this version of the ONSITE/MAXII software package. Both the maximum annual dose (ICRP 1959) and the annual effective dose equivalent, AEDE, (ICRP 1977; ICRP 1979-1982) are to be calculated. The MAXII input file for Sample Problem Four is shown in Figure 3.7. Changes from the previous sample problem are shaded on the Sample Problem Four input file to assist the user in understanding the second level of software operation.

The output resulting for this sample problem is shown in Figure 3.8. The calculated maximum annual doses for the scenario in Sample Problem Four are about 0.0016 rem to total body, 0.0077 rem to bone 8.0×10^{-6} rem to lungs, 0.028 rem to thyroid, and 3.5×10^{-4} rem to GI(LLI). The annual external dose was 5.7×10^{-6} rem, and the internal effective dose equivalent was 1.2×10^{-3} rem. Thus, the annual effective dose equivalent was 1.3×10^{-3} rem. Results of the radionuclide decay, soil and air concentration, and maximum annual dose estimate calculations were verified by hand using the equations in Section 2.

MAXI Input File
SAMPLE4.IN / MAXI Sample Problem Four

Filename/Title on next line:

```

DO YOU WISH TO CONSIDER:
0      External exposure and root penetration          IEXT
      for waste modeled as a slab (volume) source? (0-no 1-yes)
1      External exposure to surface contamination      ISUR
      modeled as a plane source? (0-no 1-yes)
1      Inhalation of resuspended material? (0-no 1-yes) INHA
1      Farm product ingestion? (0-no 1-yes)           IFOD
0      Aquatic foods ingestion? (0-no 1-yes)          IARG
1      Drinking water ingestion? (0-no 1-yes)          IWAT
0      Offsite atmospheric source? (0-no 1-yes)        IAIR
1      ICRP-26/30 as well as ICRP-2 methodology? (0-no 1-yes) IEDE
0      Decay of air release source term? (0-no 1-yes)  IDKAIR
0      Decay of water release source term? (0-no 1-yes) IDKWAT
0      Use the One-Year-of-Exposure Model? (0-no 1-yes) INTRUD

MONITORING AND OUTPUT OPTIONS
2      Level of detail in reports (1-least to 3)       IOUT
.F.    Monitor and print hand calculation report       DEBUG(4)

NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:
10     Scenario begins:                               IT1
59     Scenario ends:                                 IT2

INVENTORY:
1      Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci) INUT
1      Soil source units (0- m**2 1- m**3 2- kg)        M3M2
4      Number of radionuclides in inventory:            NIN

      Release      Irrigation      Drinking      Atmospheric      E
      Terms        Soil Source    /Aquatic     Water           Release          A
                  (per unit)      (per L)      (per L)         (per yr)         Q
      -----      -
      C060
      SR90
      U 238
      I 129
      -----      -
                        QI
                        QJ
                        QK

INVENTORY MODIFICATION FACTORS: (multipliers)
0.2    Surface inventory modification factor:          SRDIL
1.0    Irrigation/aquatic inventory modification factor: DILF
1.0    Size of site (fractional ha):                   FRSIZ
1.0    Fraction of total diet grown on site:            RPF2

EXTERNAL/INHALATION EXPOSURE:
2000.0 Hours of external exposure to contamination (h/yr): HREXT
2000.0 Hours of inhalation of airborne contamination (h/yr): HRINH
PLANEA.DAT Ext. exp. dose rate factors (plane source) filename: PLANAM
BURHFA.DAT Ext. exp. dose rate factors (volume source) filename: VOLNAM
270.0     Breathing rate (cm**3/sec):                   BRATE

```

FIGURE 3.7. Sample Problem Four Input

SELECT RESUSPENSION MODEL:

0 0-Anspaugh 1-Mass Loading IRES

0. Age of contamination (yr) Soil density (g/m**3) AGE/DEN

1.0 Top soil available (cm) Mass loading factor (g/m**3) XDPTIN/XMLF

SPECIAL PURPOSE PARAMETERS:

0 No. of years contamination blew onto the site prior to the beginning of the scenario: IBLOW

0.0 Chi/q value at the site: XQSITE

1 Use drinking water cleanup factors (0-no, 1-yes) ICLNUP

1 Use Reg. Guide 1.109 H-3, C-14 plant/soil uptake factors I1109

AGRICULTURAL PARAMETERS:

1.0 Fraction of roots in upper soil: RF1

0.0 Fraction of roots in deeply buried waste: RF2

1.0 Ratio of ext. contamination in surface/subsurface soil: RPF1

6 Months per year irrigated: IMO

150.0 Irrigation rate (L/m**2/mo): RIRR

10 Years of irrigation w/ contaminated water prior to the beginning of the dose calculation period: IRR

10 Number of food types: (1-15) NFT

FOOD TYPE INDEX	FOOD TYPE	GROWING PERIOD (days)	YIELD (kg/m**3)	HOLDUP (days)	CONSUMPTION (kg/yr)	TRANS-LOCATION FACTOR	KFDTYP
1	LEAFY VEG.	90.	1.5	1.0	9.5	1.0	---
2	O.A.G.VEG.	60.	.70	1.0	9.5	.10	GRWP
4	OT.RT.VEG.	90.	4.0	10.	76.	.10	YELD
7	ORCH.FRUIT	90.	2.0	10.	42.	.10	HLDUP
9	OT.GRAIN	90.	1.0	1.0	51.	.10	CON
10	EGGS	90.	.84	1.0	19.	.10	TRANS
11	MILK	30.	1.3	1.0	1.10E+02	1.0	
12	BEEF	90.	.84	15.	39.	.10	
13	PDRK	90.	.84	15.	29.	.10	
14	POULTRY	90.	.84	1.0	8.5	.10	

DRINKING WATER/AQUATIC FOOD PARAMETERS:

2 Number of water/food types: (1-5) NPT

TYPE INDEX	FOOD TYPE	HOLDUP (days)	CONSUMPTION (kg/yr)	KPTHWY
1	FISH	1.0	6.9	---
5	DRINK WATER	1.0	438.0	HLDUP2

USAG

FIGURE 3.7 (Contd)

 ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
 (MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE4.IN / MAXI Sample Problem Four

Executed on: 10/28/1986 at 16:36:28

Page 1

 PATHWAYS/OPTIONS CONSIDERED:

External exposure to surface contamination modeled as a plane source
 Inhalation of resuspended material
 Farm product ingestion
 Drinking water ingestion
 Committed effective dose equivalent (CEDE) calculation

TITLES OF LIBRARY FILES ACCESSED:

10: RMDLIB - Radionuclide Master Library (24-Sep-86 RAP)
 11: ORGAN DATA LIBRARY UPDATED BY RA PELDQUIN 8-Jul-86
 12: FOOD TRANSFER COEFFICIENT LIBRARY (RAP/WTF 04-APR-86 C1 Update)
 13: Committed Dose Equivalents (Sv/Bq) ICRP Publication 30 (28-Oct-86 RAP)
 14: BIOACCUMULATION FACTOR LIBRARY FOR BA NAPIER (04-APR-86/WTF)
 22: OVERBURDEN: 0.0M, SOURCE: 0.15 M (DEN: CONCRETE/1.8): MR/HR 8-Jul-86 RAP
 23: DACRIN (DIFDOS) DOSE INCREMENT FILE ONSITE/MAXI 26-Aug-86 RAP

NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:

Scenario begins: 10
 Scenario ends: 59

INVENTORY:

Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci) 1
 Soil source units: (0- m**2 1- m**3 2- kg) 1
 Number of radionuclides in inventory: 4

Release Terms	Soil Source (per m**3)	Irrigation /Aquatic (per L)	Drinking Water (per L)	Atmospheric Release (per m3)
-----	-----	-----	-----	-----
C060	.0E+00	1.0E-01	1.0E+01	.0E+00
SR90	.0E+00	1.0E-01	1.0E+01	.0E+00
Y 90	.0E+00	.0E+00	.0E+00	.0E+00
I 129	.0E+00	1.0E-01	1.0E+01	.0E+00
U 238	.0E+00	1.0E-01	1.0E+01	.0E+00
TH234	.0E+00	.0E+00	.0E+00	.0E+00
PA234M	.0E+00	.0E+00	.0E+00	.0E+00
PA234	.0E+00	.0E+00	.0E+00	.0E+00

INVENTORY MODIFICATION FACTORS: (multipliers)

Surface inventory dilution factor: .2
 Irrigation/aquatic inventory modification factor: 1.
 Size of site (fractional ha): 1.0E+00
 Fraction of total diet grown on site: 1.

FIGURE 3.8. Sample Problem Four Output

 ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
 (MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE4.IN / MAXI Sample Problem Four

Executed on: 10/28/1986 at 16:36:28

Page 2

EXTERNAL/INHALATION EXPOSURE:

Hours of external exposure to contamination (h/yr):	2.0E+03
Hours of inhalation of airborne contamination (h/yr):	2.0E+03
Breathing rate (cm**3/sec):	2.7E+02

RESUSPENSION PARAMETERS:

Model used:	Anspaugh
Average age of contamination on ground at Time Zero(yr):	.0
Top soil available for resuspension (cm):	1.

AGRICULTURAL PARAMETERS:

Fraction of roots in upper soil:	1.00
Fraction of roots in deeply buried waste:	.000
Ratio of ext. contamination in surface/subsurface soil:	1.00
Months per year irrigated:	6
Irrigation rate (L/m**2/mo):	1.5E+02
Years of irrigation w/ contaminated water prior to the beginning of the dose calculation period:	10
Number of food types:	10

FOOD TYPE INDEX	FOOD TYPE	GROWING PERIOD (days)	YIELD (kg/m**3)	HOLDUP (days)	CONSUMP- TION (kg/yr)	TRANS- LOCATION FACTOR
1	LEAFY VEG.	90.	1.50	1.	9.5	1.00
2	O.A.G.VEG.	60.	.70	1.	9.5	.10
4	OT.RT.VEG.	90.	4.00	10.	76.0	.10
7	ORCH.FRUIT	90.	2.00	10.	42.0	.10
9	OT.GRAIN	90.	1.00	1.	51.0	.10
10	EGGS	90.	.84	1.	19.0	.10
11	MILK	30.	1.30	1.	110.0	1.00
12	BEEF	90.	.84	15.	39.0	.10
13	PORK	90.	.84	15.	29.0	.10
14	POULTRY	90.	.84	1.	8.5	.10

FIGURE 3.8 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE4.IN / MAXI Sample Problem Four

Executed on: 10/28/1986 at 16:36:28

Page 3

DRINKING WATER/AQUATIC FOOD PARAMETERS:

Number of water/food types:

2

TYPE INDEX	FOOD TYPE	HOLDUP (days)	CONSUMPTION (kg/yr)
1	FISH	1.0	6.9
5	DRINK WATER	1.0	438.0

Input prepared by:

Roberta A. Delaguerre

Date:

5 Nov 86

Input checked by:

Roberta A. Delaguerre

Date:

5 Nov 86

*****PLEASE NOTE ANY SPECIAL CONSIDERATIONS IN THIS SPACE*****

* * * * *

CALCULATED VALUES:

Ingestion area correction factor:	1.0
External/inhalation area correction factor:	1.0
Inhalation exposure modification factor:	.23
External exposure modification factor:	.23

FIGURE 3.8 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE4.IN / MAXI Sample Problem Four

Executed on: 10/28/1986 at 16:36:28

Page 4

SOIL, AIR, AND WATER CONCENTRATION SUMMARY FOR YEAR: 10

Radio-nuclide	Surface Soil pCi/m2	Deep Soil pCi/m3	Air pCi/m3	Irrigation pCi/L	Drink Water pCi/L
CO 60	4.9E+02	.0E+00	4.1E-07	1.0E-01	1.0E+01
SR 90	8.6E+02	.0E+00	7.1E-07	1.0E-01	1.0E+01
Y 90	8.6E+02	.0E+00	7.1E-07	.0E+00	.0E+00
I 129	9.9E+02	.0E+00	8.2E-07	1.0E-01	1.0E+01
U 238	9.9E+02	.0E+00	8.2E-07	1.0E-01	1.0E+01
TH 234	9.9E+02	.0E+00	8.2E-07	.0E+00	.0E+00
PA 234M	9.9E+02	.0E+00	8.2E-07	.0E+00	.0E+00
PA 234	1.3E+00	.0E+00	1.1E-09	.0E+00	.0E+00

SOIL, AIR, AND WATER CONCENTRATION SUMMARY FOR YEAR: 59

Radio-nuclide	Surface Soil pCi/m2	Deep Soil pCi/m3	Air pCi/m3	Irrigation pCi/L	Drink Water pCi/L
CO 60	6.4E+02	.0E+00	4.3E-08	1.0E-01	1.0E+01
SR 90	2.8E+03	.0E+00	1.9E-07	1.0E-01	1.0E+01
Y 90	2.8E+03	.0E+00	1.9E-07	.0E+00	.0E+00
I 129	5.4E+03	.0E+00	3.6E-07	1.0E-01	1.0E+01
U 238	5.4E+03	.0E+00	3.6E-07	1.0E-01	1.0E+01
TH 234	5.4E+03	.0E+00	3.6E-07	.0E+00	.0E+00
PA 234M	5.4E+03	.0E+00	3.6E-07	.0E+00	.0E+00
PA 234	7.0E+00	.0E+00	4.7E-10	.0E+00	.0E+00

FIGURE 3.8 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE4.IN / MAXI Sample Problem Four

Executed on: 10/28/1986 at 16:36:28

Page 5

Annual Effective Dose Equivalent (AEDE): 1.3E-03

Maximum Annual Dose (ICRP-2):

To Organ:	TOTAL BODY	at Year	59	1.6E-03
To Organ:	BONE	at Year	59	7.7E-03
To Organ:	LUNGS	at Year	59	8.0E-06
To Organ:	THYROID	at Year	59	2.8E-02
To Organ:	LLI	at Year	59	3.5E-04

FIGURE 3.8 (Contd)

 ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
 (MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE4.IN / MAXI Sample Problem Four

Executed on: 10/28/1986 at 16:36:28

Page 6

DOSES FROM 1 YEAR OF EXPOSURE

Organ	Committed Dose Equivalent	Weighing Factors	Weighted Dose Equivalent
Gonads	1.1E-05	2.5E-01	2.7E-06
Breast	3.8E-06	1.5E-01	5.7E-07
R Marrow	8.0E-04	1.2E-01	9.6E-05
Lungs	4.6E-06	1.2E-01	5.5E-07
Thyroid	3.4E-02	3.0E-02	1.0E-03
Bone Surf	2.1E-03	3.0E-02	6.4E-05
LLI Wall	5.7E-04	6.0E-02	3.4E-05
Kidneys	2.0E-04	6.0E-02	1.2E-05
ULI Wall	1.9E-04	6.0E-02	1.2E-05
SI Wall	1.2E-05	6.0E-02	7.4E-07
Liver	7.9E-06	6.0E-02	4.7E-07
Effective Dose Equivalent			1.2E-03
External Dose			5.7E-06
Annual Effective Dose Equivalent			1.3E-03

FIGURE 3.8 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE4.IN / MAXI Sample Problem Four

Executed on: 10/28/1986 at 16:36:28

Page 7

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 59 FOR TOTAL BODY -----

RADIO- NUCLIDE	EXPDSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	2.5E-07	0	2.3E-13	0	7.3E-06	94	.0E+00	0	4.1E-06	0
SR90	5.2E-04	98	5.7E-10	78	1.1E-09	0	.0E+00	0	9.0E-04	83
Y 90	5.1E-13	0	3.4E-15	0	7.1E-08	0	.0E+00	0	.0E+00	0
I 129	2.8E-06	0	5.4E-12	0	3.1E-08	0	.0E+00	0	3.2E-05	3
U 238	2.9E-06	0	1.5E-10	21	7.1E-10	0	.0E+00	0	1.4E-04	12
TH234	3.9E-11	0	6.9E-14	0	5.4E-08	0	.0E+00	0	.0E+00	0
PA234M	.0E+00	0	4.2E-20	0	2.1E-07	2	.0E+00	0	.0E+00	0
PA234	1.9E-17	0	1.3E-18	0	5.9E-08	0	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
1.6E-03	5.2E-04	32	7.3E-10	0	7.7E-06	0	.0E+00	0	1.1E-03	66

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 59 FOR BONE -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	7.3E-06	94	.0E+00	0	.0E+00	0
SR90	1.9E-03	97	8.5E-09	76	1.1E-09	0	.0E+00	0	3.4E-03	58
Y 90	1.9E-11	0	1.3E-13	0	7.1E-08	0	.0E+00	0	.0E+00	0
I 129	1.0E-06	0	1.3E-13	0	3.1E-08	0	.0E+00	0	1.1E-05	0
U 238	4.9E-05	2	2.6E-09	23	7.1E-10	0	.0E+00	0	2.3E-03	41
TH234	1.3E-09	0	2.4E-12	0	5.4E-08	0	.0E+00	0	.0E+00	0
PA234M	.0E+00	0	9.1E-19	0	2.1E-07	2	.0E+00	0	.0E+00	0
PA234	7.3E-17	0	5.1E-18	0	5.9E-08	0	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
7.7E-03	2.0E-03	25	1.1E-08	0	7.7E-06	0	.0E+00	0	5.7E-03	74

FIGURE 3.8 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE4.IN / MAXI Sample Problem Four

Executed on: 10/28/1986 at 16:36:28

Page 8

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 59 FOR LUNGS -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	2.4E-10	0	7.3E-06	94	.0E+00	0	.0E+00	0
SR90	.0E+00	0	4.1E-12	0	1.1E-09	0	.0E+00	0	.0E+00	0
Y 90	.0E+00	0	1.1E-11	0	7.1E-08	0	.0E+00	0	.0E+00	0
I 129	.0E+00	0	5.0E-13	0	3.1E-08	0	.0E+00	0	.0E+00	0
U 238	.0E+00	0	2.7E-07	99	7.1E-10	0	.0E+00	0	.0E+00	0
TH234	.0E+00	0	1.5E-10	0	5.4E-08	0	.0E+00	0	.0E+00	0
PA234M	.0E+00	0	2.4E-15	0	2.1E-07	2	.0E+00	0	.0E+00	0
PA234	.0E+00	0	2.7E-15	0	5.9E-08	0	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
8.0E-06	.0E+00	0	2.7E-07	3	7.7E-06	96	.0E+00	0	.0E+00	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 59 FOR THYROID -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	7.3E-06	94	.0E+00	0	.0E+00	0
SR90	.0E+00	0	.0E+00	0	1.1E-09	0	.0E+00	0	.0E+00	0
Y 90	.0E+00	0	.0E+00	0	7.1E-08	0	.0E+00	0	.0E+00	0
I 129	2.2E-03	100	4.3E-09	100	3.1E-08	0	.0E+00	0	2.5E-02	100
U 238	.0E+00	0	.0E+00	0	7.1E-10	0	.0E+00	0	.0E+00	0
TH234	.0E+00	0	.0E+00	0	5.4E-08	0	.0E+00	0	.0E+00	0
PA234M	.0E+00	0	.0E+00	0	2.1E-07	2	.0E+00	0	.0E+00	0
PA234	.0E+00	0	.0E+00	0	5.9E-08	0	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
2.8E-02	2.2E-03	7	4.3E-09	0	7.7E-06	0	.0E+00	0	2.5E-02	91

FIGURE 3.8 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE4.IN / MAXI Sample Problem Four

Executed on: 10/28/1986 at 16:36:28

Page 9

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 59 FOR LLI -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	2.3E-06	4	1.9E-12	2	7.3E-06	94	.0E+00	0	3.9E-05	13
SR90	4.3E-05	83	4.2E-12	4	1.1E-09	0	.0E+00	0	6.8E-05	23
Y 90	2.2E-07	0	1.6E-11	18	7.1E-08	0	.0E+00	0	.0E+00	0
I 129	1.5E-07	0	5.4E-14	0	3.1E-08	0	.0E+00	0	1.7E-06	0
U 238	3.9E-06	7	2.3E-11	27	7.1E-10	0	.0E+00	0	1.9E-04	63
TH234	2.1E-06	4	4.0E-11	47	5.4E-08	0	.0E+00	0	.0E+00	0
PA234M	.0E+00	0	.0E+00	0	2.1E-07	2	.0E+00	0	.0E+00	0
PA234	7.4E-12	0	2.7E-15	0	5.9E-08	0	.0E+00	0	.0E+00	0
TOTAL	3.5E-04									
	5.2E-05	14	8.5E-11	0	7.7E-06	2	.0E+00	0	2.9E-04	83

FIGURE 3.8 (Contd)

3.2.5 Sample Problem Five

The fifth sample problem demonstrates the user-defined scenario option. This problem is intended to exercise the maximum number of exposure conditions that can be considered by the MAXII program in a single run. For this problem, the general exposure conditions described in Sample Problem Four are considered with the addition of ingestion of aquatic foods (fish obtained from a river) and root penetration into deeply buried wastes. The radionuclide concentrations in well and river water defined in Sample Problem Four, are used for the liquid pathways. A deep waste concentration of 0.1 Ci/m^3 of each of ^{60}Co , ^{129}I , and ^{238}U plus 0.001 Ci/m^3 of ^{90}Sr is also assumed. The site is assumed to cover 1 ha. The wastes are assumed to be buried for 10 years prior to the start of farming and they are assumed to be located 1.0 m from the surface. It is further assumed that about 40% of the roots from the garden crops penetrate to this depth (based on information in Napier 1982).

For the user-defined scenario, the air concentration used to estimate inhalation dose is calculated using a mass-loading equation instead of the time-dependent resuspension equation. Also, the individual's total diet is assumed to be from foods grown using the contaminated water supply. The purpose of this sample problem is to determine the doses to an individual residing on a site containing deeply buried wastes who also uses contaminated water supplies. This sample problem has been expanded in this version of the ONSITE/MAXII software package. Both the maximum annual dose (ICRP 1959) and the annual effective dose equivalent, AEDE, (ICRP 1977; ICRP 1979-1982) are to be calculated. The MAXII input file for Sample Problem Five is shown in Figure 3.9. Changes from the previous sample problem are shaded on the Sample Problem Five input file to assist the user in understanding the second level of software operation.

The output resulting for the scenario in this sample problem is shown in Figure 3.10. The maximum annual doses for Sample Problem Five are about 1.5 rem to total body, 6.2 rem to bone, 2.1×10^{-4} rem to lungs, 240 rem to thyroid, and 0.9 rem to GI(LLI). Ingestion of farm products whose roots penetrate the deeply buried wastes control the doses to total body, bone, thyroid, and GI(LLI). The dose to lungs is controlled by the external exposure pathway. The annual external dose was 2.1×10^{-4} rem, and the internal effective dose equivalent was 9.8 rem. Thus, the annual effective dose equivalent was 9.8 rem. Radioactive decay, soil and air concentration, and maximum annual dose estimate calculations were verified by hand using the equations in Section 2.

MAXI Input File
SAMPLE5.IN / MAXI Sample Problem Five

Filename/Title on next line:

```

DO YOU WISH TO CONSIDER:
1 External exposure and root penetration IEXT
  for waste modeled as a slab (volume) source? (0-no 1-yes)
1 External exposure to surface contamination ISUR
  modeled as a plane source? (0-no 1-yes)
1 Inhalation of resuspended material? (0-no 1-yes) INHA
1 Farm product ingestion? (0-no 1-yes) IFOD
1 Aquatic foods ingestion? (0-no 1-yes) IARG
1 Drinking water ingestion? (0-no 1-yes) IWAT
0 Offsite atmospheric source? (0-no 1-yes) IAIR
1 ICRP-26/30 as well as ICRP-2 methodology? (0-no 1-yes) IEDE
0 Decay of air release source term? (0-no 1-yes) IDKAIR
0 Decay of water release source term? (0-no 1-yes) IDKWAT
0 Use the One-Year-of-Exposure Model? (0-no 1-yes) INTRUD

MONITORING AND OUTPUT OPTIONS
2 Level of detail in reports (1-least to 3) IOUT
.F. Monitor and print hand calculation report DEBUG(4)

NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:
10 Scenario begins: IT1
59 Scenario ends: IT2

INVENTORY:
1 Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci) INUT
1 Soil source units (0- m**2 1- m**3 2- kg) M3M2
4 Number of radionuclides in inventory: NIN

      Release      Irrigation      Drinking      Atmospheric      E
      Terms      Soil Source      /Aquatic      Water      Release      A
              (per unit)      (per L)      (per L)      (per yr)      Q
      -----
      CO60      0.1      10.0      QI
      SR90      0.1      10.0      QJ
      U 238      0.1      10.0      QK
      I 129      0.1      10.0

INVENTORY MODIFICATION FACTORS: (multipliers)
0.2 Surface inventory modification factor: SRDIL
1.0 Irrigation/aquatic inventory modification factor: DILF
1.0 Size of site (fractional ha): FRSIZ
1.0 Fraction of total diet grown on site: RPF2

EXTERNAL/INHALATION EXPOSURE:
2000.0 Hours of external exposure to contamination (h/yr): HREXT
2000.0 Hours of inhalation of airborne contamination (h/yr): HRINH
PLANEA.DAT Ext. exp. dose rate factors (plane source) filename: PLANAM
BURIA.DAT Ext. exp. dose rate factors (volume source) filename: VOLNAM
270.0 Breathing rate (cm**3/sec): BRATE

```

FIGURE 3.9. Sample Problem Five Input

SELECT RESUSPENSION MODEL:			
1	0-Anspaugh	1-Mass Loading	IRES
1.0E6	Age of contamination (yr)	Soil density (g/m**3)	AGE/DEN
1.0E-4	Top soil available (cm)	Mass loading factor (g/m**3)	XDPTIN/XMLF
SPECIAL PURPOSE PARAMETERS:			
0	No. of years contamination blew onto the site prior to the beginning of the scenario:		IBLOW
0.0	Chi/q value at the site:		XQSITE
1	Use drinking water cleanup factors (0-no, 1-yes)		ICLNUP
1	Use Reg. Guide 1.109 H-3, C-14 plant/soil uptake factors		I1109
AGRICULTURAL PARAMETERS:			
0.6	Fraction of roots in upper soil:		RF1
0.4	Fraction of roots in deeply buried waste:		RF2
0.0	Ratio of ext. contamination in surface/subsurface soil:		RPF1
6	Months per year irrigated:		IMO
150.0	Irrigation rate (L/m**2/mo):		RIRR
10	Years of irrigation w/ contaminated water prior to the beginning of the dose calculation period:		IRR
10	Number of food types: (1-15)		NFT
FOOD TYPE INDEX			
	FOOD TYPE	GROWING PERIOD (days)	YIELD (kg/m**3)
		HOLDUP (days)	CONSUMPTION (kg/yr)
		TRANS-LOCATION FACTOR	KFDTYP
1	LEAFY VEG.	90.	1.5
2	O.A.G.VEG.	60.	.70
4	OT.RT.VEG.	90.	4.0
7	ORCH.FRUIT	90.	2.0
9	OT.GRAIN	90.	1.0
10	EGGS	90.	.84
11	MILK	30.	1.3
12	BEEF	90.	.84
13	PORK	90.	.84
14	POULTRY	90.	.84
DRINKING WATER/AQUATIC FOOD PARAMETERS:			
2	Number of water/food types: (1-5)		NPT
TYPE INDEX			
	FOOD TYPE	HOLDUP (days)	CONSUMPTION (kg/yr)
			KPTHWY
1	FISH	1.0	6.9
5	DRINK WATER	1.0	438.0

FIGURE 3.9 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE5.IN / MAXI Sample Problem Five

Executed on: 10/28/1986 at 16:41:21

Page 1

PATHWAYS/OPTIONS CONSIDERED:

External exposure/root penetration for waste modeled as slab (volume) source
External exposure to surface contamination modeled as a plane source
Inhalation of resuspended material
Farm product ingestion
Aquatic foods ingestion
Drinking water ingestion
Committed effective dose equivalent (CEDE) calculation

TITLES OF LIBRARY FILES ACCESSED:

10: RMOLIB - Radionuclide Master Library (24-Sep-86 RAP)
11: ORGAN DATA LIBRARY UPDATED BY RA PELOQUIN 8-Jul-86
12: FOOD TRANSFER COEFFICIENT LIBRARY (RAP/WTF 04-APR-86 C1 Update)
13: Committed Dose Equivalents (Sv/Bq) ICRP Publication 30 (28-Oct-86 RAP)
14: BIOACCUMULATION FACTOR LIBRARY FOR BA NAPIER (04-APR-86/WTF)
22: OVERBURDEN: 0.0M, SOURCE: 0.15 M (DEN: CONCRETE/1.8): MR/HR 8-Jul-86 RAP
23: DACRIN (DIFDOS) DOSE INCREMENT FILE ONSITE/MAXI 26-Aug-86 RAP
27: OVERBUREN: 1.0m, SOURCE: 1.0M (DEN: CONCRETE/1.8): MR/HR 18-Jul-86 RAP

NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:

Scenario begins: 10
Scenario ends: 59

INVENTORY:

Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci) 1
Soil source units: (0- m**2 1- m**3 2- kg) 1
Number of radionuclides in inventory: 4

Release Terms	Soil Source (per m**3)	Irrigation /Aquatic (per L)	Drinking Water (per L)	Atmospheric Release (per m3)
C060	1.0E+11	1.0E-01	1.0E+01	.0E+00
SR90	1.0E+09	1.0E-01	1.0E+01	.0E+00
Y 90	.0E+00	.0E+00	.0E+00	.0E+00
I 129	1.0E+11	1.0E-01	1.0E+01	.0E+00
U 238	1.0E+11	1.0E-01	1.0E+01	.0E+00
TH234	.0E+00	.0E+00	.0E+00	.0E+00
PA234M	.0E+00	.0E+00	.0E+00	.0E+00
PA234	.0E+00	.0E+00	.0E+00	.0E+00

FIGURE 3.10. Sample Problem Five Output

INVENTORY MODIFICATION FACTORS: (multipliers)	
Surface inventory dilution factor:	.2
Irrigation/aquatic inventory modification factor:	1.
Size of site (fractional ha):	1.0E+00
Fraction of total diet grown on site:	1.

FIGURE 3.10 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE5.IN / MAXI Sample Problem Five

Executed on: 10/28/1986 at 16:41:21

Page 2

EXTERNAL/INHALATION EXPOSURE:

Hours of external exposure to contamination (h/yr):	2.0E+03
Hours of inhalation of airborne contamination (h/yr):	2.0E+03
Breathing rate (cm**3/sec):	2.7E+02

RESUSPENSION PARAMETERS:

Model used:	Mass Loading
Soil density (g/m**3):	1.0E+06
Mass loading factor (g/m**3):	1.0E-04

AGRICULTURAL PARAMETERS:

Fraction of roots in upper soil:	.600
Fraction of roots in deeply buried waste:	.400
Ratio of ext. contamination in surface/subsurface soil:	.000
Months per year irrigated:	6
Irrigation rate (L/m**2/mo):	1.5E+02
Years of irrigation w/ contaminated water prior to the beginning of the dose calculation period:	10
Number of food types:	10

FOOD TYPE INDEX	FOOD TYPE	GROWING PERIOD (days)	YIELD (kg/m**3)	HOLDUP (days)	CONSUMP- TION (kg/yr)	TRANS- LOCATION FACTOR
1	LEAFY VEG.	90.	1.50	1.	9.5	1.00
2	O.A.G.VEG.	60.	.70	1.	9.5	.10
4	OT.RT.VEG.	90.	4.00	10.	76.0	.10
7	ORCH.FRUIT	90.	2.00	10.	42.0	.10
9	OT.GRAIN	90.	1.00	1.	51.0	.10
10	EGGS	90.	.84	1.	19.0	.10
11	MILK	30.	1.30	1.	110.0	1.00
12	BEEF	90.	.84	15.	39.0	.10
13	PORK	90.	.84	15.	29.0	.10
14	POULTRY	90.	.84	1.	8.5	.10

FIGURE 3.10 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE5.IN / MAXI Sample Problem Five

Executed on: 10/28/1986 at 16:41:21

Page 3

DRINKING WATER/AQUATIC FOOD PARAMETERS:

Number of water/food types:

2

TYPE INDEX	FOOD TYPE	HOLDUP (days)	CONSUMPTION (kg/yr)
1	FISH	1.0	6.9
5	DRINK WATER	1.0	438.0

Input prepared by:

Rebecca D. Subguin

Date:

5 Nov 86

Input checked by:

Rebecca D. Subguin

Date:

5 Nov 86

*****PLEASE NOTE ANY SPECIAL CONSIDERATIONS IN THIS SPACE*****

*
*
*
*
*
*
*
*
*
*

*
*
*
*
*
*
*
*
*
*

CALCULATED VALUES:

Ingestion area correction factor:	1.0
External/inhalation area correction factor:	1.0
Inhalation exposure modification factor:	.23
External exposure modification factor:	.23

FIGURE 3.10 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE5.IN / MAXI Sample Problem Five

Executed on: 10/28/1986 at 16:41:21

Page 4

SOIL, AIR, AND WATER CONCENTRATION SUMMARY FOR YEAR: 10

Radio-nuclide	Surface Soil pCi/m2	Deep Soil pCi/m3	Air pCi/m3	Irrigation pCi/L	Drink Water pCi/L
CO 60	4.9E+02	5.4E+09	3.3E-07	1.0E-01	1.0E+01
SR 90	8.6E+02	1.6E+08	5.7E-07	1.0E-01	1.0E+01
Y 90	8.6E+02	1.6E+08	5.7E-07	.0E+00	.0E+00
I 129	9.9E+02	2.0E+10	6.6E-07	1.0E-01	1.0E+01
U 238	9.9E+02	2.0E+10	6.6E-07	1.0E-01	1.0E+01
TH 234	9.9E+02	2.0E+10	6.6E-07	.0E+00	.0E+00
PA 234M	9.9E+02	2.0E+10	6.6E-07	.0E+00	.0E+00
PA 234	1.3E+00	2.6E+07	8.6E-10	.0E+00	.0E+00

SOIL, AIR, AND WATER CONCENTRATION SUMMARY FOR YEAR: 59

Radio-nuclide	Surface Soil pCi/m2	Deep Soil pCi/m3	Air pCi/m3	Irrigation pCi/L	Drink Water pCi/L
CO 60	6.4E+02	8.4E+06	4.3E-07	1.0E-01	1.0E+01
SR 90	2.8E+03	4.8E+07	1.9E-06	1.0E-01	1.0E+01
Y 90	2.8E+03	4.8E+07	1.9E-06	.0E+00	.0E+00
I 129	5.4E+03	2.0E+10	3.6E-06	1.0E-01	1.0E+01
U 238	5.4E+03	2.0E+10	3.6E-06	1.0E-01	1.0E+01
TH 234	5.4E+03	2.0E+10	3.6E-06	.0E+00	.0E+00
PA 234M	5.4E+03	2.0E+10	3.6E-06	.0E+00	.0E+00
PA 234	7.0E+00	2.6E+07	4.7E-09	.0E+00	.0E+00

FIGURE 3.10 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE5.IN / MAXI Sample Problem Five

Executed on: 10/28/1986 at 16:41:21

Page 5

Annual Effective Dose Equivalent (AEDE): 9.8E+00

Maximum Annual Dose (ICRP-2):

To Organ:	TOTAL BODY	at Year	30	1.5E+00
To Organ:	BONE	at Year	30	6.2E+00
To Organ:	LUNGS	at Year	10	2.1E-04
To Organ:	THYROID	at Year	16	2.4E+02
To Organ:	LLI	at Year	10	9.0E-01

FIGURE 3.10 (Contd)

 ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
 (MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE5.IN / MAXI Sample Problem Five

Executed on: 10/28/1986 at 16:41:21

Page 6

DOSES FROM 1 YEAR OF EXPOSURE

Organ	Committed Dose Equivalent	Weighing Factors	Weighted Dose Equivalent
Gonads	3.1E-02	2.5E-01	7.7E-03
Breast	1.1E-02	1.5E-01	1.6E-03
R Marrow	1.2E+00	1.2E-01	1.5E-01
Lungs	8.4E-03	1.2E-01	1.0E-03
Thyroid	3.1E+02	3.0E-02	9.4E+00
Bone Surf	3.0E+00	3.0E-02	9.0E-02
LLI Wall	1.2E+00	6.0E-02	7.0E-02
ULI Wall	4.2E-01	6.0E-02	2.5E-02
Kidneys	1.7E-01	6.0E-02	1.0E-02
SI Wall	3.5E-02	6.0E-02	2.1E-03
Liver	2.2E-02	6.0E-02	1.3E-03
Effective Dose Equivalent			9.8E+00
External Dose			2.1E-04
Annual Effective Dose Equivalent			9.8E+00

FIGURE 3.10 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE5.IN / MAXI Sample Problem Five

Executed on: 10/28/1986 at 16:41:21

Page 7

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 30 FOR TOTAL BODY-----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	8.9E-04	0	2.3E-12	0	2.2E-05	90	1.6E-07	0	4.1E-06	0
SR90	1.1E+00	71	3.0E-09	79	7.7E-10	0	1.8E-05	98	7.6E-04	81
Y 90	1.1E-09	0	2.4E-14	0	5.1E-08	0	.0E+00	0	.0E+00	0
I 129	3.1E-01	20	2.8E-11	0	1.6E-08	0	9.5E-08	0	3.2E-05	3
U 238	1.3E-01	8	7.4E-10	19	3.6E-10	0	6.3E-08	0	1.4E-04	14
TH234	8.6E-06	0	3.6E-13	0	2.8E-08	0	.0E+00	0	.0E+00	0
PA234M	.0E+00	0	2.2E-19	0	1.7E-06	6	.0E+00	0	.0E+00	0
PA234	4.1E-12	0	6.7E-18	0	4.8E-07	2	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
1.5E+00	1.5E+00	99	3.7E-09	0	2.4E-05	0	1.8E-05	0	9.4E-04	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 30 FOR BONE -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	2.2E-05	90	.0E+00	0	.0E+00	0
SR90	4.0E+00	64	4.4E-08	78	7.7E-10	0	6.7E-05	98	2.8E-03	54
Y 90	3.9E-08	0	8.8E-13	0	5.1E-08	0	.0E+00	0	.0E+00	0
I 129	1.1E-01	1	6.7E-13	0	1.6E-08	0	3.4E-08	0	1.1E-05	0
U 238	2.1E+00	33	1.2E-08	21	3.6E-10	0	1.1E-06	1	2.3E-03	45
TH234	3.0E-04	0	1.2E-11	0	2.8E-08	0	.0E+00	0	.0E+00	0
PA234M	.0E+00	0	4.7E-18	0	1.7E-06	6	.0E+00	0	.0E+00	0
PA234	1.6E-11	0	2.6E-17	0	4.8E-07	2	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
6.2E+00	6.2E+00	99	5.6E-08	0	2.4E-05	0	6.8E-05	0	5.2E-03	0

FIGURE 3.10 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE5.IN / MAXI Sample Problem Five

Executed on: 10/28/1986 at 16:41:21

Page 8

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 10 FOR LUNGS -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	4.9E-10	0	2.1E-04	99	.0E+00	0	.0E+00	0
SR90	.0E+00	0	1.3E-11	0	3.4E-10	0	.0E+00	0	.0E+00	0
Y 90	.0E+00	0	3.2E-11	0	2.4E-08	0	.0E+00	0	.0E+00	0
I 129	.0E+00	0	9.1E-13	0	5.7E-09	0	.0E+00	0	.0E+00	0
U 238	.0E+00	0	1.1E-07	99	1.3E-10	0	.0E+00	0	.0E+00	0
TH234	.0E+00	0	2.6E-10	0	9.9E-09	0	.0E+00	0	.0E+00	0
PA234M	.0E+00	0	4.5E-15	0	1.6E-06	0	.0E+00	0	.0E+00	0
PA234	.0E+00	0	4.9E-15	0	4.6E-07	0	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
2.1E-04	.0E+00	0	1.1E-07	0	2.1E-04	99	.0E+00	0	.0E+00	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 16 FOR THYROID -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	9.9E-05	97	.0E+00	0	.0E+00	0
SR90	.0E+00	0	.0E+00	0	5.0E-10	0	.0E+00	0	.0E+00	0
Y 90	.0E+00	0	.0E+00	0	3.4E-08	0	.0E+00	0	.0E+00	0
I 129	2.4E+02	100	1.2E-08	100	8.8E-09	0	7.5E-05	100	2.5E-02	100
U 238	.0E+00	0	.0E+00	0	2.0E-10	0	.0E+00	0	.0E+00	0
TH234	.0E+00	0	.0E+00	0	1.5E-08	0	.0E+00	0	.0E+00	0
PA234M	.0E+00	0	.0E+00	0	1.6E-06	1	.0E+00	0	.0E+00	0
PA234	.0E+00	0	.0E+00	0	4.7E-07	0	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
2.4E+02	2.4E+02	99	1.2E-08	0	1.0E-04	0	7.5E-05	0	2.5E-02	0

FIGURE 3.10 (Contd)

 ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
 (MAXI Version IBM 1.0 30-Jun-B6)

Case title: SAMPLE5.IN / MAXI Sample Problem Five

Executed on: 10/28/1986 at 16:41:21

Page 9

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 10 FOR LLI -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	1.2E-01	12	1.3E-11	7	2.1E-04	99	1.5E-06	47	3.9E-05	13
SR90	1.3E-01	14	1.3E-11	6	3.4E-10	0	1.6E-06	49	6.8E-05	23
Y 90	7.5E-04	0	4.8E-11	25	2.4E-08	0	.0E+00	0	.0E+00	0
I 129	1.7E-02	1	9.8E-14	0	5.7E-09	0	5.1E-09	0	1.7E-06	0
U 238	1.7E-01	18	3.7E-11	20	1.3E-10	0	8.4E-08	2	1.9E-04	63
TH234	4.7E-01	52	7.3E-11	39	9.9E-09	0	.0E+00	0	.0E+00	0
PA234M	.0E+00	0	.0E+00	0	1.6E-06	0	.0E+00	0	.0E+00	0
PA234	1.7E-06	0	4.9E-15	0	4.6E-07	0	.0E+00	0	.0E+00	0
TOTAL	9.0E-01		1.8E-10	0	2.1E-04	0	3.2E-06	0	2.9E-04	0

FIGURE 3.10 (Contd)

3.2.6 Sample Problem Six

This sample problem demonstrates use of the Stored Waste Scenario. The Stored Waste Scenario is a sub-set of the External Exposure Scenario (Kennedy et al. 1986). For this sample problem, a licensee is assumed to dispose of 100 m³ of noncompacted waste in drums in an aboveground storage facility. The waste is assumed to contain an average of 0.1 Ci/m³ of ⁶⁰Co and have a density of 1.0 g/cm³. The resulting dose to an intruder who enters the storage facility a few weeks after the wastes are disposed of and stays there for 500 h of exposure is determined by running MAXII with the input file shown in Figure 3.11. Changes from the previous sample problem are shaded on the Sample Problem Six input file to assist the user in understanding the second level of software operation.

Note that the ONSITE program asks for an inventory modification factor and that a value of 0.2 is used for the sample problem. This factor accounts for the mixing of the radioactive waste with nonradioactive materials like drums or packaging materials or noncontaminated soil for the case of land disposal. For consistency with the other sample problems given in Napier et al. (1984), the factor of 0.2 is used; however, more appropriate values for stored waste may be closer to 1.0 and the latter value may be substituted by the user.

The output for this sample problem is shown in Figure 3.12. The calculated total-body dose to the intruder for the scenario in this sample problem is about 6.1 rem.

```

DO YOU WISH TO CONSIDER:
1      External exposure and root penetration                                IEXT
      for waste modeled as a slab (volume) source? (0-no 1-yes)
0      External exposure to surface contamination                            ISUR
      modeled as a plane source? (0-no 1-yes)
0      Inhalation of resuspended material? (0-no 1-yes)                    INHA
0      Farm product ingestion? (0-no 1-yes)                                IFOD
0      Aquatic foods ingestion? (0-no 1-yes)                               IARG
0      Drinking water ingestion? (0-no 1-yes)                             IWAT
0      Offsite atmospheric source? (0-no 1-yes)                           IAIR
0      ICRP-26/30 as well as ICRP-2 methodology? (0-no 1-yes)            IEDE
0      Decay of air release source term? (0-no 1-yes)                     IDKAIR
0      Decay of water release source term? (0-no 1-yes)                   IDKWAT
0      Use the One-Year-of-Exposure Model? (0-no 1-yes)                   INTRUD

MONITORING AND OUTPUT OPTIONS
0      Level of detail in reports (0-least to 3)                          IOUT
.F.    Monitor and print hand calculation report                          DEBUG(4)

NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:
0      Scenario begins:                                                    IT1
49     Scenario ends:                                                       IT2

INVENTORY:
4      Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci)                INUT
1      Soil source units (0- m**2 1- m**3 2- kg)                          M3M2
1      Number of radionuclides in inventory:                              NIN

      Release      Irrigation      Drinking      Atmospheric      E
      Terms      Soil Source /Aquatic      Water      Release      A
              (per unit) (per L)      (per L)      (per yr)      Q
      -----      -----      -----      -----      -
      C060      0.10
                                           QI
                                           QJ
                                           QK

INVENTORY MODIFICATION FACTORS: (multipliers)
0.2    Surface inventory modification factor:                            SRDIL
1.0    Irrigation/aquatic inventory modification factor:                  DILF
1.0    Size of site (fractional ha):                                       FRSIZ
1.0    Fraction of total diet grown on site:                               RPF2

EXTERNAL/INHALATION EXPOSURE:
500.0  Hours of external exposure to contamination (h/yr):              HREXT
0.0    Hours of inhalation of airborne contamination (h/yr):             HRINH
PLANEA.DAT Ext. exp. dose rate factors (plane source) filename:          PLANAM
STOREDB.DAT Ext. exp. dose rate factors (volume source) filename:         VOLNAM
270.0    Breathing rate (cm**3/sec):                                       BRATE

```

FIGURE 3.11. Sample Problem Six Input

SELECT RESUSPENSION MODEL:

0	0-Anspaugh	1-Mass Loading	IRES
0.	Age of contamination (yr)	Soil density (g/m**3)	AGE/DEN
1.0	Top soil available (cm)	Mass loading factor (g/m**3)	XDPTIN/XMLF

SPECIAL PURPOSE PARAMETERS:

0	No. of years contamination blew onto the site prior to the beginning of the scenario:	IBLOW
0.0	Chi/q value at the site:	XQSITE
1	Use drinking water cleanup factors (0-no, 1-yes)	ICLNUP
1	Use Reg. Guide 1.109 H-3, C-14 plant/soil uptake factors	I1109

AGRICULTURAL PARAMETERS:

1.0	Fraction of roots in upper soil:	RF1
0.0	Fraction of roots in deeply buried waste:	RF2
0.0	Ratio of ext. contamination in surface/subsurface soil:	RPF1
6	Months per year irrigated:	IMO
150.0	Irrigation rate (L/m**2/mo):	RIRR
0	Years of irrigation w/ contaminated water prior to the beginning of the dose calculation period:	IRR
10	Number of food types: (1-15)	NFT

FOOD TYPE INDEX	FOOD TYPE	GROWING PERIOD (days)	YIELD (kg/m**3)	HOLDUP (days)	CONSUMPTION (kg/yr)	TRANS-LOCATION FACTOR	KFDTYP --- GRWP YELD HLDUP CON TRANS
1	LEAFY VEG.	90.	1.5	1.0	9.5	1.0	
2	O.A.G.VEG.	60.	.70	1.0	9.5	.10	
4	OT.RT.VEG.	90.	4.0	10.	76.	.10	
7	ORCH.FRUIT	90.	2.0	10.	42.	.10	
9	OT.GRAIN	90.	1.0	1.0	51.	.10	
10	EGGS	90.	.84	1.0	19.	.10	
11	MILK	30.	1.3	1.0	1.10E+02	1.0	
12	BEEF	90.	.84	15.	39.	.10	
13	PORK	90.	.84	15.	29.	.10	
14	POULTRY	90.	.84	1.0	8.5	.10	

DRINKING WATER/AQUATIC FOOD PARAMETERS:

2	Number of water/food types: (1-5)	NPT
---	-----------------------------------	-----

TYPE INDEX	FOOD TYPE	HOLDUP (days)	CONSUMPTION (kg/yr)	KPTHWY --- HLDUP2 USAG
1	FISH	1.0	6.9	
5	DRINK WATER	1.0	438.0	

FIGURE 3.11 (Contd)

 ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
 (MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE6.IN / MAXI Sample Problem Six; Stored Waste Sub-set of Scenario

Executed on: 10/ 2/1986 at 15:13:18

Page 1

 PATHWAYS/OPTIONS CONSIDERED:

External exposure/root penetration for waste modeled as slab (volume) source

TITLES OF LIBRARY FILES ACCESSED:

10: RMDLIB - Radionuclide Master Library (24-Sep-86 RAP)

27: ROOM: 1.0 M THICK FINITE SLAB (DEN: H2O 1.0): MR/HR 8-Jul-86 RAP

NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:

Scenario begins: 0

Scenario ends: 49

INVENTORY:

Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci) 4

Soil source units: (0- m**2 1- m**3 2- kg) 1

Number of radionuclides in inventory: 1

Release Terms	Soil Source (per m**3)	Irrigation /Aquatic (per L)	Drinking Water (per L)	Atmospheric Release (per m3)
-----	-----	-----	-----	-----
C060	1.0E+11	.0E+00	.0E+00	.0E+00

INVENTORY MODIFICATION FACTORS: (multipliers)

Surface inventory dilution factor: .2

Irrigation/aquatic inventory modification factor: 1.

Size of site (fractional ha): 1.0E+00

FIGURE 3.12. Sample Problem Six Output

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-B6)

Case title: SAMPLE6.IN / MAXI Sample Problem Six; Stored Waste Sub-set of Scenario

Executed on: 10/ 2/1986 at 15:13:18

Page 2

EXTERNAL/INHALATION EXPOSURE:

Hours of external exposure to contamination (h/yr): 5.0E+02

RESUSPENSION PARAMETERS:

Model used: Anspaugh
Average age of contamination on ground at Time Zero (yr): .0
Top soil available for resuspension (cm): 1.

Input prepared by: Robert A. Johnson Date: Oct 2 '86
Input checked by: W. E. Kennedy, Jr. Date: 10/2/86

*****PLEASE NOTE ANY SPECIAL CONSIDERATIONS IN THIS SPACE*****
*
*
*
*
*
*
*
*
*
*

CALCULATED VALUES:

Ingestion area correction factor: 1.0
External/inhalation area correction factor: 1.0
Inhalation exposure modification factor: .00
External exposure modification factor: 5.70E-02

FIGURE 3.12 (Contd)

 ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
 (MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE6.IN / MAXI Sample Problem Six; Stored Waste Sub-set of Scenario

Executed on: 10/ 2/1986 at 15:13:18

Page 3

SOIL, AIR, AND WATER CONCENTRATION SUMMARY FOR YEAR: 0

Radio- nuclide	Surface Soil pCi/m2	Deep Soil pCi/m3	Air pCi/m3	Irrigation pCi/L	Drink Water pCi/L
-----	-----	-----	-----	-----	-----
CO 60	.0E+00	2.0E+10	.0E+00	.0E+00	.0E+00

SOIL, AIR, AND WATER CONCENTRATION SUMMARY FOR YEAR: 49

Radio- nuclide	Surface Soil pCi/m2	Deep Soil pCi/m3	Air pCi/m3	Irrigation pCi/L	Drink Water pCi/L
-----	-----	-----	-----	-----	-----
CO 60	.0E+00	3.1E+07	.0E+00	.0E+00	.0E+00

FIGURE 3.12 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE6.IN / MAXI Sample Problem Six; Stored Waste Sub-set of Scenario

Executed on: 10/ 2/1986 at 15:13:18

Page 4

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 0 FOR TOTAL BODY-----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	6.1E+00	100	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
6.1E+00	.0E+00	0	.0E+00	0	6.1E+00	100	.0E+00	0	.0E+00	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 0 FOR BONE -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	6.1E+00	100	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
6.1E+00	.0E+00	0	.0E+00	0	6.1E+00	100	.0E+00	0	.0E+00	0

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 0 FOR LUNGS -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	6.1E+00	100	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
6.1E+00	.0E+00	0	.0E+00	0	6.1E+00	100	.0E+00	0	.0E+00	0

FIGURE 3.12 (Contd)

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 0 FOR THYROID -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	6.1E+00	100	.0E+00	0	.0E+00	0
TOTAL	6.1E+00									
	.0E+00	0	.0E+00	0	6.1E+00	100	.0E+00	0	.0E+00	0

FIGURE 3.12 (Contd)

ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation
(MAXI Version IBM 1.0 30-Jun-86)

Case title: SAMPLE6.IN / MAXI Sample Problem Six; Stored Waste Sub-set of Scenario

Executed on: 10/ 2/1986 at 15:13:18

Page 5

----- MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR 0 FOR LLI -----

RADIO- NUCLIDE	EXPOSURE PATHWAY									
	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
	REM	%	REM	%	REM	%	REM	%	REM	%
C060	.0E+00	0	.0E+00	0	6.1E+00	100	.0E+00	0	.0E+00	0
TOTAL	INGESTION		INHALATION		EXTERNAL		AQUATIC FOOD		DRINK WATER	
6.1E+00	.0E+00	0	.0E+00	0	6.1E+00	100	.0E+00	0	.0E+00	0

FIGURE 3.12 (Contd)

3.3 INPUT PARAMETERS

This section contains a discussion of input parameters ordered as in the MAXI1 input file. The purpose of this section is to provide more detailed information on each of the parameters than can be contained in the MAXI1 input file. The MAXI1 parameter name is listed to the extreme right on the MAXI1 input file.

Attempts were made to simplify MAXI1 logic when the IBM PC/XT/AT version was created. Consequently, most multi-purpose parameters have been redefined as two or more separate parameters. This feature simplifies input parameter descriptions. Change in usage from earlier versions of the ONSITE/MAXI1 computer programs will be noted for each parameter as appropriate. Parameter values for the five defined scenarios are presented in Table 3.1. Parameter values for the six sample problems are presented in Table 3.2. Tables 3.1 and 3.2 are located at the end of this subsection.

IEXT	Option set to consider the external exposure and terrestrial-crop root penetration pathway for waste modelled as a slab (volume) source. Waste may be stored aboveground, buried at the soil surface, or buried with a soil overburden. Allowable values are: 0-do not consider this pathway, 1-consider this pathway.
ISUR	Option set to consider the external exposure to the surface contamination pathway for waste modelled as a plane source. This pathway is selected to consider either a waste spill or agricultural activities as defined in Scenarios 3 and 4. Allowable values are: 0-do not consider this pathway, 1-consider this pathway.
INHA	Option set to consider inhalation of contamination from resuspended material and/or contamination that has blown in from offsite. Definition of this parameter in MAXI1 has simplified option testing. Allowable values: 0-do not consider this pathway, 1-consider this pathway.
IFOD	Option set to consider ingestion of terrestrial food products. Allowable values: 0-do not consider this pathway, 1-consider this pathway.
IARG	Option set to consider ingestion of aquatic food products. Allowable values: 0-do not consider this pathway, 1-consider this pathway.
IWAT	Option set to consider ingestion of drinking water. Allowable values: 0-do not consider this pathway, 1-consider this pathway.
IAIR	Option to allow an offsite source of continuing deposition via the atmospheric pathway to contaminate the site. The start of the deposition may begin before the start of the dose calculation period at a time IBLOW years earlier. In addition, the external source may be allowed to decay, from its initial value at time

IT1, if the option IDKAIR is set. For times less than IT1, the source term is reconstructed from the source given for IT1. Allowable values: 0-do not consider this pathway, 1-consider this pathway.

- IEDE Option set to consider the dosimetry methodology given in ICRP Publication No. 30 as well as ICRP Publication 2. When this option is selected, the annual effective dose equivalent (AEDE) is calculated in addition to the maximum annual dose to each organ. Allowable values: 0-do not consider this option, 1-consider this option.
- IDKAIR Option set to allow decay of the atmospheric source term (QK) starting at time IT1. Allowable values: 0-do not consider this option, 1-consider this option.
- IDKWAT Option set to allow decay of river/aquatic release source term (QI) from its initial value at time IT1. Allowable values: 0-do not consider this option, 1-consider this option.
- INTRUD Option set to consider a special one-year-of-exposure-only intruder model. The intruder in this model resides at the waste disposal site for one year only. Allowable values: 0-do not consider this option, 1-consider this option.
- IOUT Option set to indicate level of detail desired in output reports.

If option IEDE has not been set, the following reports are indicated by these indices:

- 1 - tables of maximum annual doses per organ with radionuclide and pathway contribution
- 2 - the tables listed above and a running summary of the annual doses listed by organ and total only
- 3 - the above summaries and all annual tables by organ, pathway and radionuclide.

If option IEDE has been set, the following reports are indicated by these indices:

- 1 - the annual effective dose equivalent (AEDE) and the maximum annual dose (and maximum year) to each organ
- 2 - the committed dose equivalent by organ, the effective dose equivalent, external dose equivalent, and the annual effective dose equivalent

	3 - the committed dose equivalent to each organ by radionuclide and pathway plus the maximum annual dose to each organ by radionuclide and pathway for the maximum year for each organ.
DEBUG(4)	Logical set if a special report of library and intermediate parameter values is requested. This report is useful when performing hand calculations for verification purposes.
IT1	The year after waste disposal when intrusion occurs and the annual dose and annual effective dose equivalent calculations begins. This parameter allows for correct chain decay of the source term.
IT2	The year dose calculations cease, normally IT1 + 49.
INUT	Release term input units: <ul style="list-style-type: none"> 1 - pCi 2 - μCi 3 - mCi 4 - Ci
M3M2	Soil source input unit, in terms of: <ul style="list-style-type: none"> 0 - INUT/m_3^2 1 - INUT/m 2 - INUT/kg
NIN	Number of radionuclides in the release term. Change this index to correspond to the number of radionuclides in the source term.
E	Two-character element symbol for this radionuclide.
A	Mass number of this radionuclide as specified in the file RMDONS. Input may be up to six characters in length and include metastable (M) designation. Radionuclide names (E+A) must be found in the radionuclide master library for ONSITE/MAXI1 named RMDONS, listed in Appendix B. Note: the "including daughters" designation (+D) has been deleted from the IBM PC/XT/AT version of ONSITE/MAXI1 for consistency with the ICRP Publication No. 30 methodology.
Q	Contamination deposited on the site at start of calculation. This contamination may be: <ul style="list-style-type: none"> 1 - deposited on the surface (in this case parameter ISUR should be set to 1)

- 2 - stored at the site (in this case parameter IEXT should be set to 1)
- 3 - deeply buried at the site (in this case parameter IEXT should be set to 1).

Input units are as specified by the parameters INUT and M3M2.

QI Irrigation/river release source in units of activity, as specified by the parameter INUT, per liter. To consider irrigation of terrestrial crops with contaminated water from this source, set the parameter IFOD to 1. To consider ingestion of aquatic foods grown in this contaminated water, set parameter IARG to 1.

QJ Drinking water source term in units of activity, as specified by the parameter INUT, per liter. To consider ingestion of drinking water from this contaminated source, set the parameter IWAT to 1.

QK Atmospheric release source term in units of activity, as specified by the parameter INUT, per year. This parameter allows consideration of airborne contamination deposited onto the site from offsite sources. To consider air contamination concentration contributions from this source, set the parameter IAIR to 1. To consider contamination buildup from this source, input a value for the parameter IBLOW.

NOTE: Q, QI, QJ, QK are input

Values entered for the above parameters must fall in the columns as designated by the dashed lines in the column headings. Values entered with exponential notation (i.e., FORTRAN E format) must be right-justified in the columns.

SRDIL Inventory dilution/modification factor for the soil source term. This factor allows the user to:

- 1 - assume uniform mixing of the contaminated waste with clean soil; the ONSITE/MAXI1 scenarios all assume a value of 0.2, the default value is 1.0.
- 2 - apply a consistent modification factor to all radionuclides in the source term.

DILF Inventory modification factor for the irrigation/aquatic foods source term.

FRSIZ Size of the waste disposal site in terms of fractional ha. This term is meaningful only for site sizes less than 1.0 ha. Area correction factors are calculated for:

1 - internal pathways (parameter AREAIN)

2 - external pathways (parameter AREAEX)

to account for the limited exposure potential from smaller disposal sites. Note: the parameters AREAIN and AREAEX are now calculated in MAXI1 instead of ONSITE to simplify the input process.

RPF2 Fraction of the total terrestrial foods/food products diet that is grown on the waste disposal site.

NOTE on SRDIL, DILF, FRSIZ, and RPF2 parameter interaction:

The parameters SRDIL/DILF, AREAIN (calculated from FRSIZ), AREAEX (calculated from FRSIZ), and RPF2 are all multipliers applied to the exposure/dose calculations. For example, a value of 0.2 for SRDIL and a value of 0.5 for RPF2 will result in a total modification 0.1 to the dose received from the terrestrial foods pathway, assuming the source term was located in the soil (Q).

HREXT Number of hours per year of external exposure to the contamination.

HRINH Number of hours per year that the intruder inhales airborne contamination.

PLANAM Name of the file containing the library of external exposure dose rate factors in units of mrem/yr per pCi/m². Three files are available for assignment from the ONSITE/MAXI1 data base. The dose rate factors pertain to an infinite plane of soil contamination with a waste thickness of 15 cm. The three files provide values for three different assumed waste densities:

PLANE.A.DAT	-	Waste density: 1.8 g/cm ³
PLANE.B.DAT	-	Waste density: 1.0 g/cm ³
PLANE.C.DAT	-	Waste density: 0.6 g/cm ³

This parameter is only used when the parameter ISUR has been set to 1.

VOLNAM Name of the file containing the library of external exposure dose rate factors in units of mrem/yr per pCi/m³. Twelve files are available for assignment from the ONSITE/MAXI1 data base. The 12 data files form four data sets describing possible waste configurations. The data sets, their waste configurations, and the associated files are as follows:

- 1 - Infinite surface slab source, waste extends to a depth of 1.0 m.

VOLSA.DAT	-	Waste density: 1.8 g/cm ³
VOLSB.DAT	-	Waste density: 1.0 g/cm ³
VOLSC.DAT	-	Waste density: 0.6 g/cm ³

- 2 - Infinite slab source, buried in soil with an overburden depth of 0.5 m, waste thickness of 1.0 m.

BURHFA.DAT	-	Waste density: 1.8 g/cm ³
BURHFB.DAT	-	Waste density: 1.0 g/cm ³
BURHFC.DAT	-	Waste density: 0.6 g/cm ³

- 3 - Infinite slab source, buried in soil with an overburden depth of 1.0 m, waste thickness of 1.0 m.

BUR1A.DAT	-	Waste density: 1.8 g/cm ³
BUR1B.DAT	-	Waste density: 1.0 g/cm ³
BUR1C.DAT	-	Waste density: 0.6 g/cm ³

- 4 - Rectangular slab source, 10.0 m x 3.0 m, waste thickness of 1.0 m.

STOREDA.DAT	-	Waste density: 1.8 g/cm ³
STOREDB.DAT	-	Waste density: 1.0 g/cm ³
STOREDB.DAT	-	Waste density: 0.6 g/cm ³

This parameter is only used when the parameter IEXT is set to 1.

NOTE on ISUR, PLANAM, IEXT, and VOLNAM interactions:

The file identified as PLANAM is assigned to logical unit number lun 2 by MAXI. The file identified as VOLNAM is assigned to lun 7. Files assigned to luns 2 and 7 perform essentially the same functions. Historically, input to PLANAM was defined as dose factors with units of rem/yr per pCi/m², while input to VOLNAM, assumed to be generated by the ISOSHL computer program (Engel, Greenborg, and Hendrickson 1966), was defined in terms of mrem/yr per pCi/m³. The MAXI computer program operates internally in soil concentration units of pCi/m², defined by the root and leaf pathway parameters. Whenever the external doses are calculated, the soil concentration units are converted to be compatible with the dose factors. File assignments to luns 2 and 7 are maintained in the present version of MAXI to allow simultaneous consideration of two distinct source geometries (e.g., surface and buried contaminated soil, contaminated soil and a point source, etc.).

BRATE Breathing rate of the intruder (cm^3/sec). A default value of $20 \text{ m}^3/\text{d}$ is consistent with methodology of ICRP Publication No. 30.

A breathing rate of $20 \text{ m}^3/\text{d}$ (ICRP 1975) was assumed in the DACRIN (Houston, Streng, and Watson 1974) calculations used to generate the inhalation dose rate factors library FILE23.DAT. For maximum annual dose calculations, the breathing rate is adjusted by $\text{BRATE}/230.0$.

IRES Option set to select model to use for resuspension calculations: 0-Use Anspaugh Model, 1-Use Mass Loading Model. This parameter will effect inhalation (INHA) and terrestrial food via leaf deposition (IFOD) calculations.

Two input parameters are requested for resuspension calculations. The parameters AGE and XDPTIN are associated with the Anspaugh Model, the parameters DEN and XMLF with the Mass Loading Model.

AGE/DEN AGE: The number of years that contamination existed on the surface, to account for environmental weathering, at the start of the scenario. Allowable range: 0.0 to 25.0. Default value: 0.0.

DEN: The density of the surface soil (g/m^3). Allowable range: 1.0×10^5 to 5.0×10^7 . Default value: 1.0×10^6 .

XDPTIN/XMLF XDPTIN: The contaminated surface soil is available for resuspension to a depth of XDPTIN cm. Allowable range: 0.0 to 15.0. Default value: 1.0.

XMLF: The Mass Loading Factor (g/m^3). Allowable range: 1.0×10^{-7} to 0.1. Default value: 1.0×10^{-4} .

IBLOW See IAIR; the number of years prior to scenario initiation that the offsite atmospheric source begins. This parameter is only considered when the parameter IAIR is set to 1.

XQSITE The air concentration per unit release (Chi/Q in sec/m^3) of the atmospheric release of the source term (QK) at the disposal site. This parameter is only used when the parameter IAIR is set to 1.

ICLNUP Option set to consider drinking water cleanup factors. This parameter was added to the current version of the MAXI1 program to allow greater flexibility of "environment"/scenario generation. Allowable values: 0- do not use cleanup factors, 1-use cleanup factors. Default value: 1.

I1109 Option set to consider Regulation Guide 1.109 (U.S. NRC 1977) food transfer coefficients for plants from soil for the radionuclides ^3H and ^{14}C . These coefficients, MAXI1 parameter

FDTC, [pCi per gram₃ plant (wet)/pCi per gram soil (dry)] replace the 0.0 values for ³H and ¹⁴C read from the food transfer coefficient library in file FTRANS.DAT. This parameter was added to the current version of the MAXII program to eliminate the need for a special version of FTRANS.DAT containing the Regulation Guide 1.109 values. Allowable values: 0₃ do not consider Reg. Guide 1.109 plant up-take₃ values₁₄ for ³H and ¹⁴C, 1-consider Reg. Guide 1.109 values for ³H and ¹⁴C. Default value: 1.

RF1 Fraction of terrestrial plant roots in the surface soil layer (assumed to extend to a depth of 15.0 cm).

RF2 Fraction of terrestrial plant roots extending below the 15.0-cm-deep surface soil layer.

RPF1 This is the ratio of waste concentration in surface soil to that in subsurface soils at the waste disposal site. This parameter is used only when contamination is assumed to be present in both surface and subsurface soil. RPF1 allows redistribution of the waste in the soil. Range: 0.0 to 1.0 for buried to surface redistribution. Default value is 1.0. Option IEXT must be set on.

IMO Months per year that irrigation is applied to terrestrial food crops. Default value: 6. This parameter is only used when IFOD is set to 1 and a value has been entered for QI.

RIRR Irrigation rate for terrestrial food crops (L/m²/mo). This parameter is only used when the parameter IFOD is set to 1 and a value has been entered for QI. Default value: 150.0.

IRR Number of years irrigation source (QI) is irrigated onto the site prior to the beginning of the dose calculation period. Default value: 0.

NFT Number of terrestrial food types to be considered for this scenario. Allowable range: 0 to 14.

KFD TYP Numeric index indicating the food types to consider. Allowable entries are as follows:

- 1 - Leafy vegetables
- 2 - Other aboveground vegetables
- 3 - Potatoes
- 4 - Other root vegetables
- 5 - Berries
- 6 - Melons
- 7 - Orchard fruit
- 8 - Wheat
- 9 - Other grain
- 10 - Eggs

- 11 - Milk
- 12 - Beef
- 13 - Pork
- 14 - Poultry

NOTE: For food types 10, 11, 12, 13, and 14; the values of GRWP, YELD, and TRANS apply to the feed and fodder that the animal eats.

NOTE: Be careful to right-justify the indices under the "FOOD TYPE INDEX" column heading.

GRWP The growing period in days of the corresponding food type.
For animal products, this is the growing period of the fodder
that the animal eats.

YELD The yield in kg/m^2 per year of the corresponding food type.

HLDUP The holdup period in days for the corresponding food type.

CON The consumption rate in kg/yr or L/yr of the corresponding
food type.

TRANS The translocation factor of the corresponding food type.

NPT Number of drinking water/aquatic food types to be considered for
this scenario. Range: 1 to 5.

KPTHWY Numeric index of the drinking water/aquatic food pathways
considered. Allowable values are:

- 1 - Fish
- 2 - Crustacea
- 3 - Mollusks
- 4 - Aquatic plants
- 5 - Drinking water

NOTE: Be careful to right-justify parameter values under the column heading
"TYPE INDEX."

HLDUP2 The holdup period in days for the corresponding drinking
water/aquatic food type.

USAG Consumption of drinking water and each aquatic food type; kg/yr
for edibles, and L/yr drinking water.

NOTE GRWP, YELD, HLDUP, CON, TRANS, HLDUP2, USAG input:

Values entered for the above parameters must fall in the columns
as designated by the dashed lines in the column headings.
Values entered with exponential notation (i.e., E format) must
be right-justified in the columns.

TABLE 3.1. Scenario Default Parameter Values

Parameter Name	Scenario No. 1	Scenario No. 2	Scenario No. 3	Scenario No. 4	Scenario No. 5	Waste Subset
IEXT	1	1	0	0	1	1
ISUR	0	0	1	1	1	0
INHA	0	1	1	1	1	0
IFOD	0	0	1	1	1	0
IARG	0	0	0	0	1	0
IWAT	0	0	0	1	1	0
IAIR	0	0	0	0	0	0
IEDE	0	0	0	0	0	0
IDKAIR	0	0	0	0	0	0
IDKWAT	0	0	0	0	0	0
INTRUD	0	0	0	0	0	0
IOUT	0	0	0	0	0	0
DEBUG(4)	.F.	.F.	.F.	.F.	.F.	.F.
IT1	1	1	1	1	1	1
IT2	50	50	50	50	50	50
INUT	1	1	1	1	1	1
M3M2	1	1	1	1	1	1
SRDIL	0.2	0.2	0.2	0.2	0.2	0.2
DILF	1.0	1.0	1.0	1.0	1.0	1.0
FRSIZ	1.0	1.0	1.0	1.0	1.0	1.0
RPF2	1.0	1.0	1.0	1.0	1.0	1.0
HREXT	2000.0	2000.0	2000.0	2000.0	8766.0	2000.0
HRINH	0.0	2000.0	2000.0	2000.0	8766.0	0.0
PLANAM	PLANEA	PLANEA	PLANEA	PLANEA	PLANEA	PLANEA
VOLNAM	BURHFA	BURHFA	BURHFA	BURHFA	BURHFA	STOREDA
BRATE	270.0	270.0	270.0	270.0	270.0	270.0
IRES	0	0	0	0	1	0
AGE/DEN	0.	0.	0.	0.	1.0E6	0.
XPDTIN/XMLF	1.0	1.0	1.0	1.0	1.0E-4	1.0
IBLOW	0	0	0	0	0	0
XQSITE	0.0	0.0	0.0	0.0	0.0	0.0
ICLNUP	1	1	1	1	1	1
I1109	1	1	1	1	1	1
RF1	1.0	1.0	1.0	1.0	1.0	1.0
RF2	0.0	0.0	0.0	0.0	0.0	0.0
RPF1	0.0	1.0	1.0	1.0	0.0	0.0
IMO	6	6	6	6	6	6
RIRR	150.0	150.0	150.0	150.0	150.0	150.0
IRR	0	0	0	0	0	0

TABLE 3.2. Sample Problem Parameter Values

Parameter Name	Sample Problem No. 1	Sample Problem No. 2	Sample Problem No. 3	Sample Problem No. 4	Sample Problem No. 5	Sample Problem No. 6
IEXT	1	1	0	0	1	1
ISUR	0	0	1	1	1	0
INHA	0	1	1	1	1	0
IFOD	0	0	1	1	1	0
IARG	0	0	0	0	1	0
IWAT	0	0	0	1	1	0
IAIR	0	0	0	0	0	0
IEDE	0	0	1	0	0	0
IDKAIR	0	0	0	0	0	0
IDKWAT	0	0	0	0	0	0
INTRUD	0	0	0	0	0	0
IOUT	0	0	2	0	0	0
DEBUG(4)	.F.	.F.	.F.	.F.	.F.	.F.
IT1	10	10	10	10	10	10
IT2	59	59	59	59	59	59
INUT	4	4	4	1	1	4
M3M2	1	1	1	1	1	1
SRDIL	0.2	0.2	0.2	0.2	0.2	0.2
DILF	1.0	1.0	1.0	1.0	1.0	1.0
FRSIZ	1.0	1.0	0.05	1.0	1.0	1.0
RPF2	1.0	1.0	1.0	1.0	1.0	1.0
HREXT	2000.0	3000.0	2000.0	2000.0	2000.0	500.0
HRINH	0.0	3000.0	2000.0	2000.0	2000.0	0.0
PLANAM	PLANEA	PLANEA	PLANEA	PLANEA	PLANEA	PLANEA
VOLNAM	BURHFA	VOLSA	BURHFA	BURHFA	BUR1A	STOREDB
BRATE	270.0	270.0	270.0	270.0	270.0	270.0
IRES	0	0	0	0	1	0
AGE/DEN	0.	0.	0.	0.	1.0E6	0.
XPDTIN/XMLF	1.0	1.0	1.0	1.0	1.0E-4	1.0
IBLOW	0	0	0	0	0	0
XQSITE	0.0	0.0	0.0	0.0	0.0	0.0
ICLNUP	1	1	1	1	1	1
I1109	1	1	1	1	1	1
RF1	1.0	1.0	1.0	1.0	0.6	1.0
RF2	0.0	0.0	0.0	0.0	0.4	0.0
RPF1	0.0	1.0	1.0	1.0	0.0	0.0
IMO	6	6	6	6	6	6
RIRR	150.0	150.0	150.0	150.0	150.0	150.0
IRR	0	0	0	10	10	0

3.4 ERROR AND RECOVERY

To further ease the user interaction with the ONSITE/MAXI1 computer program, error-checking and recovery capabilities have been added. The following paragraphs describe the error and recovery procedures that have been built into the ONSITE/MAXI1 computer program.

3.4.1 Error and Recovery - ONSITE

ONSITE has extensive error-checking and interactive recovery capabilities. Most input values are tested against minimum and maximum allowable limits. If a value does not fall within the allowable limits, the user is asked immediately to re-enter that value.

ONSITE will display error messages if an invalid file name is selected by the user or if the program is unable to locate and access a data base file. The following messages are displayed by ONSITE. Details of the error condition are discussed and appropriate corrective actions are suggested.

"Error opening radionuclide library." The program could not access the radionuclide library, RMDONS. Refer this problem to the person maintaining the ONSITE/MAXI1 computer package.

"Premature end-of-file discovered in library." The program expected additional data in the master radionuclide library, RMDONS. Refer this problem to the person maintaining the ONSITE/MAXI1 computer package.

3.4.2 Error and Recovery - MAXI1

MAXI1 generates the following error messages listed in alphabetical order. Extended explanations and corrective actions are included, if applicable.

- 1) DECAY CHAIN n1 HAS IMPROPER ORDER. CURRENT MEMBER INDEX IS n2. (RLIBIN).

This message indicates a problem with a decay chain organization while reading the master radionuclide library. Its occurrence indicates that 1) an unsuccessful update was made to the library, or 2) the file has been corrupted. In either case, refer the problem to the person maintaining the data base.

- 2) END OF FILE ON MASTER LIBRARY UNIT 10. STOP (RLIBIN).

MAXI1 expected additional records in the master radionuclide library. This message indicates that 1) an unsuccessful update was made to the library, or 2) the file has been corrupted. In either case, refer the problem to the person maintaining the data base.

- 3) FIL30: Error opening file: nnnnnnnn.nnn assigned to LUN mmm.

In this error message, nnnnnnnn.nnn is the name of the library file that MAXI1 was not able to open, and mmm is the logical unit to which MAXI1 was attempting to assign the file. This error will occur when the file containing ICRP Publication No. 30 dose rate factors cannot be found. Check that the file named nnnnnnnn.nnn resides in the **MAXI** subdirectory and that you are executing the MAXI1 program from the **MAXI** subdirectory.

- 4) FIL30: Error reading organ index for rrrrrrrr in file nnnnnnnn.nnn assigned to LUN mmm.

In this error message, rrrrrrrr is the name of the radionuclide, nnnnnnnn.nnn is the name of the library file in which the error occurred, and mmm is the logical unit to which the file was assigned. This error is most likely to occur when the ICRP Publication No. 30 dose rate factor file has been corrupted. Try recopying the file ORGLIB.DAT from the ONSITE/MAXI1 distribution disk.

- 5) FIL30: Error reading library title of file: nnnnnnnn.nnn assigned to LUN mmm.

In this error message, nnnnnnnn.nnn is the name of the library file in which the error occurred, and mmm is the logical unit to which the file was assigned. This error occurs when the ICRP Publication No. 30 dose rate factor file is empty or corrupted. Try recopying the named file from the ONSITE/MAXI1 distribution disk.

- 6) File: nnnnnnnn.nnn with plane source dose rate factors was not found. Program terminated.

Based on options selected in your input file, MAXI1 expected to read the file named nnnnnnnn.nnn. If input parameters ISUR was properly set to 1 for this scenario, verify that the file name was not misspelled. This message is printed in module MAXI1.

- 7) File: nnnnnnnn.nnn with slab source dose rate factors was not found. Program terminated.

Based on options selected in your input file, MAXI1 expected to read the file named nnnnnnnn.nnn. If input parameter IEXT was properly set to 1 for this scenario, verify that the file name was not misspelled. This message is printed in module MAXI1.

- 8) FILHAN: Error opening file: nnnnnnnn.nnn assigned to LUN mmm.

In this error message, nnnnnnnn.nnn is the name of the library file that MAXI1 was not able to open, and mmm is the logical unit to which MAXI1 was attempting to assign the file. This error is most likely to occur when a file cannot be found. Check that all library files reside in the **MAXI**

subdirectory and that you are executing the MAXI1 program from the MAXI subdirectory.

- 9) FILHAN: Error reading organ index for rrrrrrrr in file nnnnnnnn.nnn assigned to LUN mmm.

In this error message, rrrrrrrr is the name of the radionuclide, nnnnnnnn.nnn is the name of the library file in which the error occurred, and mmm is the logical unit to which the file was assigned. This error is most likely to occur when the organ data library, ORGLIB.DAT, has been corrupted. Try recopying the file ORGLIB.DAT from the ONSITE/MAXI1 distribution disk.

- 10) FILHAN: Error reading library title of file: nnnnnnnn.nnn assigned to LUN mmm.

In this error message, nnnnnnnn.nnn is the name of the library file that in which the error occurred, and mmm is the logical unit to which the file was assigned. This error is most likely to occur in the event of an empty or corrupted file. Try recopying the named file from the ONSITE/MAXI1 distribution disk.

- 11) IMPROPER NUMBER OF NUCLIDES IN MASTER LIBRARY, NUC = n (RLIBIN).

The program expected to find n records in the radionuclide master library. This message indicates that 1) an unsuccessful update was made to the library, or 2) the file has been corrupted. In either case, refer the problem to the person maintaining the data base.

- 12) INSET: Error opening file nnnnnnnn.nnn assigned to LUN mmm.

An error occurred while attempting to open the inhalation dose rate factor library file. This usually indicates that the file cannot be found. Check that the file named nnnnnnnn.nnn resides in the MAXI subdirectory and that you are executing the MAXI1 program from the MAXI subdirectory.

- 13) No inventory or error in subroutine ORDER.

After checking the inventory against the master data file, MAXI1 determined that there were 0 radionuclides in the source term. Check input file inventory data set.

- 14) No. of radionuclides (including daughters) = n. Maximum allowed = n2.

The maximum number of radionuclides that can be considered in a scenario is n2. After including daughters, the source term was determined to have n entries.

- 15) THERE ARE UNIDENTIFIED NUCLIDES, ISTOP = n.

This message is printed by subroutine IDNUC giving the total number (n) of radionuclide names that were not identified in the master radionuclide library. The program will not execute until all name discrepancies have

- been resolved. Be sure to change the number of radionuclides (NONUC) if any radionuclides are eliminated at this time.
- 16) THIS CODE WILL NOT RUN WITHOUT AT LEAST ONE PLANT PATHWAY -- STOP.
- If animal products are considered, at least one plant type must be included in the scenario for proper functioning of animal fodder calculations. If you wish to consider the intruder eating animal products only, set consumption (CON) of the plant type to 0.0.
- 17) Unidentified radionuclide in input inventory, rrrrrrrr
- This message is printed by subroutine IDNUC to identify those input radionuclides that MAXII does not recognize. Reference the file RMDONS.DAT to determine if rrrrrrrr is misspelled, or not included in the master list of radionuclides.

REFERENCES

- Engel, R. L., J. Greenborg, and M. M. Hendrickson. 1966. ISOSHL - A Computer Code for General Purpose Isotope Shielding Analysis. BNWL-236, Pacific Northwest Laboratory, Richland, Washington.
- Houston, J. R., D. L. Streng, and E. C. Watson. 1974. DACRIN - A Computer Program for Calculating Organ Dose from Acute or Chronic Radionuclide Inhalation. BNWL-B-389, Pacific Northwest Laboratory, Richland, Washington.
- International Business Machines (IBM) Corporation. 1983. Disk Operating System Version 2.1 Reference. IBM Corporation, Boca Raton, Florida.
- International Business Machines (IBM) Corporation. 1985. Disk Operating System Version 3.1 Reference. IBM Corporation, Boca Raton, Florida.
- International Commission on Radiological Protection (ICRP). 1959. Report of ICRP Committee II on Permissible Dose for Internal Radiation. ICRP Publication No. 2, Pergamon Press, Elmsford, New York.
- International Commission on Radiological Protection (ICRP). 1975. Report of the Task Group on Reference Man. ICRP Publication No. 23, Pergamon Press, Elmsford, New York.
- International Commission on Radiological Protection (ICRP). 1977. Recommendations of the International Commission on Radiological Protection. ICRP Publication No. 26, Pergamon Press, Elmsford, New York.
- International Commission on Radiological Protection (ICRP). 1979-1982. Limits for Intakes of Radionuclides by Workers. ICRP Publication No. 30, Parts 1, 2, and 3 (and supplements), Pergamon Press, Elmsford, New York.
- Kennedy, W. E., Jr., R. A. Peloquin, B. A. Napier, and S. M. Neuder. 1986. Intruder Dose Pathway Analysis for the Onsite Disposal of Radioactive Wastes.

- The ONSITE/MAXI1 Computer Program. NUREG/CR-3620, Supplement 1, National Technical Information Service, Springfield, Virginia.
- Napier, B. A. 1982. A Method for Determining "Allowable Residual Contamination Levels" of Radionuclide Mixtures in Soil. PNL 3852, Pacific Northwest Laboratory, Richland, Washington.
- Napier, B. A., R. A. Peloquin, W. E. Kennedy, Jr., and S. M. Neuder. 1984. Intruder Dose Pathway Analysis for the Onsite Disposal of Radioactive Wastes: The ONSITE/MAXI1 Computer Program. NUREG/CR-3620, National Technical Information Service, Springfield, Virginia.

4.0 PROGRAMMING STRUCTURE AND HIERARCHY

ONSITE/MAXI1 is a package of two separate computer codes and a data base. All the computer codes have been designed in modular fashion and are written to meet ANSI FORTRAN-77 standards. The hierarchical organization of code modules and module functions of ONSITE and MAXI1 are displayed in Figures 4.1 and 4.2, respectively.

FIGURE 4.1. ONSITE Module Hierarchy and Function

FIGURE 4-2. MAXI1 Module Hierarchy and Function

FIGURE 4.2 (Contd)

FIGURE 4.2 (Contd)

APPENDIX A
COMPUTER PROGRAM LISTINGS

APPENDIX A
COMPUTER PROGRAM LISTING - MAXI

\$INCLUDE: 'COMPILE.OPT'

Program Title: MAXI1

Developed for: U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Material Safety &
Safeguards (NMSS)
Division of Waste Management

Date: October 30, 1986

NRC Contacts: Dr. Stanley M. Neuder (301) 427-4533 or FTS 427-4533
Dr. R. B. Neel (301) 427-4559 or FTS 427-4559
U.S. Nuclear Regulatory Commission
MS 623-SS, Willste Building
Washington, DC 20555

Code Developer: W. E. Kennedy, Jr., B. A. Napier, R. A. Peloquin
Pacific Northwest Laboratory
Richland, WA 99352
Telephone (commercial and FTS): (509) 375-3849 (WEK)

Documentation: Kennedy, W. E., Jr., R. A. Peloquin, B. A. Napier,
and S. M. Neuder. 1986. INTRUDER DOSE PATHWAY
ANALYSIS FOR THE ONSITE DISPOSAL OF RADIOACTIVE
WASTES: THEN ONSITE/MAXI1 COMPUTER PROGRAM.
NUREG/CR-3620 Supplement 2, U.S. Nuclear Regulatory
Commission, Washington, D.C.

Computer Code Availability:

Information regarding the availability of this computer program
is available from

U.S. Nuclear Regulatory Commission
Information Technology Services Support Center
Mail Stop P-808
Washington, DC 20555
Telephone: (301) 492-4160 or FTS 492-4160

This program was prepared for an agency of the United States
Government. Neither the United States Government nor any agency
thereof, or any of their employees, makes any warranty, expressed
or implied, or assumes any legal liability or responsibility for

```

C   any third party's use, or the results of such use, of any portion
C   of this program, or represents that its use by such third party
C   would not infringe privately owned rights.
C
C
C-----
C
C
C   PROGRAM MAXI1
C
C   This program is designed to calculate annual radiation doses from
C   ingestion, inhalation, external surface contamination, and aquatic
C   food and water ingestion resulting from residual radioactivity at
C   decommissioned nuclear facilities and waste storage sites.
C
C   Version of 24-Sep-86 RAP
C
C-----
C
C
C$INCLUDE: 'INVIN.CMN'
C$INCLUDE: 'INVOUT.CMN'
C$INCLUDE: 'OPT.CMN'
C$INCLUDE: 'INPUT.CMN'
C$INCLUDE: 'PATH.CMN'
C$INCLUDE: 'RAD.CMN'
C$INCLUDE: 'MONITR.CMN'
C$INCLUDE: 'TITL.CMN'
C$INCLUDE: 'DAYPC.CMN'
C$INCLUDE: 'FILNAM.CMN'
C
C   LOGICAL LIVE
C
C   Get system time and date--
C   CALL MAKDAT
C
C
C---- Read input for this case and check selected DRF files -----
C
C   OPEN (5, FILE=FILN(5), STATUS='OLD')
C   CALL READIN
C   CLOSE (5)
C   OPEN (6, FILE=FILN(6), STATUS='OLD')
C
C   IF (ISUR .EQ. 1) THEN
C     LIVE = .FALSE.
C     INQUIRE (FILE=PLANAM, EXIST=LIVE)
C     IF (LIVE) THEN
C       FILN(2) = PLANAM
C     ELSE
C       GOTO 92

```

```

        ENDIF
    ENDIF

    IF (IEXT .EQ. 1) THEN
        LIVE = .FALSE.
        INQUIRE (FILE=VOLNAM, EXIST=LIVE)
        IF (LIVE) THEN
            FILN(7) = VOLNAM
        ELSE
            GOTO 93
        ENDIF
    ENDIF

C
C
C---- Set up parameters for this case -----
C
C    Calculate area/exposure correction factors--
    CALL AREA
    XF = HREXT / 8766.
    RINH = HRINH / 8766.
    XDPT = XDPTIN/15.0

C    Identify radionuclides in inventory--
    CALL IDNUC

C
C    Order radionuclides and include daughters--
    CALL ORDER

C
C    Read libraries/external exposure DRFs and store values--
    CALL FILHAN
    IF (IEDE .EQ. 1) CALL FIL30

C
C    Read incremental inhalation doses from library--
    IF (INHA .EQ. 1) CALL INSET

C
C    Print report of input parameters--
    CALL QAPAGE

C
C    Calculate ingestion dose rate factors--
    CALL DFCALC

C
C---- Perform calculations -----
C
C    Calculate pathway doses--
    CALL PADOS

C
C    Calculate annual doses--
    CALL ANDOS(NORG)

C
C    Determine maximum annual dose--
    CALL MAXDOS(NORG, NONUC)
C

```



```

C      Print results--
      IF (IEDE .EQ. 1) THEN
          CALL EDECAL
          CALL OUT30
      ENDIF
      CALL OUTPUT
      CLOSE (6)
C
C      STOP
C
C----- Error Messages -----
C
      92 WRITE (*,601) PLANAM
      601 FORMAT (' File: ',A12,' with plane source dose rate factors',
        .      ' not found. Program terminated.')
          STOP

      93 WRITE (*,602) VOLNAM
      602 FORMAT (' File: ',A12,' with slab source dose rate factors',
        .      ' not found. Program terminated.')
          STOP

C-----
C
      END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE ACHAIN (NUC,T,DK,IFRM,AL,AM,AO)
C
C      This subroutine decays radionuclide chains.
C
C      Module of MAXI30
C      Version of 24-Sep-86  RAP
C-----
C
C
C      REAL*8 A(45), SUMPR, ASUM, AMD, EXPO(9), ALD(9), ARG, ATEMP,
C      .      HILIM
C
C      DIMENSION DK(2,9),IFRM(2,9),AL(9),AM(9),AO(9)
C
C      DATA HILIM /3.0E+38/
C
C      Convert AL to double precision--
C      DO 113 IJK = 1, 9
C          ALD(IJK) = DBLE(AL(IJK))
113 CONTINUE
C
C      Initialize coefficient array--
C      DO 100 IJK = 1, 45
C          A(IJK) = 0.0D0
100 CONTINUE
C
C      Loop on chain members--
C      WRITE (*,*) 'In ACHAIN, delta time: ',T
C      DO 5 J=1,NUC
C
C          Calculate exponential for current radionuclide--
C          ARG = -ALD(J) * T
C
C          WRITE (*,1002) J, ARG, AM(J)
1002  FORMAT (' J,ARG,AM: ',I4,D15.4,E10.3)
C          EXPO(J) = DEXP(ARG)
C          JJ = J*(J-1)/2
C          J1 = J-1
C
C          IF(J1.LE.0) GO TO 4
C          IMAX=MINO(J1,2)
C          DO 3 M=1,J1
C              DO 2 L=M,J1
C                  DO 1 I=1,IMAX
C                      IF(IFRM(I,J).EQ.L) THEN
C                          A(M+JJ) = A(M+JJ) + DK(I,J) * AL(L) * A(M+L*(L-1)/2)
C                      ENDIF
1                      CONTINUE

```

```

2      CONTINUE
      A(M+JJ) = A(M+JJ) / (ALD(J)-ALD(M))
3      CONTINUE
C
4      CONTINUE
C
      ASUM = 0.0D0
      IF (J1 .NE. 0) THEN
        DO 12 IRAP = 1, J1
          JK = JJ + IRAP
          ASUM = ASUM + A(JK)
12      CONTINUE
      ENDIF
C
      AMD = AM(J)
      A(J+JJ) = AMD - ASUM
C
C
      SUMPR = 0.0D0
      DO 18 IN = 1, J
        JK = JJ + IN
        SUMPR = SUMPR + EXPO(IN) * A(JK)
C      WRITE (*,1001) JK,A(JK),EXPO(IN),SUMPR
C1001  FORMAT (' A(JK),EXPO,SUMPR: ',I4,1P,3D17.7)
18      CONTINUE

C      ATEMP = MIN (SUMPR,HILIM)
C      AO(J) = SNGL(ATEMP)
C      AO(J) = SUMPR
C
5      CONTINUE
C
      RETURN
C
C-----
      END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE AFAC (AITIM,ITIME,XDPT)
C
C      THIS SUBROUTINE CALCULATES A RESUSPENSION FACTOR USING THE ANSPAUGH
C      MODEL WITH A LOWER LIMIT OF 1.0E-9.
C
C      Module of MAXI30
C      Version of 1-Apr-86  RAP
C-----
C
C
C
$INCLUDE: 'CONC.CMN'
C
C      IF(AITIM.LE.25) THEN
C          AIRFA(ITIME)=1.0E-4*(EXP(-2.87*(SQRT(AITIM))))+1.0E-9
C          AIRFA(ITIME)=AIRFA(ITIME)*XDPT
C      ELSE
C          AIRFA(ITIME)=1.0E-9*XDPT
C      ENDIF
C
C      RETURN
C-----
C
C      END

```

\$INCLUDE: 'COMPILE.OPT'

C

C SUBROUTINE AIRDIS (IDKA,INUC,JTIME,J)

C This subroutine decays the atmospheric release source term if
C necessary. Used for cases with off-site airborne sources.

C Module of MAXI30
C Version of 7-Jun-86 RAP

C

C
C
C \$INCLUDE: 'INVOUT.CMN'
C \$INCLUDE: 'RAD.CMN'

C
C If not decaying source set AMM equal to AML--

C
C IST=INUC+1
C K=IST+J-1
C IF(IDKA.NE.0)GO TO 10
C DO 100 I=IST,K
C AMM(I)=AML(I)
100 CONTINUE

C
C GO TO 90

C
C Decay one-memeber chains--

C
C 10 IF(J.GT.1)GO TO 20

C
C AMM(IST)=AML(IST)*EXP(-AL(IST)*JTIME)
C GO TO 90

C
C CALL CHAIN DECAY ROUTINE

C
C 20 DO 200 I=IST,K
C 200 AMM(I)=AML(I)/AL(I)
C CTIME=JTIME
C CALL ACHAIN(J,CTIME,DK(1,IST),IFRM(1,IST),AL(IST),AMM(IST),
C .AMM(IST))
C DO 300 I=IST,K
C 300 AMM(I)=AMM(I)*AL(I)

C
C 90 CONTINUE
C RETURN

C

C
C END

\$INCLUDE: 'COMPILE.OPT'

C-----

C

SUBROUTINE ANDOS

C

C This subroutine summarizes annual and pathway doses.

C

C Module of MAXI30

C Version of 20-Jun-86 RAP

C

C-----

C

C

\$INCLUDE: 'INPUT.CMN'

\$INCLUDE: 'TITL.CMN'

\$INCLUDE: 'OPT.CMN'

\$INCLUDE: 'RAD.CMN'

\$INCLUDE: 'INVOUT.CMN'

\$INCLUDE: 'CONC.CMN'

\$INCLUDE: 'DOSE1.CMN'

\$INCLUDE: 'DOSE2.CMN'

C

C

ITIME=0

DO 112 I = 1, 50

DO 113 IORG = 1, NORG

ADOS(I, IORG) = 0.0

AFDOS(I, IORG) = 0.0

ADADOS(I, IORG) = 0.0

AARDOS(I, IORG) = 0.0

ADWDOS(I, IORG) = 0.0

113 CONTINUE

AEXDOS(I) = 0.0

112 CONTINUE

C

CALL ZEROR(12500, PATHOT)

C

C

DO 100 JTIME=IT1, IT2

C

ITIME=ITIME+1

C

DO 200 INUC=1, NONUC

DO 300 IORG=1, NORG

C

C

Sum over all pathways:

C

C

Total food product doses--

AFDOS(ITIME, IORG)=AFDOS(ITIME, IORG)+FDOS(ITIME, INUC, IORG)

C

```

C      Total inhalation doses--
      ADADOS(ITIME,IORG)=ADADOS(ITIME,IORG)+DADOS(ITIME,INUC,IORG)
C
C      Total aquatic food doses--
      AARDOS(ITIME,IORG)=AARDOS(ITIME,IORG)
      +ARDOS(ITIME,INUC,IORG)
C
C      Total drinking water dose--
      ADWOOS(ITIME,IORG)=ADWDOS(ITIME,IORG)
      +DWDOS(ITIME,INUC,IORG)
C
C      Total pathway dose for each organ, nuclide, and time--
C      PATHOT(ITIME,INUC,IORG) = FDOS(ITIME,INUC,IORG)
C      + DADOS(ITIME,INUC,IORG)
C      + ARDOS(ITIME,INUC,IORG)
C      + DWDOS(ITIME,INUC,IORG)
C      + EXDOS(ITIME,INUC)
C
300    CONTINUE

C      Total external dose by time--
      AEXDOS(ITIME) = AEXDOS(ITIME) + EXDOS(ITIME,INUC)
C
200    CONTINUE

C      Sum annual doses--
C      DO 400 IORG=1,NORG
      ADOS(ITIME,IORG) = AFDOS(ITIME,IORG) + ADADOS(ITIME,IORG)
      + AEXDOS(ITIME) + AARDOS(ITIME,IORG)
      + ADWDOS(ITIME,IORG)
C
400    CONTINUE
100    CONTINUE

C      RETURN
C
C-----
      END

```

\$INCLUDE: 'COMPILE.OPT'

```
C-----  
C  
C      SUBROUTINE AREA  
C  
C      This subroutine calculates external/inhalation and ingestion  
C      area correction factors for sites less than 1 ha in area  
C  
C      Module of MAXI30  
C      Version of 26-Jun-86  RAP  
C  
C-----
```

\$INCLUDE: 'INPUT.CMN'

```
      IF (FRSIZ .GE. 1.0) THEN  
        AREAIN = 1.0  
      ELSEIF (FRSIZ .GE. 0.1) THEN  
        AREAIN = 0.75  
      ELSEIF (FRSIZ .GE. 0.002) THEN  
        AREAIN = 0.50  
      ELSEIF (FRSIZ .GE. 0.005) THEN  
        AREAIN = 0.25  
      ELSE  
        AREAIN = 0.10  
      ENDIF  
C  
      IF (FRSIZ .GE. 0.125) THEN  
        AREAEX = 1.0  
      ELSEIF (FRSIZ .GE. 0.05) THEN  
        AREAEX = 2.7 * FRSIZ + 0.67  
      ELSEIF (FRSIZ .GE. 0.01) THEN  
        AREAEX = 6.5 * FRSIZ + 0.48  
      ELSEIF (FRSIZ .GE. 0.0025) THEN  
        AREAEX = 20.0 * FRSIZ + 0.35  
      ELSE  
        AREAEX = 160.0 * FRSIZ  
      ENDIF  
C  
C  
      RETURN  
C  
C-----  
      END
```



```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      BLOCK DATA
C      Common Block Initialization
C
C
C      Module of MAXI30
C      Version of 26-Jun-86   RAP
C-----
C
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'OPT.CMN'
$INCLUDE: 'PATH.CMN'
$INCLUDE: 'MONITR.CMN'
$INCLUDE: 'FILNAM.CMN'
$INCLUDE: 'LIB26.CMN'
$INCLUDE: 'ORGLAB.CMN'
C
DATA NORG, KORG /5, 1, 6, 8, 16, 23/
DATA FOD, INH, WAT, ARG /4*.FALSE./

DATA FILN /' ','PLANEA.DAT','FILE23.DAT ',' ','MAXI.IN',
.          'MAXI.OUT','BURHFA.DAT',' ',' ','RMDLIB.DAT',
.          'ORGLIB.DAT','FTRANS.DAT','LB3OSVBQ.DAT',
.          'BIOAC1.DAT'/

DATA ISEL /30*.FALSE./

DATA ONAME /'TOTAL BODY','BODY WATER',' KIDNEYS ',' LIVER ',
.           ' SPLEEN ',' BONE ',' FAT ',' LUNGS ',
.           ' ADRENALS ',' TESTES ',' OVARIES ',' SKIN ',
.           ' BRAIN ',' MUSCLE ',' PROSTATE ',' THYROID ',
.           ' PANCREAS ',' HEART ',' GI-TRACT ',' STOMACH ',
.           ' SI ',' ULI ',' LLI '/

DATA ONAME2 /'Gonads ','Breast ','R Marrow ','Lungs ',
.            'Thyroid ','Bone Surf ','St Wall ','SI Wall ',
.            'ULI Wall ','LLI Wall ','Kidneys ','Liver ',
.            'Spleen ','Adrenals ','Pancreas ','Soft Tissue',
.            'Brain ','Thymus ','Bladder Wall ','Ovaries',
.            'Remainder 1','Remainder 2','Remainder 3',
.            'Remainder 4','Remainder 5','Remainder 6',
.            'Remainder 7','Remainder B','Remainder 9',
.            'Remainder10'/
C
C
C-----
C      END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE CDECAL (INUC)
C
C      CDECAL calculates committed dose equivalent doses for each
C      pathway.
C
C      Module of MAXI30
C      Version of 24-Jun-86  RAP
C-----
C
C
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'OPT.CMN'
$INCLUDE: 'INVOUT.CMN'
$INCLUDE: 'CONC.CMN'
$INCLUDE: 'LIB26.CMN'
$INCLUDE: 'DOS26.CMN'
$INCLUDE: 'MONITR.CMN'
$INCLUDE: 'PATH.CMN'
C
C      CMSEC = 3.15E7 sec/yr * 1E-6 m**3/cm**3 = breathing rate units
DATA CMSEC /31.5/
DATA POP /1.0/

DO 501 IO = 1, 30

    DO 502 IPATH = 1,4
        CDE(IPATH,IO,INUC) = 0.0
502    CONTINUE

    IF (ISEL(IO)) THEN

C      Calculate terrestrial plant ingestion CDE--
        IF (FOD) THEN
            CDET = 0.0

            DO 505 IFD = 1, NFT
                CDET = COET + OFING(INUC,IO) * EDBCON(IFD,INUC) *
                CON(IFD) * POP * RPF2 * AREAIN
            .
            .
            .
505        CONTINUE
            COE(1,IO,INUC) = CDET
        ENDIF

C      Calculate inhalation CDE--
        IF (INH) CDE(2,IO,INUC) = (SOILCN(INUC)*AIRFA(1) +
        .
        .
        .
        AML(INUC)) * BRATE * POP *
        DFINH(INUC,IO) * CMSEC * RINH *
        AREAEX

```



```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE CONCEN (INUC,ITIME)
C
C
C      This subroutine calculates air and water concentrations for
C      unit dose rate factors--
C
C      Module of MAXI30
C      Version of 3-Jul-86  RAP
C-----
C
$INCLUDE: 'PATH.CMN'
$INCLUDE: 'CONC.CMN'
$INCLUDE: 'RAD.CMN'
$INCLUDE: 'LIBPAR.CMN'
$INCLUDE: 'INVOUT.CMN'
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'OPT.CMN'
$INCLUDE: 'MONITR.CMN'

      LOGICAL PRNT
      REAL LN2
      DATA TENV,DEPFR,SLDN / 14., .25, 224./,
      . CHKNGC,CHKNWC / .12,.3/,
      . COWGC,COWWC / 55.,60./,
      . BFFC,BFWC / 68.,50./,
      . PIGGC,PIGWC / 4.2,10./,
      . LN2 /0.6931/,
      . DPV2 /0.001/,
      . SECDA /86400./,
      . SECMO /2.6E6/

C      Calculate aquatic foods concentrations
      DO 500 IP = 1, NPT
        FDCON(IP,INUC) = BIOACF(IP,INUC) *
      . EXP(-LN2/TRAD(INUC)*HLDUP2(IP))
500 CONTINUE

      IF (FOD) THEN
        DO 300 IFD=1,NFT

          PLTCON(IFD,INUC)=0.0
          LFCON(IFD,INUC)=0.0
          EDBCON(IFD,INUC)=0.0

C          ENVDC=LN2/TENV + LN2/TRAD(INUC)
          DIVSR=(YELD(IFD)*ENVDC)/SECDA

C
C      Leaf concentration = (offsite contribution + resuspension contrib.)

```

```

      IF (DIVSR .GT. 0.0) THEN
        LFCON(IFD,INUC) = DEPFR * TRANS(IFD) *
          (SOILCN(INUC) * AIRFA(ETIME) * DPV2 +
            AMM(INUC) * DPVL(INUC) +
            AMK(INUC)*RIRR/SECMO) *
            (1.-EXP(-ENVDC * GRWP(IFD)))/DIVSR
      ENDIF
C
C   Plant concentration = leaf conc. + surface soil contribution +
C   subsurface soil contribution
C
      PLTCON(IFD,INUC)= LFCON(IFD,INUC) +
        SOILCN(INUC) / SLDN * RF1 * FDTC(IPL,INUC) +
        AMT(INUC) / SLDN * RF2 * FDTC(IPL,INUC)

      IF(KFD TYP(IFD) .LE. 9) THEN
        EDBCON(IFD,INUC)= PLTCON(IFD,INUC)*EXP(-LN2/TRAD(INUC)
          * HLDUP(IFD))
      ELSE
        RMULT = FDTC(IFD,INUC)*EXP(-LN2/TRAD(INUC)*HLDUP(IFD))

        IF (KFD TYP(IFD) .EQ. 10) THEN
          EDBCON(IFD,INUC)=CHKNGC*PLTCON(IFD,INUC) * RMULT
        ELSEIF (KFD TYP(IFD) .EQ. 11) THEN
          EDBCON(IFD,INUC)=COWGC*PLTCON(IFD,INUC) * RMULT
        ELSEIF (KFD TYP(IFD) .EQ. 12) THEN
          EDBCON(IFD,INUC)=BFFC*PLTCON(IFD,INUC) * RMULT
        ELSEIF (KFD TYP(IFD) .EQ. 13) THEN
          EDBCON(IFD,INUC)=PIGGC*PLTCON(IFD,INUC) * RMULT
        ELSEIF (KFD TYP(IFD) .EQ. 14) THEN
          EDBCON(IFD,INUC)=CHKNGC*PLTCON(IFD,INUC) * RMULT
        ENDIF
      ENDIF

300 CONTINUE
      ENDIF

      RETURN

      END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE DFCALC
C
C      DFCALC calculates dose factors for ingestion.
C
C      Module of MAXI30
C      Version of 20-Jun-86  RAP
C-----
C
$INCLUDE: 'RAD.CMN'
$INCLUDE: 'LIBPAR.CMN'
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'DF.CMN'
$INCLUDE: 'MONITR.CMN'
C
C      REAL*4 MASS(23), TRTM(4), TP(4)
C
C      DATA ALN2 /0.693/
C      DATA CONST1 /2.92E-4/
C      DATA CONST2 /0.001/
C      DATA CONST3 /0.0256/
C
C      GI TRAVEL TIMES, FRACTIONAL DAYS--
C      DATA TRTM /.0417,.1667,.3333,.7500/
C
C      TRAVEL TIMES TO GI ORGANS, FRACTIONAL DAYS--
C      DATA TP /0.0,.0417,.2083,.5417/
C
C      ICRP-23 ORGAN MASSES OR GI ORGAN CONTENTS MASS
C      DATA MASS /70000.,600.,310.,1800.,180.,7000.,13500.,
C      .1000.,14.,35.,11.,2600.,1400.,28000.,16.,20.,100.,330.,0.,250.,
C      .400.,250.,135./
C
C      IF (DEBUG(3)) WRITE (6,1002)
1002 FORMAT (// 'Chain Organ      TEF      DCFAC'//)
C
C      DO 100 INUC=1,NUC
C      DO 101 IORG=1,NORG
C
C      JORG = KORG(IORG)
C
C      TEF = TRAD(INUC)*TBIO(INUC,IORG)/(TRAD(INUC)+TBIO(INUC,IORG))
C      TEF(INUC,IORG) = TEF
C
C      IF (KORG(IORG) .LT. 20) THEN
C      DCFAC(INUC,IORG)=CONST1*FW(INUC,IORG)*EN(INUC,IORG)*
C      (TEF**2)/MASS(JORG)*CONST2
C      ELSE

```

```

        IOR=JORG-19
        DCFAC(INUC,IORG)=CONST3*TRTM(IOR)*EN(INUC,IORG)*
        .      FW(INUC,IORG)*EXP(-ALN2/TRAD(INUC)*TP(IOR))
        .      /MASS(JORG)*CONST2
        ENDIF
101  CONTINUE
C
C
100 CONTINUE
C
C
        RETURN
C-----
        END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE DOZCAL (INUC, IORG, KIRG, N)
C
C      This subroutine calculates the annual radiation dose increments
C      from ingestion of contaminated farm products
C
C      Module of MAXI30
C      Version of 23-Jun-86  RAP
C-----
C
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'RAD.CMN'
$INCLUDE: 'LI8PAR.CMN'
$INCLUDE: 'CONC.CMN'
$INCLUDE: 'DF.CMN'
$INCLUDE: 'PATH.CMN'
$INCLUDE: 'MONITR.CMN'
$INCLUDE: 'OPT.CMN'
$INCLUDE: 'DOSE1.CMN'
$INCLUDE: 'INVOUT.CMN'
C
C      REAL LOWLIM
C
C      DATA ZERO /0.0/
C      DATA SLDN /224./
C      DATA YR /365.0/
C      DATA POP /1.0/
C      DATA LOWLIM /1.0E-20/
C      DATA ALN2 /0.6931/
C
C      DO 352 I = 1, 50
C          DFDOS(I) = 0.0
C          ARGF(I) = 0.0
C          ARDW(I) = 0.0
352 CONTINUE
C
C      IF (KIRG .LT. 20) THEN
C
C          ELAMD = 0.0
C          IF (TEFF(INUC,IORG) .GT. 0.0) ELAMD = ALN2/TEFF(INUC,IORG)
C
C          M = 50 - N
C          DO 400 IYR=1,M
C              Calculate exponential part of equation--
C              IF(IYR .EQ. 1) THEN
C                  TIMES = ELAMD*YR + EXP(-ELAMD*IYR*YR)-EXP(-ELAMD*(IYR-1)*YR)
C              ELSE

```



```

      TIMES = EXP (-ELAMD*IYR*YR) - EXP (-ELAMD*(IYR-1)*YR)
      -EXP (-ELAMD*(IYR-1)*YR) + EXP(-ELAMD*(IYR-2)*YR)
      .
      ENDIF
C
C      IF radionuclide goes away, stop calculation--
      IF (TIMES .EQ. ZERO) GOTO 401
C
C      Dose increments--
      IF (FOD) THEN
        DO 200 IFD=1,NFT
          .      Dose for all other organs and pathways--
          .      DFDOS(IYR) = DFDOS(IYR) + DCFAC(INUC,IORG) * POP
          .      * EDBCON(IFD,INUC) * CON(IFD) * RPF2 *
          .      AREAIN * TIMES
200      CONTINUE
      ENDIF

      IF (WAT .OR. ARG) THEN
        DO 300 IP = 1, NPT
          IF (KPTHWY(IP) .EQ. 5) THEN
            IF (WAT) ARDW(IYR) = ARDW(IYR) + DCFAC(INUC,IORG) * POP
            * USAG(IP) * TIMES * AMJ(INUC) *
            .      FDCON(IP,INUC)
            .
          ELSE
            IF (ARG) ARGF(IYR) = ARGF(IYR) + DCFAC(INUC,IORG) * POP
            * FDCON(IP,INUC) * USAG(IP) *
            .      AMK(INUC) * TIMES
            .
888      FORMAT (' ',2I5,1P,5E9.2E2)
          ENDIF
300      CONTINUE
        ENDIF

        FDOS(IYR+N,INUC,IORG) = FDOS(IYR+N,INUC,IORG) + DFDOS(IYR)
        DWDOS(IYR+N,INUC,IORG) = DWDOS(IYR+N,INUC,IORG) + ARDW(IYR)
        ARDOS(IYR+N,INUC,IORG) = ARDOS(IYR+N,INUC,IORG) + ARGF(IYR)

400      CONTINUE
401      CONTINUE

      ELSE

C      GI tract dose, first year only--
      IYR = 1
      IF (FOD) THEN
        DO 201 IFD = 1,NFT
          .      DFDOS(IYR) = DFDOS(IYR) +
          .      DCFAC(INUC,IORG) * POP * CON(IFD) *
          .      RPF2 * AREAIN * EDBCON(IFD,INUC)
201      CONTINUE
        ENDIF
      IF (WAT .OR. ARG) THEN
        DO 301 IP = 1, NPT

```

```

      IF (KPTHWY(IP) .EQ. 5) THEN
        IF (WAT) ARDW(IYR) = ARDW(IYR) +
          .      DCFAC(INUC,IORG) * AMJ(INUC)
          .      * POP * USAG(IP) * FDCON(IP,INUC)
        ELSE
          IF (ARG) ARGF(IYR) = ARGF(IYR) +
          .      DCFAC(INUC,IORG) * POP * AMK(INUC) *
          .      USAG(IP) * FDCON(IP,INUC)
        ENDIF
301    CONTINUE
      ENDIF

      FDOS(IYR+N,INUC,IORG) = FDOS(IYR+N,INUC,IORG) + DFDOS(IYR)
      DWDOS(IYR+N,INUC,IORG) = DWDOS(IYR+N,INUC,IORG) + ARDW(IYR)
      ARDOS(IYR+N,INUC,IORG) = ARDOS(IYR+N,INUC,IORG) + ARGF(IYR)

      ENDIF

      RETURN
C
C-----
      END

```

\$INCLUDE: 'COMPILE.OPT'

```
C-----  
C  
C      SUBROUTINE DUMMY (N)  
C  
C      This subroutine reads past unused entries in the inhalation dose  
C      rate factor file.  
C  
C      Module of MAXI30  
C      Version of 3-Jun-86  RAP  
C-----  
C  
C  
C      DO 100 I = 1,N  
C          READ(3,10)  
C      10  FORMAT (1X)  
C      100 CONTINUE  
C  
C      RETURN  
C-----  
C  
C      END
```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
      SUBROUTINE EDECAL
C
C      This subroutine calculates the Effective Dose Equivalent (EDE)
C
C      Module of MAXI30
C      Verison of 27-Jun-86 RAP
C-----

$INCLUDE: 'DOS26.CMN'
$INCLUDE: 'LIB26.CMN'
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'DOSE2.CMN'
$INCLUDE: 'RAD.CMN'
$INCLUDE: 'MONITR.CMN'

      REAL TOTCDE(30), CSORT(24)
      INTEGER ICNDX(24)

      REAL WT(6)
      DATA WT /0.25, 0.15, 0.12, 0.12, 0.03, 0.03/

C      Total internal dose--

      IF (DEBUG(4)) WRITE (6,1000)
1000  FORMAT (' CDE FOR ALL ORGANS:')

      DO 100 IO = 1, NORG30
        TOTCDE(IO) = 0.0
        IF (ISEL(IO)) THEN
          DO 101 INUC = 1, NONUC
            DO 102 IPATH = 1, 4
              TOTCDE(IO) = TOTCDE(IO) + CDE(IPATH,IO,INUC)
102          CONTINUE
101        CONTINUE
          ENDIF
          IF (DEBUG(4)) WRITE (6,*) 'Organ: ',IO,TOTCDE(IO)
100 CONTINUE

C      Transfer to sort array
      IS = 0
      DO 110 IO = 7, 30
        IF (ISEL(IO)) THEN
          IS = IS + 1
          ICNDX(IS) = IO
          CSORT(IS) = TOTCDE(IO)
        ENDIF
110 CONTINUE
      NIS = IS

```

C Sort CSORT array, highest dose first--

```
      N = NIS - 1
200  CONTINUE
      FLAG = 0
      J = 1
201  CONTINUE
      IF (CSORT(J) .LT. CSORT(J+1)) THEN
        CTEMP = CSORT(J)
        NTEMP = ICNDX(J)
        CSORT(J) = CSORT(J+1)
        ICNDX(J) = ICNDX(J+1)
        CSORT(J+1) = CTEMP
        ICNDX(J+1) = NTEMP
        FLAG = 1
      ENDIF
      J = J + 1
      IF (J .LE. N) GOTO 201
      IF (FLAG .GT. 0) THEN
        N = N - 1
        IF (N .GT. 0) GOTO 200
      ENDIF
202  CONTINUE
```

C Transfer values to print arrays--

```
      DO 300 IO = 1,6
        CDEPR(IO) = TOTCDE(IO)
        IOP(IO) = IO
        HWT(IO) = WT(IO)
300  CONTINUE

      DO 301 IS = 1,5
        CDEPR(IS+6) = CSORT(IS)
        IOP(IS+6) = ICNDX(IS)
        IF (ICNDX(IS) .EQ. 16) THEN
          HWT(IS+6) = 1.00
        ELSE
          HWT(IS+6) = 0.06
        ENDIF
301  CONTINUE
```

C Calculate weighted values, EDE

```
      EDE = 0.0
      DO 400 IH = 1, 11
        WDE(IH) = CDEPR(IH) * HWT(IH)
        EDE = EDE + WDE(IH)
400  CONTINUE
      WBEDE = EDE + AEXDOS(1)
```

RETURN

C

C-----
 END

\$INCLUDE: 'COMPILE.OPT'

C-----

C

SUBROUTINE FIL30

C

C

C

This subroutine handles reading of the ICRP-26/30 library files
and storing of parameters for radionuclides in the inventory.

C

C

Module of MAXI30

C

Version of 26-Aug-86 RAP

C

C-----

C

\$INCLUDE: 'TITL.CMN'

\$INCLUDE: 'RAD.CMN'

\$INCLUDE: 'LIBPAR.CMN'

\$INCLUDE: 'DF.CMN'

\$INCLUDE: 'INPUT.CMN'

\$INCLUDE: 'MONITR.CMN'

\$INCLUDE: 'FILNAM.CMN'

\$INCLUDE: 'OPT.CMN'

\$INCLUDE: 'LIB26.CMN'

DIMENSION F1(5), CDF(5), RW(5)

CHARACTER W*6, DUM*1

NORG30 = 0

LUN = 13

OPEN (LUN, FILE=FILN(13), STATUS='OLD', IOSTAT=IOS)

IF (IOS .NE. 0) GOTO 98

NC=1

IFLG1=0

C

110 CONTINUE

REWIND LUN

READ (LUN, '(A80)', END=97) TITL13

C

111 CONTINUE

C

READ (LUN, 200, END=113) EL, W, NOR

C

WRITE (*, 200) EL, W, NOR

200 FORMAT(A2, 1X, A6, I4)

IF (EL .EQ. ELTO(NC) .AND. W .EQ. AWO(NC)) THEN

READ (LUN, 201, END=97) (F1(J), J=1, 5)

201

FORMAT (2X, 5E9.2)

DO 301 J = 1, 5

IF (F1(J) .EQ. 9.9) F1(J) = 0.0

```

301      CONTINUE

      IFH = NTR(NC) + 2
      IFG = 1
      IF (F1(2) .EQ. F1(IFH)) IFG = 2

      DO 114 I = 1, NOR
        READ (LUN,202,END=97) INDX, (CDF(J), J=1,5)
202      FORMAT (I2, 5E9.2)

        IF (INDX .LT. 1 .OR. INDX .GT. 21) GOTO 96
        IF (INDX .GT. NOR30) NOR30 = INDX
        ISEL(INDX) = .TRUE.

        DFINH(NC,INDX) = CDF(IFH) * 3.7
        DFING(NC,INDX) = CDF(IFG) * 3.7

114      CONTINUE

      IF (INDX .EQ. 21) THEN

        READ (LUN,203,END=97) (RW(J),J=1,5)
203      FORMAT (2X, 5E9.2)

        IRWG = INT (RW(IFG)/0.06)
        DFG = OFING(NC,21)
        DO 115 IR = 1, IRWG
          INDX = 20 + IR
          ISEL(INDX) = .TRUE.
          OFING(NC,INDX) = DFG / FLOAT(IRWG)
115      CONTINUE

        IRWH = INT (RW(IFH)/0.06)
        DFH = DFINH(NC,21)
        DO 116 IR = 1, IRWH
          INDX = INDX + 1
          ISEL(INDX) = .TRUE.
          DFINH(NC,INDX) = DFH / FLOAT(IRWH)
116      CONTINUE

        IF (INDX .GT. NOR30) NOR30 = INDX
        ENDIF

        READ (LUN,202) IDUM
        READ (LUN,202) IDUM

        NC = NC+1
        IF (NC .GT. NONUC) GOTO 214

      ELSE
        DO 210 I = 1, NOR+3
          READ (LUN,202) INDX

```

```

        IF (INDX .EQ. 21) READ (LUN,200) DUM
210    CONTINUE
        ENDIF

        GOTO 111

113 CONTINUE
        IF (IFLG1 .EQ. 0) THEN
            IFLG1 = 1
        ELSE
C      No information this radionuclide
            IFLG1 = 0
            NC = NC + 1
        ENDIF
C
        IF (NC .LE. NONUC) GOTO 110
214 CLOSE (LUN)
        RETURN
C
C----- Error Messages -----
C
98 CONTINUE
WRITE (*,9008) FILN(LUN), LUN
9008 FORMAT ('FIL30: Error opening file:',A15,' assigned to LUN ',I3)
STOP

97 CONTINUE
WRITE (*,9000) FILN(LUN), LUN
9000 FORMAT ('FIL30: Error reading library title of file:',A15,/
.          ' assigned to LUN ',I3)
STOP

96 CONTINUE
WRITE (*,9006) INDX, EL, W, FILN(LUN), LUN
9006 FORMAT ('FIL30: Error reading organ index for ',A2,A6,' in file'/
.          ' ',A15,' assigned to LUN ',I3)
END

```



```
$INCLUDE: 'COMPILE.OPT'
```

```
C-----
```

```
C
```

```
      SUBROUTINE FILHAN
```

```
C
```

```
C
```

```
C      This subroutine handles reading of library files and storing of  
C      parameters for radionuclides in the inventory.
```

```
C
```

```
C      Module of MAXI30
```

```
C      Version of 24-Sep-86  RAP
```

```
C
```

```
C-----
```

```
C
```

```
$INCLUDE: 'TITL.CMN'
```

```
$INCLUDE: 'RAD.CMN'
```

```
$INCLUDE: 'LIBPAR.CMN'
```

```
$INCLUDE: 'DF.CMN'
```

```
$INCLUDE: 'PATH.CMN'
```

```
$INCLUDE: 'INPUT.CMN'
```

```
$INCLUDE: 'MONITR.CMN'
```

```
$INCLUDE: 'FILNAM.CMN'
```

```
$INCLUDE: 'OPT.CMN'
```

```
C
```

```
      DIMENSION BIOAC1(9), FTRC(6), LFT(15), EI(3)
```

```
      CHARACTER*6 W
```

```
      REAL HELT, CELT
```

```
C
```

```
      DATA LFT/1,1,1,1,1,1,1,1,1,2,3,4,5,6,0/
```

```
      DATA HELT, CELT /'H ','C '/
```

```
C
```

```
C---- Read food transfer coefficients-----
```

```
C
```

```
      LUN = 12
```

```
      OPEN (12, FILE=FILN(12), STATUS='OLD', IOSTAT=IOS)
```

```
      IF (IOS .NE. 0) GOTO 98
```

```
      NC=1
```

```
C
```

```
120  CONTINUE
```

```
      REWIND 12
```

```
      IFLG1=0
```

```
      READ (12, '(A80//)', END=99) TITLF
```

```
C
```

```
121  CONTINUE
```

```
C
```

```
1000  READ (12,1000, END=123) FELT, DVEL, (FTRC(I), I=1,6)
```

```
      FORMAT (A2,7E9.2)
```

```
C
```

```

      IF (FELT .EQ. ELTO(NC)) THEN
        DPVL(NC) = DVEL
        DO 124 IFD = 1, NFT
          IDX = KFD TYP(IFD)
          KFD = LFT(IDX)
          IF (KFD .GT. 0 .AND. KFD .LT. 16) THEN
            FDT C(IFD,NC) = FTRC(KFD)
            IF (I1109 .EQ. 1 .AND. KFD .EQ. 1) THEN
              IF (FELT .EQ. HELT) FDT C(IFD,NC) = 4.8
              IF (FELT .EQ. CELT) FDT C(IFD,NC) = 5.5
            ENDIF
          ELSE
            1005 WRITE (*,1005) NC,IFD,KFD,FTRC(KFD),FDT C(IFD,NC)
              FORMAT (' Error in KFD value in subroutine DFCALC'//
                ' NC,IFD,KFD,FTRC,FDT C: ',3I5,2X,1P2E10.2E2)
            STOP
          ENDIF
        124 CONTINUE
          NC = NC+1
          IF (NC .GT. NONUC) GOTO 125
        ENDIF
        GOTO 121

    123 CONTINUE
      IF (IFLG1 .EQ. 0) THEN
        IFLG1 = 1
      ELSE
        C      No information this radionuclide
        IFLG1 = 0
        NC = NC + 1
      ENDIF

    C
      IF (NC .LE. NONUC) GOTO 120
    125 CLOSE (LUN)
    C
    C
    C----- Read bioaccumulation factor library-----
    C
      LUN = 14
      OPEN (14, FILE=FILN(14), STATUS='OLD', IOSTAT=IOS)
      IF (IOS .NE. 0) GOTO 98

      NC=1
      IFLG1=0
    C
    140 CONTINUE
      REWIND 14
      READ(14,'(A80/)',END=99) TITLB
    C
    141 CONTINUE
    C
      READ(14,'(A2,8F9.1,F6.1)',END=143) BELT, (BIOAC1(I),I=1,9)

```

```

C      IF (BELT .EQ. ELTO(NC)) THEN
C
      DO 144 IP = 1, NPT
        JPT = KPTHWY(IP)
        IF (JPT .LT.5) THEN
          KPT = JPT+4
          BIOACF(IP,NC) = BIOAC1(KPT)
        ELSE
          IF (JPT .EQ. 5) THEN
            IF (ICLNUP .EQ. 1) THEN
              BIOACF(IP,NC) = BIOAC1(9)
            ELSE
              BIOACF(IP,NC) = 1.0
            ENDIF
          ENDIF
        ENDIF
      144 CONTINUE
        NC = NC+1
        IF (NC .GT. NONUC) GOTO 145
      ENDIF
      GOTO 141

      143 CONTINUE
        IF (IFLG1 .EQ. 0) THEN
          IFLG1 = 1
        ELSE
C          No information this radionuclide
          IFLG1 = 0
          NC = NC + 1
        ENDIF

C      IF (NC .LE. NONUC) GOTO 140
      145 CLOSE (LUN)

C
C
C----- Read organ data library -----
C
      LUN = 11
      OPEN (11, FILE=FILN(11), STATUS='OLD', IOSTAT=IOS)
      IF (IOS .NE. 0) GOTO 98

      NC=1
      IFLG1=0
      IFLG2=0

C
      110 CONTINUE
        REWIND 11
        READ (11,'(A80)',END=99) TITLO

C
      111 CONTINUE
C

```

```

200  READ (11,200,END=113) EL,W,IOR,TBI,FWI,F2PI,(EI(I),I=1,3)
    FORMAT(A2,A6,I2,6E8.2)

    IF (EL .EQ. ELTO(NC) .AND. W .EQ. AWO(NC)) THEN
        DO 114 IORG = 1, NORG
            KIRG = KORG(IORG)
            IF (IOR .EQ. KIRG) THEN
                IF (KIRG .LT. 20) THEN
                    FW(NC,IORG) = FWI
                ELSEIF (KIRG .LT. 23) THEN
                    FW(NC,IORG) = 1.0
                ELSE
C           Total body is always first organ
                    FWI = FW(NC,1)
                    IF (FWI .EQ. 1.0) THEN
                        FW(NC,IORG) = 0.05
                    ELSE
                        FW(NC,IORG) = 1.0 - FWI
                    ENDIF
                ENDIF
C
                IF (EI(3) .GT. 0.0) THEN
                    EN(NC,IORG) = EI(3)
                ELSE
                    EN(NC,IORG) = EI(1)
                ENDIF
                TBIO(NC,IORG) = TBI
            ENDIF
114    CONTINUE
            IFLG2 = 1
        ELSE
            IF (IFLG2 .EQ. 1) THEN
                NC = NC+1
                IFLG2 = 0
                BACKSPACE 11
            ENDIF
        ENDIF
        IF (NC .LE. NONUC) GOTO 111

113 CONTINUE
        IF (IFLG1 .EQ. 0) THEN
            IFLG1 = 1
        ELSE
C           No information this radionuclide
            IFLG1 = 0
            NC = NC + 1
        ENDIF
C
        IF (NC .LE. NONUC) GOTO 110
        CLOSE (LUN)
C

```

C---- read surface external exposure dose rate factor library-----

```
C
  IF (ISUR .EQ. 1) THEN

    LUN = 2
    OPEN (2, FILE=FILN(2), STATUS='OLD', IOSTAT=IOS)
    IF (IOS .NE. 0) GOTO 98

    NC=1
    IFLG1=0

C
  220 CONTINUE
    REWIND 2
    READ (2, '(A80//)', END=99) TIT22
C
  221 CONTINUE
C
    READ (2, '(A2,A6,E9.1)', END=223) E, W, EXSUR

    IF (E .EQ. ELTO(NC) .AND. W .EQ. AWO(NC)) THEN
      DEXT(NC) = EXSUR
      NC = NC+1
      IF (NC .GT. NONUC) GOTO 225
    ENDIF
    GOTO 221

  223 CONTINUE
    IF (IFLG1 .EQ. 0) THEN
      IFLG1 = 1
    ELSE
C      No information this radionuclide
      IFLG1 = 0
      NC = NC + 1
    ENDIF
C
    IF (NC .LE. NONUC) GOTO 220
  225 CLOSE (LUN)
    ENDIF
```

C
C
C---- read deep external exposure dose rate factor library-----

```
C
  IF (IEXT .EQ. 1) THEN

    OPEN (7, FILE=FILN(7), STATUS='OLD', IOSTAT=IOS)
    IF (IOS .NE. 0) GOTO 98

    NC=1
    IFLG1=0

C
  270 CONTINUE
```

```

        REWIND 7
        READ (7, '(A80//)', END=99) TIT27
C
271 CONTINUE
C
        READ (7, '(A2,A6,E9.1)', END=273) E, W, EXDEEP

        IF (E .EQ. ELTO(NC) .AND. W .EQ. AWO(NC)) THEN
            DEDXT(NC) = EXDEEP
            NC = NC+1
            IF (NC .GT. NONUC) GOTO 275
        ENDIF
        GOTO 271

273 CONTINUE
        IF (IFLG1 .EQ. 0) THEN
            IFLG1 = 1
        ELSE
C          No information this radionuclide
            IFLG1 = 0
            NC = NC + 1
        ENDIF
C
        IF (NC .LE. NONUC) GOTO 270
275 CLOSE (LUN)
        ENDIF

        RETURN
C
C----- Error Messages -----
C
98 CONTINUE
        WRITE (*,9008) FILN(LUN), LUN
9008 FORMAT ('FILHAN: Error opening file:',A15,' assigned to LUN ',I3)
        STOP

99 CONTINUE
        WRITE (*,9000) FILN(LUN), LUN
9000 FORMAT ('FILHAN: Error reading library title of file:',A15,/
        .      ' assigned to LUN ',I3)
        STOP

        END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE HEADNG
C
C      This subroutine prints page heading for quality assurance and
C      results reports.
C
C      Module of MAXI30
C      Version of 29-Jun-86  RAP
C-----
C
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'TITL.CMN'
$INCLUDE: 'DAYPC.CMN'
C
C      CHARACTER*1 FF
C      DATA IPN /0/
C      IPN = IPN + 1
C      FF = CHAR(12)
C
C      WRITE(6,1) FF, TITLE1
C      WRITE (6,2) TODAY, CLOCK, IPN
C
1  FORMAT(A1,1X,79('-',),/,16X,
.      ' ICRP-2 and ICRP-26/30 Maximum Annual Dose Calculation'/,
.      24X,
.      '(MAXI Version IBM 1.0 30-Jun-86)',/,
.      ' Case title: ',A70)
2  FORMAT(' Executed on: ',A10,' at ',A10,30X,'Page',I4)
C
C      WRITE(6,18)
18  FORMAT (1X,78('-',))
C
C      RETURN
C-----
C
END

```

\$INCLUDE: 'COMPILE.OPT'

C-----

C

SUBROUTINE IDNUC

C

C

C

This module controls reading of the master radionuclide library
and attempts to identify the input inventory.

C

C

Module of MAXI30

C

Version of 19-Jun-86 RAP

C

C-----

C

\$INCLUDE: 'RMD.CMN'

\$INCLUDE: 'RAD.CMN'

C

LOGICAL FOUND

C

C

Read Master Radionuclide Library--
CALL RLIBIN

C

C

Initialize count index on unidentified radionuclides--
ISTOP=0

C

C

Loop on input radionuclides, test against master library--
DO 3 IN=1,NIN

C

FOUND = .FALSE.

IL = 0

1 CONTINUE

C

IL = IL+1

IF (IL .GT. NUC) THEN

C

C

print name of unknown nuclide--

ISTOP=ISTOP+1

WRITE (*,100) ELTI(IN),AWI(IN)

100

FORMAT (1H0,'Unidentified radionuclide in input inventory
A2,A6)

FOUND = .TRUE.

C

ELSE

C

IF (ELT(IL) .EQ. ELTI(IN)) THEN

IF (AW(IL) .EQ. AWI(IN)) THEN

C

C

Store input into arrays at proper positions--

NFLAG(IL) = IN

NFLAGC(NCHN(IL)) = 1


```

C          FOUND = .TRUE.
C          ENDIF
C          ENDIF
C          ENDIF
C          IF (.NOT. FOUND) GO TO 1
C 3 CONTINUE
C          IF (ISTOP .GT. 0) THEN
C              Print total number of unknown radionuclides and stop--
C              WRITE (*, 200) ISTOP
200  FORMAT (iH0,'There were ',I4,' unidentified radionuclides.')
C              STOP
C          ENDIF
C          RETURN
C-----
C          END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
      SUBROUTINE INSET
C
C      INSET reads the inhalation dose conversion factor file from the
C      file assigned to logical unit 3.
C
C      Module of MAXI1
C      Version of 26-Aug-86   RAP
C-----
C
$INCLUDE: 'TITL.CMN'
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'RAD.CMN'
$INCLUDE: 'DF.CMN'
$INCLUDE: 'MONITR.CMN'
$INCLUDE: 'FILNAM.CMN'
$INCLUDE: 'LIBPAR.CMN'
C
      CHARACTER*6 AWD
      LOGICAL ICHK(50), DONE, FOUND
      DIMENSION IDORG(5), DIN(3,51,5)
      DATA ICHK /50*.FALSE./
C
      DO 351 IORG = 1, NORG
        DO 352 INUC = 1, NONUC
          DO 353 IY = 1, 50
            INDOS(IY,INUC,IORG) = 0.0
353      CONTINUE
352      CONTINUE
351      CONTINUE
C
      OPEN (3, FILE=FILN(3), STATUS='OLD', IOSTAT=IOS)
      IF (IOS.NE. 0) GOTO 98

      READ (3, '(A80)') TITLDI
      READ (3, *) NDI
      IF (DEBUG(2)) WRITE (*, '(1H ,A80)') TITLDI
C
      READ(3,11)(IDORG(I),I=1,5)
11  FORMAT(1X,5I5)
C
C      Loop on radionuclides in DIFDOS-generated file--
C
      DO 100 IDI=1,NDI
C
      READ (3,12) ELTD,AWD,N1,N2,N3
C      WRITE (*,12) ELTD,AWD,N1,N2,N3
12  FORMAT(1X,A2,A6,2X,3I5)

```

```

C
C      Match with desired radionuclides--
C
      FOUND = .FALSE.
      DO 200 INUC=1,NONUC
C
          IF(ELTD.NE.ELTO(INUC).OR.AWD.NE.AWO(INUC)) GOTO 200
          FOUND = .TRUE.
          ICHK(INUC)=.TRUE.
C
C      Read all data for found radionuclide into buffer--
C
          IF (N1 .GT.0) THEN
              READ(3,13)((DIN(1,IYR,IOR),IOR=1,5),IYR=1,N1)
          ENDIF
C
          IF (N2.GT.0) THEN
              READ(3,13)((DIN(2,IYR,IOR),IOR=1,5),IYR=1,N2)
          ENDIF
C
          IF (N3 .GT. 0) THEN
              READ(3,13)((DIN(3,IYR,IOR),IOR=1,5),IYR=1,N3)
          ENDIF
C
13      FORMAT(11X,5E10.2)
C
          IF (N1 .GT. 50) N1=50
          IF (N2 .GT. 50) N2=50
          IF (N3 .GT. 50) N3=50
C
C      Identify organ and solubility class--
C
      DO 300 IORG=1,NORG
          DO 400 JORG=1,5
              IF(IDORG(JORG).NE.KORG(IORG)) GO TO 400
C
                  ISCL = NTR(INUC)
                  NMAX = N1
                  IF (ISCL .EQ. 2) NMAX = N2
                  IF (ISCL .EQ. 3) NMAX = N3
C
                  DO 411 IYR=1,NMAX
                      INDOS(IYR,INUC,IORG)=DIN(ISCL,IYR,JORG)
411              CONTINUE
400          CONTINUE
300      CONTINUE
200      CONTINUE
C
C      If no match, read past library data--
      IF (.NOT. FOUND) THEN
          N4=N1+N2+N3

```

```

        CALL DUMMY(N4)
    ENDIF
C
C
    DONE = .TRUE.
    DO 201 INUC = 1, NONUC
C      WRITE (*,*) 'ICLK: ',ICLK(INUC)
      IF (.NOT. ICHK(INUC)) DONE = .FALSE.
201    CONTINUE

    IF (DONE) THEN
      CLOSE (3)
      RETURN
    ENDIF

100 CONTINUE

```

C---- Error Messages -----

```

    WRITE (*,*) 'INSET: data not found for one or more chain members'

    STOP

97 WRITE (*,*) 'INSET: NTR not set for radionuclide ',INUC
    STOP

98 WRITE (*,980) FILN(3)
980 FORMAT ('INSET: Error opening file ',A15,' assigned to LUN 3')
    STOP

    END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE MAKDAT
C
C      This subroutine converts the date and time into character strings
C
C      Module of MAXI30
C      Version of 26-Jun-86  RAP
C-----
C
$INCLUDE: 'DAYPC.CMN'

      CALL GETDAT (MONTH, DAY, YEAR)
      CALL GETTIM (Ihour, MINT, ISEC, IFrac)

      WRITE (TODAY(1:), '(I2)') MONTH
      WRITE (TODAY(3:), '(A)') '/'
      WRITE (TODAY(4:), '(I2)') DAY
      WRITE (TODAY(6:), '(A)') '/'
      WRITE (TODAY(7:), '(I4)') YEAR

      WRITE (CLOCK(1:), '(I2)') Ihour
      WRITE (CLOCK(3:), '(A)') ':'
      WRITE (CLOCK(4:), '(I2)') MINT
      WRITE (CLOCK(6:), '(A)') ':'
      WRITE (CLOCK(7:), '(I2)') ISEC

      RETURN
C-----
      END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE MAXDOS
C
C      This subroutine finds the maximum dose for each organ.
C
C      Module of MAXI30
C      Verison of 19-Jun-86 RAP
C-----
C
C
C
$INCLUDE: 'DOSE1.CMN'
$INCLUDE: 'DOSE2.CMN'
$INCLUDE: 'MXTIM.CMN'
$INCLUDE: 'INPUT.CMN'
C
C      REAL*4 MAXID(5)
C
C      CALL ZEROR(5,MAXID)
C
C      ITIME=0
C      DO 2 I=1,5
C          MAXTIM(I)=1
C      2 CONTINUE
C
C
C      DO 100 JTIME=IT1,IT2
C
C          ITIME=ITIME+1
C
C          DO 200 IORG=1,NORG
C
C              IF(ADOS(ITIME,IORG).GT.MAXID(IORG)) THEN
C                  MAXID(IORG)=ADOS(ITIME,IORG)
C                  MAXTIM(IORG)=ITIME
C                  MAXD(IORG)=JTIME
C              ENDIF
C
C          DO 210 INUC = 1, NONUC
C              IF (PATHOT(ITIME,INUC,IORG) .GT. MAXPTH(INUC,IORG) ) THEN
C                  MAXPTH(INUC,IORG) = PATHOT(ITIME,INUC,IORG)
C                  MAXPM(INUC,IORG) = ITIME
C              ENDIF
C 210      CONTINUE
C
C 200      CONTINUE
C 100      CONTINUE
C      RETURN
C-----
C      END

```

```
$INCLUDE: 'COMPILE.OPT'
```

```
C-----
```

```
C
```

```
      SUBROUTINE MLOAD (ITIME,DEN,XMLF)
```

```
C
```

```
C      This subroutine calculates resuspension using the mass loading  
C      equation.
```

```
C
```

```
C      Module of MAXI30
```

```
C      Version of 3-Apr-86  RAP
```

```
C
```

```
C-----
```

```
C
```

```
C
```

```
$INCLUDE: 'CONC.CMN'
```

```
C
```

```
      AIRFA(ITIME)=XMLF/DEN/0.15
```

```
C
```

```
      RETURN
```

```
C
```

```
C-----
```

```
      END
```

```

$INCLUDE: 'COMPILE.OPT'
C-----

C
C      SUBROUTINE ORDER
C
C      This module reorders the input inventory to follow order of the
C      Master Radionuclide Library (RMDLIB) and include daughters.
C
C      Module of MAXI30
C      Version of 26-Aug-86  RAP
C-----

C
$INCLUDE: 'RMD.CMN'
$INCLUDE: 'RAD.CMN'
$INCLUDE: 'INVIN.CMN'
$INCLUDE: 'INVOUT.CMN'
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'MONITR.CMN'
$INCLUDE: 'OPT.CMN'

      REAL NVUNIT(4)
      DATA NVUNIT /1.0, 1.0E6, 1.0E9, 1.0E12/

C      Maximum no. of radionuclides that can be considered--
      DATA NMAX /20/

      INUC=0
      ICHN=0

C
C
C      Set RIM values based on M3M2--
      RIM = 1.0
      IF (M3M2 .EQ.1) RIM = 0.15
      IF (M3M2 .EQ.2) RIM = 224.

C
C
      DO 20 IC=1,NCH

C      If this chain is not used, skip--
      IF (NFLAGC(IC) .EQ.1) THEN

          ICHN = ICHN+1
          NCN = NOFNUC(IC)
          IOFNUC(ICHN) = NCN
          N1 = NCHST(IC)
          N2 = N1+NCN-1
          IONE = 0
          I = 0

```



```

C
C      Loop on all nuclides in active chain (IM = IMEM)--
      IM = 0
      DO 15 IL=N1,N2
C
C      WRITE (*,*) 'IL: ',IL
      IM = IM + 1
      IF (IONE .EQ. 0) THEN
        IF (NFLAG(IL) .EQ. 0) THEN
          I = IM
        ELSE
          IONE = 1
        ENDIF
      ENDIF

      IF (IONE .EQ. 1) THEN
        INUC=INUC+1
C
C      Include nuclide IL in array position INUC--
C
        ELTO(INUC) = ELT(IL)
        AWO(INUC) = AW(IL)
        TRAD(INUC) = TR(IL)
        IFRM(1,INUC) = MAX (0,IFR(1,IL)-I)
        IFRM(2,INUC) = MAX (0,IFR(2,IL)-I)
        DK(1,INUC) = DKF(1,IL)
        DK(2,INUC) = DKF(2,IL)
        AL(INUC) = 0.693 / TR(IL) * 365.25
        NTR(INUC) = NSOLD(IL)
C
C      WRITE (*,*) ' INUC: ', INUC
C
        IF (NFLAG(IL) .NE. 0) THEN
          NFIL = NFLAG(IL)
          QSAV(INUC) = Q(NFIL) * NVUNIT(INUT)
          AM(INUC) = Q(NFIL) * SRDIL * RIM * NVUNIT(INUT)
          AMI(INUC) = QI(NFIL) * NVUNIT(INUT)
          AMJ(INUC) = QJ(NFIL) * NVUNIT(INUT)
          AML(INUC) = QK(NFIL) * NVUNIT(INUT) * XQSITE / 3.15E7
C
C      to convert from sec to yr
        ENDIF
      ENDIF
15    CONTINUE
      IOFNUC(ICHN) = NCN-I
C $      ENDIF
      20 CONTINUE
C
      NONUC = INUC

```

C---- Error Messages -----

```
      IF (NONUC.LE.0) THEN
        WRITE (*,300)
300    FORMAT (' No inventory or error in subroutine ORDER.')
        STOP

      ELSEIF (NONUC .GT. NMAX) THEN

        WRITE (*,301) NONUC,NMAX
301    FORMAT (' No. of radionuclides (including daughters) = ',I3/
      .        ' Maximum allowed = ',I4)

      ENDIF
```

C

C-----

```
      RETURN
      END
```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE OUT30
C
C      This subroutine prints a report of MAXI1 results - ICRP-26/30
C      methodology.
C
C      Module of MAXI30
C      Version of 24-Sep-86    RAP
C-----
C
$INCLUDE: 'OPT.CMN'
$INCLUDE: 'DOS26.CMN'
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'DOSE2.CMN'
$INCLUDE: 'MXTIM.CMN'
$INCLUDE: 'ORGLAB.CMN'
$INCLUDE: 'RAD.CMN'
$INCLUDE: 'DOSE1.CMN'
C
C      CHARACTER*50 DASH1
C      DATA DASH1 /'-----'/'
C
C      Print titles--
C      CALL HEADNG
C
C      WRITE (6,100) WBEDE,(ONAME(KORG(IORG)),MAXD(IORG),
C      .                ADOS(MAXTIM(IORG),IORG),IORG=1,NORG)
100 FORMAT (///' Annual Effective Dose Equivalent (AEDE):',T50,1P,
C      .      E9.1E2///
C      .      ' Maximum Annual Dose (ICRP-2):'//
C      .      5('      To Organ: ',A10,' at Year ',0P,I3,T50,
C      .      1P,E9.1E2)///)
C
C      IF (IOUT .GT. 1) THEN
C
C      CALL HEADNG
C      WRITE (6,110) DASH1
C      DO 10 IO = 1, 11
C      WRITE (6,111) ONAME2(IOP(IO)), CDEPR(IO), HWT(IO), WDE(IO)
10  CONTINUE
C      WRITE (6,112) DASH1, EDE, AEXDOS(1), DASH1, WBEDE
110  FORMAT (///,T10,' DOSES FROM 1 YEAR OF EXPOSURE',//
C      .      T10,'      Committed      Weighted'//
C      .      T10,'      Dose      Weighing      Dose'//
C      .      T10,'      Organ      Equivalent      Factors      Equivalent'//
C      .      '      ',T10,A50)

```

```

111  FORMAT (' ',T10,A12,4X,1P,3(E9.1E2,2X))
112  FORMAT (' ',T10,A50/
.      T10,'Effective Dose Equivalent',T48,1P,E9.1E2/
.      T10,'External Dose',T48,E9.1E2/' ',T10,A50,/
.      T10,'Annual Effective Dose Equivalent',
.      T48,E9.1E2)
ENDIF

IF (IOUT .GT. 2) THEN

    ISET = 51 / (10 + NONUC)
    IS = ISET

    DO 200 IO = 1, 11

        IF (IS .LT. ISET) THEN
            IS = IS + 1
        ELSE
            IS = 1
            CALL HEADNG
        ENDIF

        WRITE(6,13) ONAME2(IOP(IO))
        T1 = 0.0
        T2 = 0.0
        T3 = 0.0
        T4 = 0.0
        T5 = 0.0
        DO 201 INUC=1,NONUC
            WRITE(6, 15) ELTO(INUC),AWO(INUC),CDE(1,IO,INUC),
.                  CDE(2,IO,INUC), EXDOS(1,INUC), CDE(3,IO,INUC),
.                  CDE(4,IO,INUC)
.                  T1 = T1 + CDE(1,IO,INUC)
.                  T2 = T2 + CDE(2,IO,INUC)
.                  T3 = T3 + EXDOS(1,INUC)
.                  T4 = T4 + CDE(3,IO,INUC)
.                  T5 = T5 + CDE(4,IO,INUC)
201      CONTINUE
        WRITE (6,16) T1,T2,T3,T4,T5,CDEPR(IO)
200      CONTINUE
    ENDIF

C
13  FORMAT(//,' COMMITTED DOSE EQUIVALENT (CDE) TO: ',A12
.      ' FROM 1 YEAR OF EXPOSURE'//
.      T12, '-----',
.      ' EXPOSURE PATHWAY',
.      '-----'/
.      ' RADIO-      INGESTION      INHALATION      EXTERNAL',
.      '      AQUATIC FOOD DRINK WATER'//
.      ' NUCLIDE ',5(' (rem) '),/
.      '-----'
.      '-----')

```

```

C
15 FORMAT(1X,A2,A6,2X, 5(1X,1PE9.1E2,4X))
C
16 FORMAT(' -----
      ' '-----' /
      ' TOTAL      ',5(1X,1PE9.1E2,4X)/1X,1PE7.1E2)
C
C RETURN
C
C-----
C
      END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
      SUBROUTINE OUTPUT
C
C      This subroutine prints a report of MAXI1 results.
C
C      Module of MAXI30
C      Version of 24-Sep-86   RAP
C-----
C
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'RAD.CMN'
$INCLUDE: 'OPT.CMN'
$INCLUDE: 'INVOUT.CMN'
$INCLUDE: 'CONC.CMN'
$INCLUDE: 'TITL.CMN'
$INCLUDE: 'DOSE1.CMN'
$INCLUDE: 'DOSE2.CMN'
$INCLUDE: 'MXTIM.CMN'
$INCLUDE: 'ORGLAB.CMN'
C
C
      CHARACTER*10 ONA(5)
C
C      Print titles--
      ISET = 51 / (11 + NONUC)
      IS = ISET
C
C      DO 100 IORG=1,NORG
C
      IF (IS .LT. ISET) THEN
        IS = IS + 1
      ELSE
        IS = 1
        CALL HEADNG
      ENDIF
C
      ONA(IORG)=ONAME(KORG(IORG))
      WRITE(6, 13) MAXD(IORG),ONA(IORG)
      WRITE(6, 14)
C
C
      DO 200 INUC=1,NONUC
C
      K=MAXTIM(IORG)
C
      ATEMP = AFDOS(K,IORG)
      IPFD = 0
      IF (ATEMP .GT. 0.) IPFD=FDOS(K,INUC,IORG)/ATEMP*100

```

```

C      ATEMP = ADADOS(K,IORG)
      IPDAD = 0
      IF (ATEMP .GT. 0.) IPDAD=DADOS(K,INUC,IORG)/ATEMP*100
C
      IPEX = 0
      IF (AEXDOS(K) .GT. 0.) IPEX=EXDOS(K,INUC)/AEXDOS(K)*100
C
      ATEMP = AARDOS(K,IORG)
      IARG = 0
      IF (ATEMP .GT. 0.) IARG=ARDOS(K,INUC,IORG)/ATEMP*100
C
      ATEMP = ADWDOS(K,IORG)
      IDWD = 0
      IF (ATEMP .GT.0.) IDWD=DWDOS(K,INUC,IORG)/ATEMP*100
C
      WRITE(6, 15) ELTO(INUC),AWO(INUC),FDOS(K,INUC,IORG),
      .             IPFD,DADOS(K,INUC,IORG),IPDAD,
      .             EXDOS(K,INUC),IPEX,
      .             ARDOS(K,INUC,IORG),IARG,DWDOS(K,INUC,IORG),IDWD
200  CONTINUE
C
      IPAF = 0
      IPAD = 0
      IPAX = 0
      IAGD = 0
      IDWA = 0
      ATEMP = ADOS(K,IORG)
C
      IF (ATEMP .GT. 0.) THEN
        IPAF=AFDOS(K,IORG)/ATEMP*100
        IPAD=ADADOS(K,IORG)/ATEMP*100
        IPAX=AEXDOS(K)/ATEMP*100
        IAGD=AARDOS(K,IORG)/ATEMP*100
        IDWA=ADWDOS(K,IORG)/ATEMP*100
      ENDIF
C
      WRITE(6,16) ADOS(K,IORG),AFDOS(K,IORG),IPAF,
      .           ADADOS(K,IORG),IPAD,
      .           AEXDOS(K),IPAX,
      .           AARDOS(K,IORG),IAGD,
      .           ADWDOS(K,IORG),IDWA
C
C
100 CONTINUE
C
C
13  FORMAT(//,' -----',
      .     ' MAXIMUM ANNUAL DOSE SUMMARY FOR THE YEAR',
      .     I4,' FOR ',A10,'-----'/)

```

```

14 FORMAT( ' ----- EXPOSURE PATHWAY',
.         ' -----' /
.         ' RADIO-      INGESTION      INHALATION      EXTERNAL',
.         '    AQUATIC FOOD DRINK WATER' /
.         ' NUCLIDE  ',5(' REM      %'),/
.         ' -----' ,
.         ' -----' )
C
15 FORMAT(1X,A2,A6, 5(1X,1PE9.1E2,I4))
C
16 FORMAT(' -----' ,
.         ' -----' /
.         '    TOTAL      INGESTION      INHALATION      EXTERNAL',
.         '    AQUATIC FOOD DRINK WATER' /
.         ' (1X,1PE8.1E2, 1X, 5(1PE9.1E2,I4,1X)))
C
C
C   Print maximum dose by all pathways for wach year and organ report--
C   IF (IOUT.EQ. 4) THEN
C
C       CALL HEADNG
C       WRITE (6, 33) (ONA(IORG), IORG=1,NORG)
C
C       DO 70 INUC = 1, NONUC
C           WRITE (6,34) ELTO(INUC), AWO(INUC),
C               (MAXPM(INUC,I), PATHOT(MAXPM(INUC,I),INUC,I),
C               I = 1, NORG)
C 70  CONTINUE
C   ENDIF
C
C 33 FORMAT ( ' ----- MAXIMUM DOSE BY NUCLIDE AND ORGAN SUMMED ',
.           ' OVER ALL PATHWAYS -----' /
.           ' Radio-      ',5(' ',A11),/
.           ' Nuclide    ',5('Year (rem) '),/
.           ' -----' ,
.           ' -----' ,/)
C
C 34 FORMAT ( ' ',A2,A6,1X, 5(1PE9.1E2,I4))
C
C
C   Test on output class and continue--
C   IF(IOUT.EQ.0 .OR. IEDE.EQ.1) GO TO 999
C
C       Print tabulation of annual doses by organ (IOUT=1)
C
C       CALL HEADNG
C       WRITE(6, 20) IT2
C       WRITE(6, 21) (ONA(IORG),IORG=1,NORG)
C

```



```

C      Loop on years and organs--
C
      ITIME=0
      DO 300 JTIME=IT1,IT2
        ITIME=ITIME+1
        WRITE(6, 22) JTIME, (ADOS(ITIME,IORG), IORG=1,NORG)
300    CONTINUE
C
20    FORMAT(/,2X,'ANNUAL DOSE SUMMARY FOR ',I5,' YEARS')
21    FORMAT(2X,'YEAR',5X,5(A10,2X))
22    FORMAT(1X,I5,5X,5(1PE9.1E2,3X))
C
C
C      Print long form if specified--
C
      IF(IOUT.LT.2)GO TO 999
      ITIME=0
      DO 500 JTIME=IT1,IT2
        ITIME=ITIME+1
        DO 600 IORG=1,NORG
C
          WRITE(6, 25) JTIME,ONA(IORG)
          WRITE(6, 14)
C
C      Loop on radionuclides--
C
      DO 700 INUC=1,NONUC
C
        ATEMP=AFDOS(ITIME,IORG)
        IPFD = 0
        IF (ATEMP .GT. 0.) IPFD=FDOS(ITIME,INUC,IORG)/ATEMP*100
C
        ATEMP=ADADOS(ITIME,IORG)
        IPDAD=0
        IF (ATEMP .GT. 0.) IPDAD=DADOS(ITIME,INUC,IORG)/ATEMP*100
C
        ATEMP=AEXDOS(ITIME)
        IPEX = 0
        IF (ATEMP .GT. 0.) IPEX=EXDOS(ITIME,INUC)/ATEMP*100
C
        ATEMP = AARDOS(ITIME,IORG)
        IARG = 0
        IF (ATEMP .GT. 0.) IARG=ARDOS(ITIME,INUC,IORG)/ATEMP*100
C
        ATEMP = ADWDOS(ITIME,IORG)
        IDWD = 0
        IF (ATEMP .GT. 0.) IDWD=DWDOS(ITIME,INUC,IORG)/ATEMP*100
C

```

```

        WRITE(6, 15) ELTO(INUC),AWO(INUC),FDOS(ETIME,INUC,IORG),
        .           IPFD,DADOS(ETIME,INUC,IORG),
        .           IPDAD,EXDOS(ETIME,INUC,IPEX),
        .           ARDOS(ETIME,INUC,IORG),IARG,
        .           DWDOS(ETIME,INUC,IORG),IDWD
C
700  CONTINUE
C
        IPAF = 0
        IPAD = 0
        IPAX = 0
        IAGD = 0
        IDWA = 0
        ATEMP = ADOS(ETIME,IORG)
C
        IF (ATEMP .GT. 0.) THEN
            IPAF=AFDOS(ETIME,IORG)/ATEMP*100
            IPAD=ADADOS(ETIME,IORG)/ATEMP*100
            IPAX=AEXDOS(ETIME)/ATEMP*100
            IAGD=AARDOS(ETIME,IORG)/ATEMP*100
            IDWA=ADWDOS(ETIME,IORG)/ATEMP*100
        ENDIF
C
        WRITE(6,16) ADOS(ETIME,IORG),AFDOS(ETIME,IORG),IPAF,
        .           ADADOS(ETIME,IORG),IPAD,
        .           AEXDOS(ETIME),IPAX,
        .           AARDOS(ETIME,IORG),IAGD,
        .           ADWDOS(ETIME,IORG),IDWA
600  CONTINUE
500  CONTINUE
C
        25 FORMAT(/,13X,'ANNUAL DOSE SUMMARY FOR YEAR ',I5,1X,
        . 'AND ORGAN ',A10)
999  CONTINUE
C
C
        RETURN
C
C-----
C
        END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
      SUBROUTINE PADOS
C
C      PADOS calculates doses for each pathway.
C
C      Module of MAXI30
C      Version of 8-Jul-86  RAP
C-----
C
C
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'OPT.CMN'
$INCLUDE: 'TITL.CMN'
$INCLUDE: 'RAD.CMN'
$INCLUDE: 'INVOUT.CMN'
$INCLUDE: 'CONC.CMN'
$INCLUDE: 'DF.CMN'
$INCLUDE: 'DOSE1.CMN'
$INCLUDE: 'MONITR.CMN'
$INCLUDE: 'PATH.CMN'
$INCLUDE: 'LIBPAR.CMN'
C
      REAL AO(50), XFACT
      LOGICAL INTFLG

      DATA XFACT /5.844E-11/

      INTFLG = .FALSE.
      IF (FOD .OR. WAT .OR. ARG) INTFLG=.TRUE.

      DO 100 IN = 1, NONUC
        SOILCN(IN) = 0.0
        AIRFA(IN) = 0.0
        AO(IN) = 0.0
        DO 102 IT = 1, 50
          EXDOS(IT,IN) = 0.0
          DO 101 IO = 1, NORG
            FDOS(IT,IN,IO) = 0.0
            DADOS(IT,IN,IO) = 0.0
            ARDOS(IT,IN,IO) = 0.0
            DWDOS(IT,IN,IO) = 0.0
          101 CONTINUE
        102 CONTINUE
      100 CONTINUE

C      Breathing rate correction factor--
      BREATE = BRATE/230.

      IDKA = IDKAIR

```

```

ITIM2=0
ITA=IT1-IBLOW
ITW=IT1-IRR
ITIME=-MAX(IRR,IBLOW)
ITM=IT1+ITIME
C
C Master loop on time--
C DO 50 JTIME = ITM,IT2
C
IF(INTRUD.NE.0.AND.JTIME.GT.IT1)GO TO 50
ITIM2=ITIM2+1
ITIME=ITIME+1
N=ITIME-1
IF (ITIM2.EQ.1) AITIME=JTIME
IF (ITIM2.GT.1) AITIME=1.0
BITIME = FLOAT(JTIME) + AGE - FLOAT(ITM)
C
C Call resuspension or mass loading factor--
C
IF (ITIME .GT. 0) THEN
  IF (IRES .EQ. 1) THEN
    CALL MLOAD (ITIME, DEN, XMLF)
  ELSE
    CALL AFACT (BITIME, ITIME, XDPT)
  ENDIF
ENDIF
C
INUC=0
C Loop on radionuclide chains--
DO 200 ICH = 1,ICHN
C
C Set irrigation and aquatic food water concentration to AMK:
C Once, if constant source
C Every time, if decaying source
C
J=IOFNUC(ICH)
IF (JTIME.EQ.ITA) THEN
  CALL AIRDIS (IDKA, INUC, JTIME, J)
ENDIF
IF (JTIME.EQ.ITW) THEN
  CALL WATER (IDKWAT, INUC, JTIME, J)
ENDIF
C
C
C Set soil concentration, dependent on irrigation, subsurface, etc.--
C CALL SOLCON (ITIM2, ICH, INUC, AITIME, J, AO, JTIME)
C
IF (IDKA .NE. 0 .AND. JTIME .GE. ITA)
. CALL AIRDIS (1,INUC,JTIME,J)
C

```

```

      IF (IDKWAT .NE. 0 .AND. JTIME .GE. ITW)
      .   CALL WATER (1,INUC,JTIME,J)
C
      DO 290 JNUC=1,J
C
      INUC=INUC+1
      IF (JTIME.LT.IT1) GO TO 290
C
      Calculate external total body dose--
C
      EXDOS(ITIME,INUC)=DEXT(INUC)*SOILCN(INUC)*XF*AREAEX*XFACT
      .   +DEDXT(INUC)*AMT(INUC)*XF*AREAEX*XFACT
C
      where  $5.844E-11 = h/yr * rem/mrem * Ci/pCi * 0.15$ 
C
      Calculate food concentration factors--
      IF (INTFLG) CALL CONCEN (INUC,ITIME)
C
      DO 300 IORG=1,NORG
      KIRG = KORG(IORG)
C
      Calculate yearly dose factor increments--
      IF (INTFLG) CALL DOZCAL (INUC, IORG, KIRG, N)
C
      M = 50 - N
      DO 400 ITTIM=1,M
      RINDOS = INDOS(ITTIM,INUC,IORG)
      IF (RINDOS .EQ. 0.0) GOTO 401
      IR = ITTIM+N
      DADOS(IR,INUC,IORG) = DADOS(IR,INUC,IORG) + RINDOS *
      .   (AIRFA(ITIME)*SOILCN(INUC)+
      .   AMM(INUC)) * RINH * AREAIN *
      .   BREATE
      400      CONTINUE
      401      CONTINUE
      300      CONTINUE

      IF (JTIME .EQ. IT1 .AND. IEDE .GT. 0) CALL CDECAL (INUC)

      290      CONTINUE
      200      CONTINUE
C
      IF (DEBUG(4) .AND. ITIME .EQ. 1) THEN
      WRITE (6,1001)
      DO 701 INUC = 1, NONUC
      WRITE (6,1002) INUC, (BIOACF(IP,INUC),IP=1,2),
      .   (FDCON(IP,INUC),IP=1,NPT)
      701      CONTINUE
      WRITE (6,1003)
      DO 702 INUC = 1, NONUC
      WRITE (6,1004) INUC, 1,
      .   LFCON(1,INUC),
      .   PLTCON(1,INUC), EDBCON(1,INUC)

```

```

702  CONTINUE
      ENDIF
      IF (JTIME .EQ. IT1 .OR. JTIME .EQ. IT2) CALL PNT0(ITIME,JTIME)
C
50  CONTINUE
    RETURN

C---- Format Statements -----
1001 FORMAT (///' AQUATIC INGESTION REPORT (FIRST YEAR):'//
.          ' RADIO-'//
.          ' NUCLIDE      BIOACF(1) BIOACF(2) FDCON(1)',
.          ' FDCON(2) ...')

1002 FORMAT (' ',I6,4X,1P,7E10.1E2)

1003 FORMAT (///' TERRESTRIAL INGESTION REPORT (FIRST YEAR):'
.          '///' RADIO-'//
.          ' NUCLIDE      PATH      LFCON      PLTCON      EBDCON')

1004 FORMAT (' ',I6,6X,I2,4X,1P,5E10.1E2)
C
C-----
      END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE PNT0 (ITIME,JTIME)
C
C      THIS SUBROUTINE IS USED TO PRINT THE RESULTING TIME DEPENDENT
C      SOIL, AIR, IRRIGATION WATER, AND DRINKING WATER CONCENTRATIONS
C
C      Module of MAXI30
C      Version of 29-Jun-86 RAP
C-----
C
$INCLUDE: 'CONC.CMN'
$INCLUDE: 'RAD.CMN'
$INCLUDE: 'INVOUT.CMN'
$INCLUDE: 'MONITR.CMN'

      LOGICAL FIRST
      DATA FIRST /.TRUE./

      IF (FIRST) THEN

          CALL HEADNG
          FIRST = .FALSE.

      ELSE

          WRITE (6,52)

      ENDIF

      WRITE (6,59) JTIME
      WRITE (6,58)

      DO 100 JNUC=1, NONUC
C
          AIRCON = SOILCN(JNUC) * AIRFA(ITIME) + AML(JNUC)
          AMTT = AMT(JNUC)/.15

          WRITE (6,60) ELTO(JNUC), AWO(JNUC), SOILCN(JNUC), AMTT,
C
C      100    AIRCON, AMI(JNUC), AMJ(JNUC)
C      CONTINUE
C
          RETURN

```

```

C---- Format Statements -----
59 FORMAT (/ ' SOIL, AIR, AND WATER CDNCENTRATION ',
.          'SUMMARY FOR YEAR:',
.          I4)
58 FORMAT (//, ' Radio-      Surface Soil  Deep Soil      Air',
.          '      Irrigation  Drink Water'//
.          ' nuclide      pCi/m2      pCi/m3      pCi/m3',
.          '      pCi/L      pCi/L'//
.          '-----'
.          '-----')
C
52 FORMAT (///)
C
60 FORMAT(1X,A2,1X,A6,5(2X,1PE10.1E2))
C
C
C-----
C
C          END

```



```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE QAPAGE
C
C      This subroutine prints a report of input parameter values.
C
C      Module of MAXI30
C      Version of 27-Oct-86  RAP
C-----
C
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'OPT.CMN'
$INCLUDE: 'RAD.CMN'
$INCLUDE: 'INVIN.CMN'
$INCLUDE: 'INVOUT.CMN'
$INCLUDE: 'TITL.CMN'
$INCLUDE: 'PATH.CMN'
$INCLUDE: 'LIBPAR.CMN'
$INCLUDE: 'MONITR.CMN'
$INCLUDE: 'ORGLAB.CMN'
C
C      CHARACTER FDK*13,FINTRD*8,FM3M2*5
C      CHARACTER FDJ*13, ID*3, IDL*3
C      CHARACTER PNAME*10
C      CHARACTER UNITS*7,FNAME*11
C
C      DIMENSION FNAME(5), UNITS(8), PNAME(16)
C
C      DATA FNAME /'FISH','CRUSTACEA','MOLLUSCS','PLANTS',
C      .           'DRINK WATER'/
C
C      DATA UNITS /'(kg/yr)','(kg/yr)','(kg/yr)','(kg/yr)',
C      .           '(L/yr)','(h/yr)','(h/yr)','(h/yr)'/
C
C      DATA PNAME /'LEAFY VEG.','O.A.G.VEG.','POTATOES',
C      .           'OT.RT.VEG.','BERRIES','MELONS','ORCH.FRUIT','WHEAT',
C      .           'OT.GRAIN','EGGS','MILK','BEEF','PORK','POULTRY',
C      .           ' ',' '/
C
C      CALL HEADNG
C
C      WRITE (6,1116)
1116 FORMAT (/ ' PATHWAYS/OPTIONS CONSIDERED:')
C      IF (IEXT .EQ. 1) WRITE (6,'(2A)') '      External exposure/',
C      . 'root penetration for waste modeled as slab (volume) source'
C      IF (ISUR .EQ. 1) WRITE (6,'(2A)') '      External exposure to'
C      . 'surface contamination modeled as a plane source'
C      IF (INHA .EQ. 1) WRITE (6,*)
C      . 'Inhalation of resuspended material'
C      IF (IFOD .EQ. 1) WRITE (6,*) '      Farm product ingestion'

```

```

        IF (IARG .EQ. 1) WRITE (6,*) '    Aquatic foods ingestion'
        IF (IWAT .EQ. 1) WRITE (6,*) '    Drinking water ingestion'
        IF (IAIR .EQ. 1) WRITE (6,*) '    Off site atmospheric source'
        IF (IEDE .EQ. 1) WRITE (6,*) '    Committed effective dose ',
        . 'equivalent (CEDE) calculation'
        IF (IDKAIR .EQ. 1) WRITE (6,*)
        . '    Decay of air release source term'
        IF (IDKWAT .EQ. 1) WRITE (6,*)
        . '    Decay of water release source term'
        IF (INTRUD. EQ. 1) WRITE (6,*)
        . '    Use the One-Year-of-Exposure Model'

C
        WRITE (6,*) ' '
        WRITE (6,*) 'TITLES OF LIBRARY FILES ACCESSED:'
C
        WRITE(6,1000)TITLR
1000 FORMAT(/,' 10: ', A74)
C
        IF (FOD) WRITE (6,1001) TITL0, TITLF
1001 FORMAT( ' 11: ',A74/
        . ' 12: ',A74)

        IF (IEDE .EQ. 1) WRITE (6,1114) TITL13
1114 FORMAT (' 13: ',A74)

        IF (ARG .OR. WAT) WRITE (6,1115) TITLB
1115 FORMAT( ' 14: ',A74)

        IF (ISUR .EQ. 1) WRITE (6,1002) TIT22
1002 FORMAT (' 22: ', A74)
C
        IF (INHA .EQ. 1) WRITE (6,1003) TITLDI
1003 FORMAT (' 23: ', A74)
C
        IF (IEXT .EQ. 1) WRITE(6,3) TIT27
        3 FORMAT(' 27: ', A74)

C
C
C
        WRITE(6,21)IT1,IT2
21 FORMAT(/,' NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:'/
        . 5X,'Scenario begins:',T66,I5,/
        . 5X,'Scenario ends:',T66,I5)
C
        FM3M2 = 'm**2)'
        IF (M3M2.EQ.1) FM3M2 = 'm**3)'
        IF (M3M2.EQ.2) FM3M2 = 'kg) '

        WRITE (6,1020) INUT, M3M2, NIN, FM3M2

```

```

1020 FORMAT (/, ' INVENTORY: '/
. 5X, 'Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci)',
. T66, I4/
. 5X, 'Soil source units: (0- m**2 1- m**3 2- kg)', T66, I4/
. 5X, 'Number of radionuclides in inventory:', T66, I4//
. 5X, 'Release          Irrigation    Drinking    ',
. 'Atmospheric'/
. 5X, 'Terms      Soil Source /Aquatic      Water      Release'/
. 15X, '(per ', A5, ' (per L)      (per L)      (per m3)'/
. 5X, '-----',
. '-----')

DO 13 I = 1, NONUC
WRITE (6,1021) ELTO(I), AWO(I), QSAV(I), AMI(I), AMJ(I), AML(I)
13 CONTINUE
1021 FORMAT (5X,A2,A6,4(2X,1PE11.1E2))

WRITE (6,1022) SRDIL, DILF, FRSIZ
1022 FORMAT (/' INVENTORY MODIFICATION FACTORS: (multipliers)'/
. 5X, 'Surface inventory dilution factor:', T66, 1PG9.1E2/
. 5X, 'Irrigation/aquatic inventory modification factor:',
. T66, G9.1E2/
. 5X, 'Size of site (fractional ha):', T66, E9.1E2)

IF (IFOD .EQ. 1) WRITE (6,1023) RPF2
1023 FORMAT (5X, 'Fraction of total diet grown on site:', T66, G9.1E2)

CALL HEADNG
IF (ISUR.EQ.1.OR.IEXT.EQ.1.OR.INHA.EQ.1) THEN
WRITE (6,*) ' '
WRITE (6,*) ' EXTERNAL/INHALATION EXPOSURE:'
IF (ISUR .EQ. 1 .OR. IEXT .EQ.1) WRITE (6,1030) HREXT
IF (INHA .EQ. 1) WRITE (6,1031) HRINH
WRITE (6,1032) BRATE
ENDIF

1030 FORMAT (5X, 'Hours of external exposure to contamination (h/yr):',
. T66, 1PG9.1E2)
1031 FORMAT (5X, 'Hours of inhalation of airborne contamination ',
. '(h/yr):', T66, 1PG9.1E2)
1032 FORMAT (5X, 'Breathing rate (cm**3/sec):', T66, 1PG9.1E2)

WRITE (6,*) ' '
WRITE (6,*) ' RESUSPENSION PARAMETERS:'
IF (IRES .EQ. 0) THEN
WRITE (6,1041) AGE, XDPTIN
ELSE
WRITE (6,1042) DEN, XMLF
ENDIF

```

```

1041 FORMAT (5X,'Model used: ', T66,'Anspaugh'/
.         5X,'Average age of contamination on ground at Time Zero',
.         '(yr):',T66,1PG9.1E2/
.         5X,'Top soil available for resuspension (cm):',
.         T66,G9.1E2)

1042 FORMAT (5X,'Model used:',T66,'Mass Loading'/
.         5X,'Soil density (g/m**3):',T66,1PE9.1E2/
.         5X,'Mass loading factor (g/m**3): ',T66,E9.1E2)

      IF (IAIR .EQ. 1) WRITE (6,1050) IBLOW, XQSITE

1050 FORMAT (/ ' SPECIAL PURPOSE PARAMETERS: '/
.         5X,'No. of years contamination blew onto the site prior to '/
.         7X,'the beginning of the scenario:',T66,I9,/
.         5X,'Chi/q value at the site:',T66,E9.1E2)

      IF (IFOD .EQ. 1) WRITE (6,1060) RF1, RF2, RPF1, IMO, RIRR, IRR,NFT

1060 FORMAT (/ ' AGRICULTURAL PARAMETERS: '/
.         5X,'Fraction of roots in upper soil:',T66,1PG9.3E2/
.         5X,'Fraction of roots in deeply buried waste:',T66,G9.3E2/
.         5X,'Ratio of ext. contamination in surface/subsurface soil:',
.         T66,G9.3E2/
.         5X,'Months per year irrigated:',T66,0P,I9,1P/
.         5X,'Irrigation rate (L/m**2/mo):',T66,G9.1E2/
.         5X,'Years of irrigation w/ contaminated water prior to the'/
.         7X,'beginning of the dose calculation period:',T66,I9/
.         5X,'Number of food types:',T66,0P,I9)

      IF (FOD) THEN
        WRITE (6,1061)

1061 FORMAT (/ ' FOOD                                GROWING                                ',
.         ' CONSUMP-  TRANS- '/
.         ' TYPE                                PERIOD   YIELD      HOLDUP   ',
.         ' TION      LOCATION' /
.         ' INDEX      FOOD TYPE   (days)  (kg/m**3) (days) ',
.         ' (kg/yr)   FACTOR' /
.         ' -----  -----  -----  -----  ----- ',
.         ' -----  ----- ')

      DO 10 I = 1, NFT

        WRITE (6,1070) KFD TYP(I), PNAME(KFD TYP(I)),GRWP(I), YELD(I),
.         HLDUP(I), CON(I), TRANS(I)

10 CONTINUE

1070 FORMAT (1X,I5,4X,A13,F7.0,2X,F9.2,2X,F6.0,2X,F9.1,2X,F8.2)
      CALL HEADNG
      ENDIF

```

```

      IF (IWAT .EQ. 1.OR. IARG .EQ. 1) THEN
        WRITE (6,1080) NPT
1080  FORMAT (/ ' DRINKING WATER/AQUATIC FOOD PARAMETERS: '/
        .      5X, 'Number of water/food types:', T66, I9 //
        .      ' TYPE                      HOLDUP  CONSUMPTION' /
        .      ' INDEX      FOOD TYPE      (days) (kg/yr)' /
        .      ' -----      -' )

      DO 11 I = 1, NPT
        WRITE (6,1081) KPTHWY(I), FNAME(KPTHWY(I)), HLDUP2(I), USAG(I)
11  CONTINUE
1081  FORMAT (1X, I5, 6X, A13, F6.1, 2X, F9.1)
      ENDIF

      WRITE(6,46)
46  FORMAT(///, ' Input prepared by: _____ ',
        .      '      Date: _____ ', //
        .      ' Input checked by: _____ ',
        .      '      Date: _____ ')

C
C
      IBOX=8
      WRITE(6,14)
      DO 16 I=1, IBOX
        WRITE(6,15)
16  CONTINUE
      WRITE(6,17)

14  FORMAT(//, 5X, 7('*'), 'PLEASE NOTE ANY SPECIAL CONSIDERATIONS IN',
        .  ' THIS SPACE', 7('*'))
15  FORMAT(5X, '*', 64X, '*')
17  FORMAT(5X, 66('*'))

C
      WRITE (6,1090) AREAIN, AREAEX, RINH, XF
1090  FORMAT (/// ' CALCULATED VALUES: '/
        .      5X, 'Ingestion area correction factor:', T66, 1PG9.2E2/
        .      5X, 'External/inhalation area correction factor:', T66, G9.2E2/
        .      5X, 'Inhalation exposure modification factor:', T66, G9.2E2/
        .      5X, 'External exposure modification factor:', T66, G9.2E2/)

      IF (DEBUG(4)) THEN
        CALL HEADNG
        WRITE (6,1113)
1113  FORMAT (/// ' RADIONUCLIDE PARAMETER REPORT: ' //
        .      '      RADIO-'/
        .      ' CHAIN  NUCLIDE      AL      TRAD      NTR      ',
        .      ' DPVL   DK(1)      DK(2)')

      I = 0
      DO 330 IC= 1, ICHN
        DO 331 ICM = 1, IOFNUC(IC)
          I = I + 1

```

```

        WRITE (6,1123) IC,ICM,ELTO(I),AWO(I),AL(I), TRAD(I),
        .           NTR(I), DPVL(I),
        .           (IFRM(J,I),DK(J,I),J=1,2)
1123      FORMAT (1X,I2,I3,3X,A2,A6,1X,2G10.3E2,I4,2X,E7.1E2,
        .           2(2X,I2,F7.4))
331      CONTINUE
330      CONTINUE

        WRITE (6,1112)
1112      FORMAT (// ' LIBRARY PARAMETER REPORT: '//,
        .           ' RADIO-' /
        .           ' NUCLIDE   ORGAN      EN          TBIO      FW')
        DO 300 I = 1, NONUC
            WRITE (6,1121) (ELTO(I),AWO(I),IORG,EN(I,IORG),TBIO(I,IORG),
        .           FW(I,IORG),IORG=1,NORG)
1121      FORMAT (1X,A2,A6,2X,I4,3X,1P3G10.2E2)
300      CONTINUE
        ENDIF
C
        RETURN
C
C-----
        END

```

\$INCLUDE: 'COMPILE.OPT'

C-----

C

 SUBROUTINE READIN

C

C Read input parameters

C

C

C Module of MAXI30

C Version of 20-Oct-86 RAP

C

C-----

\$INCLUDE: 'INPUT.CMN'

\$INCLUDE: 'OPT.CMN'

\$INCLUDE: 'PATH.CMN'

\$INCLUDE: 'MONITR.CMN'

\$INCLUDE: 'INVIN.CMN'

\$INCLUDE: 'RAD.CMN'

\$INCLUDE: 'TITL.CMN'

 CHARACTER*10 DUM

 READ (5,1) DUM

 READ (5,'(A80)') TITLE1

 READ (5,11) DUM, DUM

 READ (5,*) IEXT

 READ (5,1) DUM

 READ (5,*) ISUR

 READ (5,1) DUM

 READ (5,*) INHA

 READ (5,*) IFOD

 READ (5,*) IARG

 READ (5,*) IWAT

 READ (5,*) IAIR

 READ (5,*) IEDE

 READ (5,*) IDKAIR

 READ (5,*) IDKWAT

 READ (5,*) INTRUD

 READ (5,11) DUM, DUM

 READ (5,*) IOUT

 READ (5,*) DEBUG(4)

 READ (5,11) DUM,DUM

 READ (5,*) IT1

 READ (5,*) IT2

 READ (5,11) DUM, DUM

 READ (5,*) INUT

 READ (5,*) M3M2

 READ (5,*) NIN

 READ (5,11111) DUM, DUM, DUM, DUM, DUM

 DO 100 IN = 1, NIN

 READ (5,2) ELTI(IN), AWI(IN), Q(IN), QI(IN), QJ(IN), QK(IN)

100 CONTINUE

```
READ (5,11) DUM, DUM
READ (5,*) SRDIL
READ (5,*) DILF
READ (5,*) FRSIZ
READ (5,*) RPF2
READ (5,11) DUM, DUM
READ (5,*) HREXT
READ (5,*) HRINH
READ (5,'(A12)') PLANAM
READ (5,'(A12)') VOLNAM
READ (5,*) BRATE
READ (5,11) DUM, DUM
READ (5,*) IRES
READ (5,*) RESUP1
READ (5,*) RESUP2
READ (5,11) DUM, DUM
```

```
IF (IRES .EQ. 0) THEN
  AGE = RESUP1
  XDPTIN = RESUP2
ELSEIF (IRES .EQ. 1) THEN
  DEN = RESUP1
  XMLF = RESUP2
ENDIF
```

```
READ (5,*) IBLOW
READ (5,1) DUM
READ (5,*) XQSITE
READ (5,*) ICLNUP
READ (5,*) I1109
READ (5,11) DUM, DUM
READ (5,*) RF1
READ (5,*) RF2
READ (5,*) RPF1
READ (5,*) IMO
READ (5,*) RIRR
READ (5,*) IRR
READ (5,1) DUM
READ (5,*) NFT
READ (5,11111) DUM, DUM, DUM, DUM, DUM
```

```
DO 101 IF = 1, NFT
  READ (5,3) KFDTP(IF), GRWP(IF), YELD(IF), HLDUP(IF), CON(IF),
  .      TRANS(IF)
```

101 CONTINUE

```
READ (5,11) DUM, DUM
READ (5,*) NPT
READ (5,11111) DUM,DUM,DUM,DUM
```



```

      DO 102 IP = 1, NPT
      READ (5,4) KPTHWY(IP), HLDUP2(IP), USAG(IP)
102 CONTINUE

C---- Set option flags -----
      IF (IFOD .EQ. 1) FOD = .TRUE.
      IF (INHA .EQ. 1) INH = .TRUE.
      IF (IWAT .EQ. 1) WAT = .TRUE.
      IF (IARG .EQ. 1) ARG = .TRUE.

C---- Find an index to give correct FDTC in PLTCON for non-plant paths
      IPL = 0
      IF (IFOD .EQ. 1) THEN
        DO 10 I=1,NPT
          IF(KFDTP(I).GT.9)GO TO 10
          IPL=I
10      CONTINUE
          IF (IPL .EQ. 0) GOTO 98
        ENDIF
      RETURN

C---- Set RPF1 to proper default value for surface-only case -----
      (IF ISUR .EQ. 1 .AND. IEXT .EQ. 0 .AND. RPF1 .EQ. 0.0) RPF1 = 1.0
      WRITE (*,*)
      WRITE (*,*) 'The parameter RPF1 has been set to 1.0 assuming'
      WRITE (*,*) 'uniform distribution of a surface source.'

C---- Error Messages -----
C
C      IF THERE ARE NO PLANT PATHWAYS, PRINT MESSAGE AND STOP
98 WRITE (*,12)
12 FORMAT(1H1,' THIS CODE WILL NOT RUN WITHOUT AT LEAST',
.      ' ONE PLANT PATHWAY--STOP')
      STOP

C---- Format Statements -----
      1 FORMAT (A10)
      2 FORMAT (14X, A2, A6, 2X, 4(G11.2, 2X))
      3 FORMAT (I5, 19X, G7.2, G11.2, G8.2, G11.2, G10.2)
      4 FORMAT (I5, 19X, G6.2, G11.2)
      11 FORMAT (A10/A10)
      1111 FORMAT (A10/A10/A10/A10)
      11111 FORMAT (A10/A10/A10/A10/A10)

C-----
      END

```

\$INCLUDE: 'COMPILE.OPT'

C-----

C

SUBROUTINE RLIBIN

C

C

C

THIS SUBROUTINE READS A MASTER NUCLIDE DATA LIBRARY WITH CHAIN
DECAY DATA.

C

C

Module of MAXI30

C

Version of 24-Sep-86 RAP

C

C-----

C

\$INCLUDE: 'RMD.CMN'

\$INCLUDE: 'TITL.CMN'

\$INCLUDE: 'MONITR.CMN'

\$INCLUDE: 'FILNAM.CMN'

\$INCLUDE: 'RAD.CMN'

C

DIMENSION IT(2),FR(2)

CHARACTER A*6, NS1*1

C

C

Initialize indices--

C

IMO=0

NCH=0

NUC=1

C

C

Read title--

OPEN (10, FILE=FILN(10), STATUS='OLD', IOSTAT=IOS)

IF (IOS .NE. 0) GOTO 96

READ (10, '(A80)', END=99) TITLR

IF (DEBUG(2)) WRITE (*, '(1H0,A80)') TITLR

C

C

C

Read and count nuclide ID and decay data--

C

1 READ(10,100,END=99) E,A,T,IM,IT(1),FR(1),IT(2),FR(2),NS1

C

C

Test for end of library--

C

IF(IM.GT.0) GO TO 2

NUC=NUC-1

IF(NUC.GT.300) GO TO 98

IF(NUC.LT.1) GO TO 98

CLOSE (10)

RETURN

```

C
C      Test for new chain, IM = 1--
C      2  IF ( IM .LE. 1) THEN
C
C          First member of new chain--
C
C          NCH=NCH+1
C          NOFNUC(NCH)=1
C          IMO=1
C          NCHST(NCH)=NUC
C
C      ELSE
C
C          Daughter radionuclides--
C
C          Test order--
C          IF (IM-IMO.NE.1) GO TO 97
C
C          IMO=IM
C          NOFNUC(NCH)=NOFNUC(NCH)+1
C          IFR(1,NUC)=IT(1)
C          IFR(2,NUC)=IT(2)
C          DKF(1,NUC)=FR(1)
C          DKF(2,NUC)=FR(2)
C
C      ENDIF
C
C
C      NS2 = 0
C      IF (NS1 .EQ. 'D') NS2 = 1
C      IF (NS1 .EQ. 'W') NS2 = 2
C      IF (NS1 .EQ. 'Y') NS2 = 3
C      IF (NS2 .LT. 1) GOTO 95
C
C      Set data for current radionuclide--
C
C      ELT(NUC)=E
C      AW(NUC)=A
C      TR(NUC)=T
C      NSOLD(NUC) = NS2
C      NCHN(NUC)=NCH
C      NUC=NUC+1
C
C      GO TO 1
C
C----- Print error messages and stop -----
C
C      95 WRITE (*,601)
C      601 FORMAT (' RLIBIN: Inhalation class not set')
C      STDP

```

```

96 WRITE (*,600) FILN(10)
600 FORMAT (' RLIBIN: Error opening file: ',A15,' assigned to '
.      'LUN 10')
STOP

97 WRITE (*,500) NCH,IM,ELT(NUC),AW(NUC)
500 FORMAT(' RLIBIN: Decay chain',I4,' has improper order. Current'
.      ' member is',I4/
.      '      After ',A2,A6)
STOP

98 WRITE (*,300) NUC
300 FORMAT(' RLIBIN: Improper number of nuclides in library, NUC=',I8)
STOP

99 WRITE (*,400)
400 FORMAT(' RLIBIN: Premature End of file on LUN 10')
STOP
C
C---- Input data formats -----
C
100 FORMAT(A2,A6,E10.2,I2,2(I2,F7.4),33X,A1)
101 FORMAT (' ',A2,A6,E10.2,2X,I4)
200 FORMAT(20A4)
C
C-----
C
END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE SOLCON (ITIM2, ICH, INUC, AITIME, J, AO, JTIME)
C
C      This subroutine calculates the soil concentration of both
C      the decaying surface contamination and deposited contamination
C      from irrigation.
C
C      Module of MAXI30
C      Version of 27-Oct-86  RAP
C-----
C
$INCLUDE: 'INPUT.CMN'
$INCLUDE: 'INVOUT.CMN'
$INCLUDE: 'RAD.CMN'
$INCLUDE: 'OPT.CMN'
$INCLUDE: 'CONC.CMN'
$INCLUDE: 'MONITR.CMN'
C
C      DIMENSION AO(50)
C
C      IST=INUC+1
C      IF (J.EQ.1) THEN
C
C          Decay one member chains and correct for irrigation buildup--
C
C          AO(IST) = AO(IST)+AMK(IST)*RIRR*IMO+AMM(IST)*3.15E4
C          AO(IST) = AO(IST)*EXP(-AL(IST))
C
C          SOILCN(IST) = AM(IST)*RPF1*EXP(-AL(IST)*JTIME)+AO(IST)
C
C          IF (IEXT .EQ. 1 .AND. JTIME .GE. IT1) THEN
C              AMT(IST) = AM(IST) * EXP(-AL(IST)*JTIME)
C          ENDIF
C
C      ELSE
C
C          K = IST+IOFNUC(ICH)-1
C          IF (DEBUG(3)) WRITE (*,*) ' IST, K in SOLCON: ', IST, K
C
C          Call chain decay routine--
C
C          DO 100 I=IST,K
C              IF (ITIM2 .EQ. 1) THEN
C                  SOILCN(I) = (AM(I)*RPF1 +
C                      .      AMK(I)*RIRR*IMO+3.15E4*AMM(I)) /AL(I)
C              ELSE
C                  SOILCN(I) = (SOILCN(I) + AMK(I)*RIRR*IMO+3.15E4*AMM(I))
C                      .      /AL(I)
C              ENDIF
C          100 CONTINUE
C      ENDIF

```

```

100  CONTINUE
C
    CALL ACHAIN (J,ATIME,DK(1,IST),IFRM(1,IST),AL(IST),
        SOILCN(IST), SOILCN(IST))
C
    DO 200 I=IST,K
        SOILCN(I)=SOILCN(I)*AL(I)
200  CONTINUE
C
    IF (JTIME .GE. IT1 .AND. IEXT .EQ. 1) THEN
C
        Set AMT, amount of deeply buried contamination--
C
        DO 300 I=IST,K
            AM(I)=AM(I)/AL(I)
300  CONTINUE
C
        ATIM=JTIME
        CALL ACHAIN (J,ATIM,DK(1,IST),IFRM(1,IST),AL(IST),
            AM(IST),AMT(IST))
C
        DO 310 I=IST,K
            AM(I)=AM(I)*AL(I)
            AMT(I)=AMT(I)*AL(I)
310  CONTINUE
C
        ENDIF
    ENDIF
C
    RETURN
C
C-----
END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
C      SUBROUTINE WATER (IDKWAT,INUC,JTIME,J)
C
C      This subroutine decays the water release source term if
C      necessary.  Used for overflow release cases.
C
C      Module of MAXI30
C      Version of 3-Apr-86  RAP
C-----
C
$INCLUDE: 'INVOUT.CMN'
$INCLUDE: 'RAD.CMN'
C
C      If not decaying water source, set AMK equal to AMI--
C
C      IST=INUC+1
C      K=IST+J-1
C      IF(IDKWAT.NE.0)GO TO 10
C      DO 100 I=IST,K
100    AMK(I)=AMI(I)
C      GO TO 90
C
C      Decay one member chains--
C
C      IF(J.GT.1)GO TO 20
C
C      AMK(IST)=AMI(IST)*EXP(-AL(IST)*JTIME)
C      GO TO 90
C
C      Call chain decay routine--
C
C      20  00 200 I=IST,K
200    AMI(I)=AMI(I)/AL(I)
C      CTIME=JTIME
C      CALL ACHAIN(J,CTIME,DK(1,IST),IFRM(1,IST),AL(IST),AMI(IST),
C      &AMK(IST))
C      DO 300 I=IST,K
C      AMI(I)=AMI(I)*AL(I)
300    AMK(I)=AMK(I)*AL(I)
C
C      90  RETURN
C-----
C      END

```

```
$INCLUDE: 'COMPILE.OPT'
```

```
C-----
```

```
C
```

```
    SUBROUTINE ZEROI (N, K)
```

```
C
```

```
    This subroutine initializes a specified number of array elements  
    (integer) to zero.
```

```
C
```

```
    Module of MAXI30
```

```
C
```

```
    Version of 3-Apr-86  RAP
```

```
C
```

```
C-----
```

```
C
```

```
    DIMENSION K(N)
```

```
C
```

```
    DO 1 J=1,N
```

```
        K(J)=0
```

```
1 CONTINUE
```

```
C
```

```
    RETURN
```

```
C
```

```
C-----
```

```
    END
```



```
$INCLUDE: 'COMPILE.OPT'
```

```
C-----
```

```
C
```

```
      SUBROUTINE ZEROR (N, A)
```

```
C
```

```
C      This subroutine initializes a specified number of array elements  
C      (real) to zero.
```

```
C
```

```
C      Module of MAXI30
```

```
C      Version of 3-Apr-86  RAP
```

```
C
```

```
C-----
```

```
C
```

```
      DIMENSION A(N)
```

```
C
```

```
      DO 1 J=1,N
```

```
        A(J)=0.0
```

```
1 CONTINUE
```

```
C
```

```
      RETURN
```

```
C
```

```
C-----
```

```
      END
```

FILE: CONC.CMN

```
C-----
C
C Concentration Common Block
C Module of MAXI30 Version of 19-Jun-86 RAP
C
COMMON /CONC/ SOILCN(20),
. AIRFA(50),
. PLTCON(15,20),
. LFCON(15,20),
. EDBCON(15,20),
. FDCON(5,20)
REAL*4 LFCON
C
C-----
```

FILE: DAYPC.CMN

```
C-----
C DAYPC
C DESCRIPTION: SYSTEM DATE FOR THE IBM PC IN INTEGER FORMAT
C USED BY: MAXI30, HEADNG
C-----
C
C INTEGER*2 MONTH, DAY, YEAR, I HOUR, MINT, ISEC, IFRAC
COMMON /DAYPC/ MONTH, DAY, YEAR, I HOUR, MINT, ISEC, IFRAC
C
C CHARACTER*10 TODAY, CLOCK
COMMON /DACPCC/ TODAY, CLOCK
C
C-----
```

FILE: DF

```
C-----
C
C Dose Rate Factor Common Blocks
C Module of MAXI30 Version of 19-Jun-86 RAP
C
COMMON /DF/ DFDOS(50),
. INDOS(50,20,5),
. DEXT(20),
. ARGF(50),
. ARDW(50),
. DEDXT(20),
. DCFAC(20,5),
. TEFF(20,5)
REAL*4 INDOS
C-----
```

FILE: DOS26.CMN

```
C-----
C
C   Dose Common Blocks
C   Module of MAXI30           Version of 23-Jun-86  RAP
C
C   COMMON /DOS26 / CDE(4,20,30), CDEPR(30), IOP(30), WDE(11),
C   .               HWT(11), EDE, WBEDE
C
C-----
```

FILE: DOSE1.CMN

```
C-----
C
C   Dose Common Blocks
C   Module of MAXI30           Version of 19-Jun-86  RAP
C
C   COMMON /DOSE1 / EXDOS(50,20),
C   .               FDOS(50,20,5),
C   .               DADOS(50,20,5),
C   .               ARDOS(50,20,5),
C   .               DWDOS(50,20,5)
C
C-----
```

FILE: DOSE2.CMN

```
C-----
C
C   Summed Dose Common Blocks
C   Module of MAXI30           Version of 20-Jun-86  RAP
C
C   COMMON /DOSE2/ AFDOS(50,5),
C   .               ADADOS(50,5),
C   .               AARDOS(50,5),
C   .               ADWDOS(50,5),
C   .               AEXDOS(50),
C   .               ADOS(50,5)
C
C-----
```

FILE: FILNAM.CMN

```
C-----
C
C   Standard Filename Common Block
C   Module of MAXI30                      Version of 3-Jun-86 RAP
C
C   COMMON /FILNAM/ FILN(14)
C   CHARACTER FILN*15
C-----
```

FILE: INPUT.CMN

```
C-----
C
C   Input Parameters Common Block
C   Module of MAXI30                      Version of 24-Jun-86 RAP
C
C   COMMON /INPUT/ XQSITE,RIRR,RPF,XMLF,DILF,IMO,DEN,
C   .              KORG(5),NORG,
C   .              XDPTIN,XDPT,AGE,
C   .              RF1,RF2,
C   .              RPF1,RPF2,
C   .              HREXT,HRINH,
C   .              SRDIL,FRSIZ,
C   .              IT1,IT2,IRR,NORG30,BRATE
C
C   COMMON /INPUTC/ PLANAM, VOLNAM
C   CHARACTER PLANAM*12, VOLNAM*12
C
C   COMMON /CALC/ AREAIN, AREAEX, RINH, XF
C-----
```

FILE: INVIN.CMN

```
C-----
C
C   Input Inventory Common Block
C   Module of MAXI30                      Version of 19-JUN-86 RAP
C
C   COMMON /INVIN/ FINV,
C   .              Q(20),
C   .              QI(20),
C   .              QJ(20),
C   .              QK(20)
C
C-----
```

FILE: INVOUT.CMN

```
C-----
C
C   Calculation/Output Inventory Common Block
C   Module of MAXI30           Version of 19-Jun-86 RAP
C
C   COMMON /INVOUT/ AM(20), QSAV(20),
C   .               AMI(20), AMT(20),
C   .               AMJ(20), AMK(20),
C   .               AML(20), AMM(20)
C
C
C-----
```

FILE: LIB26.CMN

```
C-----
C
C   Library Parameters Common Block
C   Module of MAXI30           Version of 23-Jun-86 RAP
C
C   COMMON /LIB26/ ISEL(30),
C   .               DFINH(20,30),
C   .               DFING(20,30)
C
C   LOGICAL ISEL
C
C-----
```

FILE: LIBPAR.CMN'

```
C-----
C
C   Library Parameters Common Block
C   Module of MAXI30           Version of 19-Jun-86 RAP
C
C   COMMON /LIBPAR/ EN(20,5),
C   .               TBIO(20,5),
C   .               FW(20,5),
C   .               DPVL(20),
C   .               FDTG(15,20),
C   .               BIDACF(5,20)
C
C-----
```

FILE: MONITR.CMN

```
C-----
C
C   Monitor Parameters Common Block
C   Module of MAXI30           Version of 9-Apr-86  RAP
C
C   COMMON /MONITR/ DEBUG(20)
C   LOGICAL DEBUG
C
C   (1) - Input checking monitor
C   (2) - File handling monitor
C   (3) - Concentration calculations
C-----
```

FILE: MXTIM.CMN

```
C-----
C
C   Maximum Doses and Times Common Blocks
C   Module of MAXI30           Version of 28-Mar-86  RAP
C
C   COMMON /MXTIM/ MAXTIM(5),
C   .               MAXD(5),
C   .               MAXPM(50,5)
C-----
```

FILE: OPT.CMN

```
C-----
C
C   Option Flags Common Block
C   Module of MAXI30           Version of 23-Jun-86 RAP
C
C   COMMON /OPT/ IAIR, IDKAIR, IBLOW, INTRUD, IDKWAT, ISUR, INHA,
C   .             IFOD, IARG, IWAT, IEXT, IOUT, NEXT, M3M2,
C   .             IRES, INUT, ICLNUP, I1109, IEDE,
C   .             FOD, WAT, ARG, INH
C
C   LOGICAL FOD, WAT, ARG, INH
C-----
```

FILE: ORGLAB.CMN

```
C-----  
C  
C   Organ Labels Common Block  
C   Module of MAXI30           Version of 24-Jun-86 RAP  
C  
C  
C   COMMON /ORGLAB/ ONAME(23), ONAME2(30)  
  
C   CHARACTER*12 ONAME2  
C   CHARACTER*10 ONAME  
C-----
```

FILE: PATH.CMN

```
C-----  
C  
C   Food Pathway Common Block  
C   Module of MAXI30           Version of 19-Jun-86 RAP  
C  
C  
C   COMMON /PATH/ NFT, IPL,  
C   .             KFDTP(15),  
C   .             TRANS(15),  
C   .             HLDUP(15),  
C   .             YELD(15),  
C   .             GRWP(15),  
C   .             CON(15),  
C   .             NPT,  
C   .             KPTHWY(5),  
C   .             USAG(5),  
C   .             HLDUP2(5)  
C  
C  
C-----
```

FILE: RAD.CMN

```
C-----
C
C   Radionuclide-Specific Common Blocks
C   Module of MAXI30                Version of 8-Jul-86 RAP
C
C   COMMON /RAD/ NIN, NONUC, ICHN,
C   .           ELTI(20), ELTO(20),
C   .           NTR(20),
C   .           AL(20),
C   .           TRAD(20),
C   .           IOFNUC(20),
C   .           DK(2,20),
C   .           IFRM(2,20),
C   .           NFLAG(300),
C   .           NFLAGC(220)
C
C   COMMON /RADC/ AWI(20),
C   .           AWO(20)
C
C   CHARACTER*6 AWI, AWO
C
C-----
```

FILE: RMD.CMN

```
C-----
C
C   Radionuclide Master Library Common Blocks
C   Module of MAXI30                Version of 8-Jul-86 RAP
C
C   COMMON /RMD/ ELT(300),
C   .           TR(300),
C   .           IFR(2,300),
C   .           NCHN(300),
C   .           DKF(2,300),
C   .           NOFNUC(220),
C   .           NCHST(220),
C   .           NUC, NCH,
C   .           NSOLD(300)
C
C   COMMON /RMDC/ AW(300)
C   CHARACTER*6 AW
C
C-----
```


FILE: TITL.CMN

```
C-----
C
C   Titles Common Block
C   Module of MAXI30                      Version of 24-Jun-86 RAP
C
C
C   COMMON /TITL/ TITLR,
C   .             TITLF,
C   .             TITLO,
C   .             TITL13,
C   .             TITLB,
C   .             TITLDI,
C   .             TIT22,
C   .             TIT27,
C   .             TITLE1
C
C   CHARACTER*80 TITLR, TITLF, TITLO, TITL13, TITLB, TITLDI,
C   .            TIT22, TIT27, TITLE1
C-----
```

FILE: COMPILE.OPT

```
$DEBUG
$LIST
$STORAGE: 2
$PAGESIZE: 63
$TITLE: 'MAXI1 Source Code'
$SUBTITLE: 'IBM PC/XT/AT Version 1.0'
```

COMPUTER PROGRAM LISTING - ONSITE

\$INCLUDE: 'COMPILE.OPT'

C
C
C Program Title: ONSITE
C
C Developed for: U.S. Nuclear Regulatory Commission
C
C Office of Nuclear Regulatory Material Safety &
C Safeguards (NMSS)
C Division of Waste Management
C
C Date: October 30, 1986
C
C NRC Contacts: Dr. Stanley M. Neuder (301) 427-4533 or FTS 427-4533
C Dr. R. B. Neel (301) 427-4559 or FTS 427-4559
C U.S. Nuclear Regulatory Commission
C MS 623-SS, Willste Building
C Washington, DC 20555
C
C Code Developer: W. E. Kennedy, Jr., B. A. Napier, R. A. Peloquin
C Pacific Northwest Laboratory
C Richland, WA 99352
C Telephone (commercial and FTS): (509) 375-3849 (WEK)
C
C Documentation: Kennedy, W. E., Jr., R. A. Peloquin, B. A. Napier,
C and S. M. Neuder. 1986. INTRUDER DOSE PATHWAY
C ANALYSIS FOR THE ONSITE DISPOSAL OF RADIOACTIVE
C WASTES: THEN ONSITE/MAXI1 COMPUTER PROGRAM.
C NUREG/CR-3620 Supplement 2, U.S. Nuclear Regulatory
C Commission, Washington, D.C.
C
C Computer Code Availability:
C
C Information regarding the availability of this computer program
C is available from
C
C U.S. Nuclear Regulatory Commission
C Information Technology Services Support Center
C Mail Stop P-808
C Washington, DC 20555
C Telephone: (301) 492-4160 or FTS 492-4160
C
C This program was prepared for an agency of the United States
C Government. Neither the United States Government nor any agency
C thereof, or any of their employees, makes any warranty, expressed
C or implied, or assumes any legal liability or responsibility for
C any third party's use, or the results of such use, of any portion
C of this program, or represents that its use by such third party
C would not infringe privately owned rights.
C

ON SITE is the interactive user interface for the ON SITE/MAXI1 software package. ON SITE creates a file containing the input parameters for MAXI1.

Version of 1-Oct-86 RAP

The program ON SITE includes the following modules:

BLOCKD - initialize COMMON parameters
CHANGE - to query if parameter is to be changed, and if so, to input the new value
CHANG2 - test input value against parameter bounds
DISINV - to display and control modifications to the user-entered inventory
GROUP - to determine if changes are required for a group of parameters
FILNAM - construct output file name
INTRO - to display introductory messages
MODIF - to modify selected scenario parameters
ON SITE - program control and general parameter input
OPTION - control input of pathway options for user-defined scenario
QUANTI - to read in source term this radionuclide
RADIN - to read in and test radiological inventory
RDLIST - to display the radionuclide master list
RITFIL - to write MAXI1 input stream
SELECT - to select and test scenario option
SCENR - to establish scenario default parameters
SELECT - to select and test scenario option
WASTE - construct external dose rate file name based on waste location

Program variable descriptions --

IDT - selected diet option
IWD - selected waste density option
IRS - Index of scenario used for default values
ICFLAG - CHANGE subroutine passing flag: (returned)
0 - no change requested
1 - change requested
IGFLAG - GROUP subroutine flag: (returned)
0 - no change requested in this group
1 - change requested in this group
ITFLAG - CHANGE subroutine passing flag: (sent)
1 - integer value
2 - real value
3 - double precision value

```

C      IX      - CHANGE subrouotine passing parameter - integer value
C      IH      - CHANGE passing parameter - maximum allowable integer
C                input
C      IL      - CHANGE passing parameter - minimum allowable integer
C                input
C      GNAME    - Character*16 name of subgroup passed to GROUP
C      RX      - CHANGE subroutine passing parameter - real value
C      RH      - CHANGE passing parameter - maximum allowable real input
C      RL      - CHANGE passing parameter - minimum allowable real input
C      R8X     - CHANGE subroutine passing parameter - real*8 value
C
C---- data definition and intialization -----
C
C$INCLUDE: 'ONSITE.CMN'
C
C      CHARACTER*8 R8X
C      CHARACTER*32 EXTFAC(5)
C      CHARACTER WLOC*12
C      CHARACTER FNAME*40
C
C      DATA EXTFAC /'On surface          (15 cm thick)',
C      .            'On surface          (1 m thick)',
C      .            'Overburden of 0.5 m (1 m thick)',
C      .            'Overburden of 1.0 m (1 m thick)',
C      .            'Stored waste        (1 m thick)'/
C
C
C---- introduce program, describe scenarios to user, & establish defaults ----
C
C      OPEN (10,FILE='RMDONS.DAT',STATUS='OLD')
C      OPEN (3,FILE='ONSITE.WRK',STATUS='NEW')
C      OPEN (8,FILE='DEFAULT.IN',STATUS='OLD')
C
C      CALL INTRO
C      CALL SCENR
C
C---- input title -----
C
C      WRITE (SCRN,1100)
C      1100 FORMAT (' ',20('/),' ',
C      . 'Enter a descriptive title to identify this case: ')
C      READ (KEY,'(A)') TITL
C
C---- review return comes to this location ----
C      201 CONTINUE
C
C---- input report option -----

```

```

C
  WRITE (SCRN,1101)
1101 FORMAT (' ',14('/),' ',
  . 'Do you wish to consider ICRP Publication 30 as well as'/
  . ' ICRP Publication 2 methodology (N/Y)?')
  READ (KEY,'(A1)') IY
C
  IF (IY .EQ. 'Y' .OR. IY .EQ. 'y') IEDE = 1
  IF (IEDE .EQ. 0) THEN
    WRITE (SCRN,1120)
    WRITE (SCRN,1121) IOUT
1120  FORMAT (' ',14('/),' ',
  . 'Three types of printer reports are available: '//
  . '      0- Tables of maximum annual dose per organ with radio'
  . 'nuclide and'/'      pathway contribution'/'
  . '      1- Table above plus annual doses by organ and total'/'
  . '      2- Table above plus annual doses by organ, pathway and',
  . ' radionuclide')
  ELSE
    WRITE (SCRN,1122)
    WRITE (SCRN,1121) IOUT
1122  FORMAT (' ',14('/),' ',
  . 'Three types of printer reports are available: '//
  . '      0- The annual effective dose equivalent (AEDE) and the'/'
  . 'maximum annual dose (and maximum year) to each organ'/'
  . '      1- The committed dose equivalent by organ, the effective'/'
  . 'dose equivalent, external dose equivalent, and the'/'
  . 'annual effective dose equivalent'/'
  . '      2- The committed dose equivalent to each organ by radio',
  . 'nuclide'/'      and pathway plus the maximum annual dose',
  . 'to each organ'/'      by radionuclide and pathway for the',
  . 'maximum year for each organ')
  IEDE = 0
  ENDIF
1121 FORMAT (///' ',
  . 'The current selection is:',I2)
  CALL CHANGE ((1), ICFLAG, IX, (0), (2), RX, RL, RH, R8X)
  IF (ICFLAG.EQ.1) IOUT = IX
C
C-- if scenario 1, 2, or 5, find out where the wastes are located and
C-- set flags
C
  IF (IEXT .EQ. 1) THEN
    WRITE (SCRN,1210)
    DO 302 I = 1, 5
      WRITE (SCRN, 1211) I, EXTFAC(I)
302  CONTINUE
    WRITE (SCRN,1212) ILOC
C
1210  FORMAT (' ',14('/),' ',
  . 'In this scenario, waste location and depth may be: '//)
1211  FORMAT(15X,I2,' - ', A32)

```

```

1212     FORMAT (//,' See Table 2.3-1 of NUREG/CR-3620 Supplement.'/
.       ' The current selection is: ',I1)
        CALL CHANGE ((1),ICFLAG,IX,(1),(5),RX,RL,RH,R8X)
        IF (ICFLAG.EQ. 1) ILOC = IX
        ENDIF
C
C---- if user-defined scenario, select pathways -----
C
        IF (IRS .LT. 5) GO TO 111
        IMOD=1
        CALL OPTION
111 CONTINUE
C
C---- set area correction factor -----
C
400 CONTINUE
C
        WRITE (SCRN,1300) FRSIZ
1300     FORMAT (' ',14('/),' ',
.       'The size of the site in terms of fractional hectares'/
.       ' (ie., 10000 sq m), is ',1PE10.3,'.')
        CALL CHANGE ((2),ICFLAG,IX,IL,IH,RX,(1.E-30),(1.E30),R8X)
        IF (ICFLAG.EQ.1) FRSIZ = RX
C
        WRITE (SCRN,1301) FRSIZ
1301     FORMAT (////' ',
.       'The inventory will automatically be adjusted by the'/
.       ' appropriate area correction factor for each exposure'/
.       ' pathway based on a site size of ', 1PE10.3, ' hectares.'/)
C
        GNAME = 'site size
        CALL GROUP (IGFLAG)
C
        IF (IGFLAG.EQ.1) GO TO 400
C
C---- modify pathway parameters -----
C
        IF (IRS .EQ. 5) GO TO 100
        WRITE (*,1001) IRS
1001     FORMAT (' ',10('/),' ',
.       .14X,44('#')//14X,'Do you wish to review/modify any pathway
.       ./14X,'parameter values for Scenario ',I1,' (N/Y) ?')
        READ (*,'(A)') IDUM
        WRITE (SCRN,1002)
1002     FORMAT (' ',14('/))
C
        IF (IDUM .EQ. 'Y' .OR. IDUM .EQ. 'y') IMOD =1
C
100 CONTINUE
        IF (IMOD .EQ. 1) CALL MODIF
C

```

```

C----- start and end times -----
C
200 CONTINUE
C
  WRITE (SCRN,1110) IT1
1110 FORMAT (' ',20('/),' ',
  . 'The dose calculations begin ',I4,' years after the waste is'
  . '/' disposed.')
  IF (IRR .GT. 0) WRITE (SCRN,1112)
1112 FORMAT (' See Section 3.1 in NUREG/CR-3620 Supplement. ')
  CALL CHANGE ((1), ICFLAG, IX, IRR, (9999), RX, RL, RH, R8X)
  IF (ICFLAG.EQ.1) IT1 = IX
C
  IT2 = IT1 + 49
  WRITE (SCRN,1111) IT2
1111 FORMAT (' ',
  . 'The dose calculations will end ',I4,' years after the waste is'/'
  . '/' disposed. OK? (Y/N)')
  READ (KEY, '(A)') IDUM
  IF (IDUM .EQ. 'N' .OR. IDUM .EQ. 'n') GO TO 200
C
C
C----- input ratio and inventory units -----
C
C
  IF (ISUR .EQ. 1 .AND. IEXT .EQ. 1) THEN
C
  WRITE (SCRN,1220) RPF1
1220 FORMAT (' ',14('/),' ',
  . 'This scenario assumes contamination to both surface ',
  . '(top 15 cm) and'/' subsurface (below 15 cm) soil.'/'
  . 'What is the ratio of the waste concentration in the ',
  . 'surface soil'/' to the waste concentration in the ',
  . 'subsurface soil?'/' For example: If the waste concentra',
  . 'tion in the subsurface soil is four times'/' more concen',
  . 'trated than the surface soil, the ratio of the waste concen',
  . 'tration'/' in the surface soil to that in the subsurface ',
  . 'soil is 1:4. The number to'/' type in in this case is ',
  . '1/4, or 0.25. If subsurface waste concentration'/' is the ',
  . 'same as the surface, the ratio is 1:1. The number to type ',
  . 'in this'/' case is 1/1, or 1.00.'/' The input inventories ',
  . '(waste) go into the subsurface soil compartment.'/' The ',
  . 'current selection is: ', 1PG10.3)
  CALL CHANGE ((2), ICFLAG, IX, IL, IH, RX, (0.0), (10.0), R8X)
  IF (ICFLAG .EQ. 1) RPF1 = RX
C
  ENDIF
C
C
  IF (IRS .EQ. 4) GO TO 300
C
  WRITE (SCRN,1230)

```

```

      DO 131 I = 1, 4
        WRITE (SCRN,1231) I, NVU(I)
131  CONTINUE
      WRITE (SCRN, 1232) INUT
C
1230  FORMAT(' ',24('/),' ',
. 'The surface/buried inventory may be entered as: '///)
1231  FORMAT(15X, I1,' - ',A4)
1232  FORMAT(//,' ',
. 'The current selection is: ',I1)
      CALL CHANGE ((1),ICFLAG, IX, (1), (4), RX,RL,RH,R8X)
      IF (ICFLAG .EQ. 1) INUT = IX
C
C
      WRITE (SCRN,1200)
      DO 142 I = 1, 3
        IM3 = I - 1
        WRITE (SCRN,1201) IM3, NVU(INUT), UNITS(I)
142  CONTINUE
      WRITE (SCRN,1202) M3M2
C
1200  FORMAT (' ',14('/),' ',
. 'The contamination deposited on the site at start of'
. ' calculation may be entered in the following units: '//)
1201  FORMAT (15X, I1,' - ',A4,A16)
1202  FORMAT (//, ' Usually 0 for surface contamination and ',
. ' 1 for buried'
. ' contamination. The current selection is: ',I1)
      CALL CHANGE ((1),ICFLAG,IX,(0),(2),RX,RL,RH,R8X)
      IF (ICFLAG .EQ. 1) M3M2 = IX
C
300  CONTINUE
C
      IF (IRS .EQ. 4) GO TO 301
C
      WRITE (SCRN,1250) SRDIL
1250  FORMAT(' ',14('/),' ',
. 'The radionuclide inventory modification factor is: ',1PG10.2/
. ' (range = 0.0 to 1.0E+20, usually 0.0 to 1.0)'//
. ' This factor will be used as a multiplier of all input'
. ' concentrations. It is a handy parameter to correct units'
. ' or make other changes (such as dilution of inventory with'
. ' clean soil).')
      CALL CHANGE ((2),ICFLAG,IX,IL,IH,RX, (0.0),(1.E20),R8X)
      IF (ICFLAG .EQ. 1) SRDIL = RX
301  CONTINUE
C
C

```



```

C---- allow user to review parameters before entering the inventory -----
C
      GNAME = 'any of the above'
      CALL GROUP (IGFLAG)
      IF (IGFLAG .EQ. 1) THEN
        IMOD = 0
        GO TO 201
      ENDIF
C
C
C---- input inventory and write file -----
C
      CALL RADIN
      CALL DISINV
      CALL WASTE (WLOC)
      CALL FILNAM (FNAME)
      CALL RITFIL (FNAME)
C
C---- end of program -----
C
      WRITE (SCRN,8000)
8000 FORMAT (' ',20('/),
      .10X,'To execute MAXI1 on the IBM PC/XT/AT interactively, type:'//
      .30X,'MAXI'//
C-----
      END

```

\$INCLUDE: 'COMPILE.OPT'

C-----

C

BLOCK DATA

C

C

This module initializes COMMON BLOCK variables

C

C

Module of ONSITE

C

IBM PC/XT/AT Version of 26-Jun-86 RAP

C

C-----

C

\$INCLUDE: 'ONSITE.CMN'

C

C----- set default values per scenario -----

C

DATA IAIR, IEDE, IDKAIR, IDKWAT, INTRUD, IOUT / 6*0 /
DATA IT1, IT2, INUT, M3M2 / 1, 50, 2*1 /
DATA SRDIL, DILF, FRSIZ, RPF2, RPF1 / 0.2, 4*1.0 /
DATA PLANAM, VOLNAM / 'PLANEA.DAT ', 'BURHFA.DAT ' /
DATA IBLOW, ICLNUP, I1109, XQSITE / 0, 2*1, 0.0 /
DATA RF1, RF2, RIRR, IRR, IMO / 1.0, 0.0, 150.0, 0, 6 /

C

C

DATA BRATE, AGE, DEN / 270.0, 0.0, 1.0E6 /
DATA XPDTIN, XMLF / 1.0, 1.0E-4 /
DATA IARG, IRES, HREXT, HRINH / 2*0, 2*2000.0 /
DATA IEXT, INHA, IWAT, ISUR, IFOD / 1, 1, 0, 1, 1 /
DATA DEBUG / 4*.FALSE. /
DATA IBS, ILOC / 1, 2 /
DATA IWD, IDT / 2*1 /

C

DATA KEY, SCRIN, OUT, IRS, IMOD / 2*0, 7, 1, 0 /
DATA NVU / 'pCi ', 'uCi ', 'mCi ', 'Ci ' /
DATA NVUNIT / 1.0, 1.0E+6, 1.0E+9, 1.0E+12 /

C

DATA UNITS / '/square meter ',
 '/cubic meter ',
 '/kg of soil ' /

C

DATA KFD TYP / 1, 2, 4, 7, 9, 10, 11, 12, 13, 14, 5*0 /
DATA GRWP / 90.0, 60.0, 4*90.0, 30.0, 3*90.0, 5*0.0 /
DATA YELD / 1.5, .70, 4.0, 2.0, 1.0, .84, 1.3, 3*.84, 5*0.0 /
DATA HLDUP / 2*1.0, 2*10.0, 3*1.0, 2*15.0, 1.0, 5*0.0 /
DATA CON / 2*9.5, 76.0, 42.0, 51.0, 19.0, 1.10E+02, 39.0, 29.0, 8.5, 5*0.0 /
DATA TRANS / 1.0, 5*.10, 1.0, 3*.10, 5*0.0 /

C

DATA KPTHWY / 1, 5, 3*0 /
DATA HLDUP2 / 2*1.0, 3*0.0 /

```

DATA USAG / 6.9, 438.0, 3*0.0 /
DATA NPT, NFT, NIN / 2, 10, 0 /
C
DATA FODLAB / 'LEAFY VEG. ' 'O.A.G.VEG. ' 'OT.RT.VEG. '
. 'ORCH.FRUIT ' 'OT.GRAIN ' 'EGGS '
. 'MILK ' 'BEEF ' 'PORK '
. 'POULTRY ' ' ' ' '
. ' ' ' ' /
C
DATA AQUALAB / 'FISH ' 'DRINK WATER ' '
. ' ' ' /
C
C
END
C-----

```

\$INCLUDE: 'COMPILE.OPT'

C-----

C

C SUBROUTINE CHANGE (ITFLAG, ICFLAG, IX, IL, IH, RX, RL, RH, R8X)

C

C CHANGE is called to query if parameter is to be changed,

C and if so, to input the new value and test if within the

C limits.

C

C This subroutine will handle integer, real and alphanumeric

C input and will test the limits on integer and real input.

C Alphanumeric input is read into the real*8 variable.

C

C ICFLAG - CHANGE subroutine passing flag: (returned)

C 0 - no change requested

C 1 - change requested

C 2 - input only, not change (received)

C ISRT - logical unit number of scratch file used for

C conversion

C IFLAG() - exceptable/not acceptable flag for each character

C of input string

C IH - maximum allowable integer input (received)

C IL - minimum allowable integer input (received)

C ITFLAG - CHANGE subroutine passing flag: (received)

C 1 - integer value

C 2 - real value

C 3 - alphanumeric input - real*8

C IVAL() - ASCII value of each character of input string

C IVL - ASCII value of current character of input string

C IX - new integer value (returned)

C LETTER() - array containing each character of input string

C RX - new real value (returned)

C RH - maximum allowable real input (received)

C RL - minimum allowable real input (received)

C R8X - real*8 alphanumeric string input (returned)

C WORD - input string

C WRDLEN - number of characters in input string

C

C Module of ONSITE

C IBM PC/XT/AT Version of 1-Oct-86 RAP

C-----

C

C \$INCLUDE: 'ONSITE.CMN'

C

C CHARACTER*8 R8X

C

C DIMENSION IVAL(10), IFLAG(10)

C

C INTEGER WRDLEN, IVL

```

      CHARACTER*10 WORD
      CHARACTER*1 LETTER(10)
      EQUIVALENCE (WORD, LETTER(1))
C
      ISRT = 3
C
C
C      ---- this is input only, not a change ----
C
      IF (ICFLAG .EQ. 2) THEN
        ICFLAG = 2
        GOTO 200
      ENDIF
C
C      ---- query if change requested ----
C
      ICFLAG = 0
      WRITE (SCRN,1000)
1000  FORMAT (// ' ',70('-',),//
      . ' Do you wish to change this value (N/Y)?')
      READ (KEY,'(A1)') IY
C
      IF (IY .NE. 'Y' .AND. IY .NE. 'y') GO TO 700
C
      ICFLAG = 1
100  CONTINUE
C
      WRITE (SCRN, 1010)
1010  FORMAT (' ',/, ' Enter new value: ')
C
C      ---- input response as a character string ----
C
200  CONTINUE
C
      READ (KEY,8010) WORD
C
      IF (ITFLAG .EQ. 3) GO TO 700
C
      WRDLEN = 0
      DO 500 I = 1, 10
C
        WRDLEN = WRDLEN + 1
        IFLAG(I) = 0
        IVL = ICHAR(LETTER(I))
        IVAL(I) = IVL
C
C      ---- all numerals are valid ----
      IF (IVL .LT. 48) IFLAG(I) = 1
      IF (IVL .GT. 57) IFLAG(I) = 1
C

```

```

C      IF (IFLAG(I) .GT. 0) THEN
C
C          ---- space is OK, but quit scan ----
C          IF (IVL .EQ. 32 .OR. IVL .EQ. 13) THEN
C              IFLAG(I) = 2
C              WRDLEN = I-1
C              GOTO 501
C          ENDIF
C
C          ---- reset for leading sign ----
C          IF (IVL .EQ. 45 ) IFLAG(I) = 0
C          IF (IVL .EQ. 43 ) IFLAG(I) = 0
C
C          ---- E is allowable -----
C          IF (IVL .EQ. 69) THEN
C              IF ( I .NE. 1 .AND. ITFLAG .EQ. 2) IFLAG(I) = 0
C          ENDIF
C
C          ---- Decimal point is allowable ----
C          IF (IVL .EQ. 46) THEN
C              IF (ITFLAG .EQ. 2) IFLAG(I) = 0
C          ENDIF
C
C      ENDIF
C
C      500      CONTINUE
C      501      CONTINUE
C
C      IF (WRDLEN .LT. 1) WRDLEN = 1
C      IF (IVAL(WRDLEN) .EQ. 69) IFLAG(I) = 1
C
C      IGOOD = 1
C      DO 502 I = 1, WRDLEN
C          IF (IFLAG(I) .GT. 0) IGOOD = 0
C      502      CONTINUE
C
C      IF (IGOOD .EQ. 1) THEN
C          WRITE (ISRT,8010) WORD
C      8010      FORMAT (A10)
C          BACKSPACE ISRT
C
C          IF (ITFLAG .EQ. 1) THEN
C              READ (ISRT,*,ERR=100,END=100) IX
C              IF (IX .LT. IL .OR. IX .GT. IH) GOTO 100
C          ENDIF
C
C          IF (ITFLAG .EQ. 2) THEN
C              READ (ISRT,*,ERR=100,END=100) RX
C              IF (RX .LT. RL .OR. RX .GT. RH) GOTO 100
C          ENDIF
C
C

```

```

        ELSE
          GOTO 100
        ENDIF
C
    700 CONTINUE
C
        WRITE (SCRN,1001)
    1001 FORMAT (' ',10(/))
C
        RETURN
C
C ---- Format Statements -----
C
    8003 FORMAT (A8)
C-----
C
        END

```

\$INCLUDE: 'COMPILE.OPT'

```
C-----
C
C      SUBROUTINE CHANG2 (IX)
C
C      CHANG2 is called by SELECT to test the limits on a
C      parameter in the SELECT subroutine.
C
C      This subroutine handles integer, real, and alphanumeric
C      input and tests the limits on integer input.
C
C      This module is very much like CHANGE. Look at CHANGE
C      for documentation.
C
C      Module of ONSITE
C      IBM PC/XT/AT Version of 26-Jun-86 RAP
```

```
C-----
C
C $INCLUDE: 'ONSITE.CMN'
```

```
C-----
C
C      DIMENSION IVAL (10), IFLAG (10)
C
C      INTEGER WRDLEN
C      CHARACTER*10 WORD
C      CHARACTER*1 LETTER(10)
C      EQUIVALENCE (WORD, LETTER(1))
C
C      ISRT = 3
C
C 100 CONTINUE
C      READ (KEY,8010) WORD
C
C      WRDLEN = 0
C      DO 500 I = 1, 10
C
C          WRDLEN = WRDLEN + 1
C          IFLAG(I) = 0
C          IVL = ICHAR(LETTER(I))
C          IVAL(I) = IVL
C
C      ---- all numerals are valid ----
C      IF (IVL .LT. 48) IFLAG(I) = 1
C      IF (IVL .GT. 57) IFLAG(I) = 1
C
C      IF (IFLAG(I) .GT. 0) THEN
C
C          ---- space is OK, but quit scan ----
C          IF (IVL .EQ. 32 .OR. IVL .EQ. 13) THEN
C              IFLAG(I) = 2
C              WRDLEN = I-1
```



```

        GOTO 501
    ENDIF
C
C      ---- reset for leading sign ---
    IF (IVL .EQ. 45) IFLAG(I) = 0
    IF (IVL .EQ. 43) IFLAG(I) = 0
C
C      ---- E is allowable ----
    IF (IVL .EQ. 69) THEN
        IF (I .NE. 1 .AND. ITFLAG .EQ. 2) IFLAG(I) = 0
    ENDIF
C
    ENDIF
C
500    CONTINUE
501    CONTINUE
C
    IF (WRDLEN .LT. 1) WRDLEN = 1
    IF (IVAL(WRDLEN) .EQ. 69) IFLAG(I) = 1
C
    IGOOD = 1
    DO 502 I = 1, WRDLEN
        IF (IFLAG(I) .GT. 0) IGOOD = 0
502    CONTINUE
C
    IF (IGOOD .EQ. 1) THEN
        WRITE (ISRT, 8010) WORD
8010    FORMAT (A10)
        BACKSPACE ISRT
        READ (ISRT,*,ERR=100,END=100) IX
    ELSE
        WRITE (SCRN,1000)
1000    FORMAT (14X,'To select a scenario enter 1, 2, 3, 4, or 5: ')
        GOTO 100
    ENDIF
C
    RETURN
C
C-----
END

```

\$INCLUDE: 'COMPILE.OPT'

C-----

C

SUBROUTINE DISINV

C

C This subroutine displays the radionuclide inventory, allows the
C user to first modify quantities in the inventory, and then to add
C radionuclides to the list. If changes or additions are requested,
C the inventory will be redisplayed; the user does not return from
C this subroutine until satisfied with the inventory.

C

C Module of ONSITE

C IBM PC/XT/AT Version of 1-Oct-86 RAP

C

C-----

C

\$INCLUDE: 'ONSITE.CMN'

C

300 CONTINUE

C

WRITE (SCRN,1000) NVU(INUT), UNITS(M3M2+1), NVU(INUT),
NVU(INUT)

1000 FORMAT(///T24,'Surface/Buried', T57,'Drinking'/
T29, A4, T41, 'Irrigation Water'/
T11,'Radionuclide',T25,A13, T43,A4,'/1', T58,A4,'/1',/
T11,'-----',3X,3('-----',5X))

C

C

DO 100 I = 1, NIN

WRITE (SCRN,1001) ELTI(I), AWI(I), Q(I), QI(I), QJ(I)

100 CONTINUE

1001 FORMAT(11X,A2,A6,3(5X,1PG10.2))

C

GNAME = 'the above

CALL GROUP (IGFLAG)

IF (IGFLAG.NE. 0) THEN

C

IMOD = 1

WRITE (SCRN,1011)

1011 FORMAT (///' You may now modify the quantity of selected'/
' radionuclides. To delete a radionuclide,'/
' enter zero quantity.'////)

C

DO 200 I = 1, NIN

WRITE (SCRN,1010) ELTI(I), AWI(I), Q(I), NVU(INUT),
UNITS(M3M2+1), QI(I), NVU(INUT), QJ(I), NVU(INUT)

1010 FORMAT (///' Radionuclide ',A2,A6,' : '//
' Surface/Buried: ',1PG10.2,1X,A4,A13/
' Irrigation: ',1PG10.2,1X,A4,'/1'/
' Drinking Water: ',1PG10.2,1X,A4,'/1')

```

        CALL GROUP(IGFLAG)
        IF (IGFLAG .NE. 0) CALL QUANTI (I)
200    CONTINUE
C
C
        ELSE
C
        IMOD = 0
C
        ENDIF
C
C
        WRITE (SCRN,1020)
1020    FORMAT (///' Do you wish to add radionuclides to the above',
        .      ' inventory (N/Y) ?')
        READ (KEY,'(A1)') IY
C
        IF (IY .EQ. 'Y' .OR. IY .EQ. 'y') THEN
            IMOD = 1
            CALL RADIN
        ENDIF
C
C
        IF (IMOD .EQ. 1) GO TO 300
C
        RETURN
C-----
END

```

```
$INCLUDE: 'COMPILE.OPT'
```

```
C-----
```

```
C
```

```
    SUBROUTINE GROUP (IGFLAG)
```

```
C
```

```
    This subroutine introduces a new category of parameters and allows  
    the user the option of skipping edits to that entire group of  
    parameters.
```

```
C
```

```
    Parameters:
```

```
C
```

```
    IGFLAG - flag returned to calling program to indicate user  
             preference concerning this group:  
             0 - do not change any parameters  
             1 - display/query this parameter group
```

```
C
```

```
    Module of ONSITE
```

```
C
```

```
    IBM PC/XT/AT Version of 1-Oct-86 RAP
```

```
C
```

```
C-----
```

```
C
```

```
$INCLUDE: 'ONSITE.CMN'
```

```
    IGFLAG = 0
```

```
C
```

```
    WRITE (SCRN,1000) GNAME
```

```
1000 FORMAT (' ',1('/),' ',70('#'))//
```

```
    . ' Do you wish to review or change ', A16,  
    . ' parameters (N/Y)?'
```

```
C
```

```
    READ (KEY,'(A1)') IDUM
```

```
    IF (IDUM .EQ. 'Y' .OR. IDUM .EQ. 'y') IGFLAG = 1
```

```
C
```

```
    RETURN
```

```
C
```

```
C-----
```

```
C
```

```
    END
```

```

$INCLUDE: 'COMPILE.OPT'
C-----
C
      SUBROUTINE FILNAM (FNAME)
C
C      This subroutine creates the ONSITE output file. This output
C      file will be used in MAXI.
C
C      FNAME - The filename for the ONSITE output file
C
C      Module of ONSITE
C      IBM PC/XT/AT Version of 26-Jun-86 RAP
C-----
C
$INCLUDE: 'ONSITE.CMN'
C
      CHARACTER FNAME*40, OPUT*40, DNAME*8, INPUT*40, SUFFIX*11
      CHARACTER*1 ALPHA(40)
      CHARACTER*1 CHECK(40)
      CHARACTER*1 BETA(8)
      CHARACTER*1 ROOT(11)
      EQUIVALENCE (INPUT, ALPHA(1))
      EQUIVALENCE (OPUT, CHECK(1))
      EQUIVALENCE (DNAME, BETA(1))
      EQUIVALENCE (SUFFIX, ROOT(1))
      INTEGER IVL, ICL, IOL, IOCHECK
      LOGICAL CNAM
C
1000 CONTINUE
C
      WRITE (SCRN, 100)
100  FORMAT (' ',14('/),' ',
      . 'The scenario created is going to be saved as the ONSITE ',
      . 'output/' file. You are going to type in the complete file',
      . 'name for the/' output file. Are you using the muse sub',
      . 'directory (Y/N)?')
      READ (KEY,'(A)') IDUM
      IF (IDUM .EQ. 'N' .OR. IDUM .EQ. 'n') GOTO 200
C
      INPUT = '\MUSE\
      GOTO 400
200 CONTINUE
      WRITE (SCRN, 300)
300  FORMAT (' ',3('/),' ',
      . 'Enter your subdirectory name. Example: \MAXI\ and ',
      . '\MAXI\DNSITE\ are/' acceptable subdirectory names. \MAXI, ',
      . 'ONSITE\, and MAXI\ONSITE\' are unacceptable names.')
      READ (KEY,'(A)') INPUT
C
      I = 1
      IVL = ICHAR(ALPHA(I))

```

```

IF (IVL .NE. 92) THEN
  CHECK(I) = '\'
  DO 1200 L = 2,40
    ICL = ICHAR(ALPHA(I))
    IF (ICL .EQ. 32) THEN
      IOL = ICHAR(ALPHA(I-1))
      IF (IOL .NE. 92) THEN
        CHECK(L) = '\'
        M = L
        GOTO 1300
      ENDIF
      M = L-1
      GOTO 1300
    ENDIF
    CHECK(L) = ALPHA(I)
    IF (L .EQ. 40) CHECK(L) = '\'
    M = L
    I = I+1
1200  CONTINUE
1300  CONTINUE
    WRITE (INPUT(1:),'(A)') OUTPUT(1:M)
    GOTO 400
  ENDIF
C
DO 1400 I = 1, 40
  ICL = ICHAR(ALPHA(I))
  IF (ICL .EQ. 32) THEN
    IOL = ICHAR(ALPHA(I-1))
    IF (IOL .NE. 92) ALPHA(I) = '\'
    GOTO 400
  ENDIF
  IF (I .EQ. 40) ALPHA(I) = '\'
1400 CONTINUE
400 CONTINUE
C
  WRITE (SCRN,500)
500  FORMAT (' ',3('/),' ',
  . 'Enter a prefix filename of no more than 8 characters.',
  . ' Example:/' SAMPLE1, OUTPUT1, and DATAFILE are all good ',
  . 'prefix filenames./' DATA.OUT and FILE.OUT include the ',
  . 'suffix so they are not/' acceptable prefix filenames.')
  READ (KEY,'(A)') DNAME
C
DO 550 I = 1, 8
  IVL = ICHAR(BETA(I))
  IF (IVL .EQ. 46) THEN
    WRITE (SCRN,750)
750  FORMAT (' ',3('/),' ','Your filename contains a suffix')
    GOTO 1000
  ENDIF
550 CONTINUE
C

```

```

SUFFIX= '

DO 2000 N= 1,8

    IVL= ICHAR(BETA(N))
    ROOT(N)= BETA(N)

    IF (IVL .EQ. 32) THEN
        ROOT(N)= '.'
        ROOT(N+1)= 'I'
        ROOT(N+2)= 'N'
        GOTO 3000
    ELSEIF (N .EQ. 8) THEN
        ROOT(N+1)= '.'
        ROOT(N+2)= 'I'
        ROOT(N+3)= 'N'
    ENDIF

2000 CONTINUE
3000 CONTINUE
C
    J = 1
    DO 600 I = 1, 40

        IVL = ICHAR(ALPHA(I))
        IF (IVL .EQ. 32) THEN
            ALPHA(I) = ROOT(J)
            ICL = ICHAR(ROOT(J))
            IF (ICL .EQ. 32) GOTO 700
            IF (J .EQ. 11) GOTO 700
            J = J+1
        ENDIF

600 CONTINUE

700 CONTINUE
    FNAME = INPUT
C
    INQUIRE (FILE=FNAME, EXIST=CNAM)

    IF (CNAM) THEN
        WRITE (SCRN,800)
800    FORMAT (' ',3('/),' ',
        . 'This file already exists. Do you wish to overwrite this ',
        . 'file (N/Y)?')
        READ (KEY,'(A)') IDUM
        IF (IDUM .EQ. 'Y' .OR. IDUM .EQ. 'y') GOTO 900
        GOTO 1000
    ENDIF
900 CONTINUE

```

```

OPEN (7,FILE=FNAME,STATUS='NEW',IOSTAT=IOCHECK)
IF (IOCHECK .GT. 0) THEN
    WRITE (SCRN,1100)
1100  FORMAT (' ',3('/),' ',
    . 'There is an error in naming the output file.')
    GOTO 1000
ENDIF
RETURN
C-----
END

```


\$INCLUDE: 'COMPILE.OPT'

C-----

C

SUBROUTINE INTRO

C

C This subroutine displays introductory messages, describes
C available scenarios, and queries for user's selection.

C

C Module of ONSITE

C IBM PC/XT/AT Version of 26-Jun-86 RAP

C

C-----

C

\$INCLUDE: 'ONSITE.CMN'

C

C

WRITE (SCRN,2000)

2000 FORMAT (' ',24('/),30X, 19('=')/33X,'ONSITE/MAXI1'/30X,
. 19('='),////////)

C

WRITE (SCRN,2011)

2011 FORMAT (14X,'This interactive program will assist you ',
'in the creation'/
.14X,'of scenarios for assessment of onsite disposal of low-'/
.14X,'level waste. Doses to man through the specified pathways'/
.14X,'will be simulated by the computer program MAXI1. ICRP'/
.14X,'Publication 30 as well as ICRP Publication 2 methodology'/
.14X,'may be used to calculate dose.'///
.14X,'The following notes may be of interest:')

C

WRITE (SCRN,2010)

READ (KEY,8003) IDUM

C

WRITE (SCRN,2001)

2001 FORMAT (' ', 24('/),
.14X,'1) If the default condition is selected, you need only'/
.14X,'press <return>. YES-or-NO questions are designated by'/
.14X,'(Y/N) and should be answered with a Y or N. The default'/
.14X,'condition is always listed first.')

C

WRITE (SCRN,2002)

2002 FORMAT ('0',
.13X,'2) The values you enter will be tested against reasonable'/
.14X,'limits and if they are not accepted you will be asked to'/
.14X,'supply another value.')

C

WRITE (SCRN,2010)

2010 FORMAT (/14X,'When you have finished reading, press <return>')

READ (KEY,8003) IDUM

8003 FORMAT (A8)

```

C
C---- loop until user is satisfied with scenario selection -----
C
C 100 CONTINUE
C
C      CALL SELECT
C
C      IF (IRS .EQ. 1) WRITE (SCRN,2100)
2100 FORMAT (' ',24('/),
.14X,'SCENARIO 1: External Exposure'//
.14X,'This scenario can be used alone or as part of Scenarios 2'//
.14X,'and 3. Occupational conditions of 2000 h/yr of external'//
.14X,'exposure are assumed. Waste may be located on the surface,'//
.14X,'buried at 0.5 m, buried at 1.0 m, or stored.')
C
C      IF (IRS .EQ. 2) WRITE (SCRN,2200)
2200 FORMAT (' ',24('/),
.14X,'SCENARIO 2: External Exposure plus Inhalation from Resus',
.14X,'pension'//
.14X,'This scenario assumes surface contamination results over a'//
.14X,'limited area. The scenario defaults to 2000 h/yr exposure'//
.14X,'to surface contamination and inhalation. The Anspaugh')
C      IF (IRS .EQ. 2) WRITE (SCRN,2201)
2201 FORMAT (14X,
.14X,'resuspension model is used. User may define the fraction'//
.14X,'of soil in the top 15 cm containing buried waste (defaults'//
.14X,'to 0.2).')
C
C      IF (IRS .EQ. 3) WRITE (SCRN, 2300)
2300 FORMAT (' ',24('/),
.14X,'SCENARIO 3: Agricultural Activities'//
.14X,'This scenario assumes surface contamination (as in Scenario'//
.14X,'2) with farming; defaults to 2000 h/yr exposure to surface')
C      IF (IRS .EQ. 3) WRITE (SCRN, 2301)
2301 FORMAT (14X,
.14X,'contamination and inhalation. Anspaugh resuspension model'//
.14X,'is used. Scenario defaults to total diet of fruits, veg-'//
.14X,'atables, and animal products grown on the site. The user'//
.14X,'may specify the percentage of soil containing waste in the'//
.14X,'top 15 cm.')
C
C      IF (IRS .EQ. 4) WRITE (SCRN, 2400)
2400 FORMAT (' ',24('/),
.14X,'SCENARIO 4: Irrigation and Drinking Water'//
.14X,'This scenario accounts for the use of well or river water'//
.14X,'for irrigation and drinking. Assumes an irrigation rate')
C      IF (IRS .EQ. 4) WRITE (SCRN, 2401)
2401 FORMAT (14X,
.14X,'of 150 l/sq m/mo for 6 months. Defaults to Anspaugh model'//
.14X,'for inhalation. Assumes total diet and 1.2 liters/day of'//
.14X,'drinking water.')

```

```

C      IF (IRS .EQ. 5) WRITE (SCRN,2500)
2500  FORMAT (' ',24('/),
      .14X,'SCENARIO 5: User Defined Scenario'//
      .14X,'This scenario defaults to a full year of exposure to'/
      .14X,'external contamination and a full year of inhalation.'/
      .14X,'The user may specify any parameters to define a scenario.')

```

```

C      WRITE (SCRN,2600) IRS
2600  FORMAT (' ',2('/),
      .14X,'Scenario ',I1,' is now selected. Do you wish to change'/
      .14X,'this selection (N/Y)?:')
      READ (KEY,'(A1)') IDUM
      IF (IDUM .NE. 'Y' .AND. IDUM .NE. 'y') RETURN

```

```

C      GO TO 100

```

```

C
C
C-----

```

```

      END

```

```

$INCLUDE: 'COMPILE.OPT'
C-----

C
C      SUBROUTINE MODIF
C
C      This subroutine allows the user to change selected parameters of
C      Scenarios 1 through 4 or to create a scenario (Scenario 5).
C
C      Module of ONSITE
C      IBM PC/XT/AT Version of 1-Oct-86 RAP
C-----

C
$INCLUDE: 'ONSITE.CMN'
C
C      CHARACTER*8 R8X
C
C----- review/query/modify agricultural parameters -----

C
C
C      IF (IFOD .EQ. 0) GO TO 100
1000  CONTINUE
C
C      GNAME = 'agricultural      '
C      CALL GROUP (IGFLAG)
C      IF (IGFLAG .EQ. 0) GO TO 100
C
C      ---- skip roots is Scenario 3, assumes surface contamination ----
C      IF (IRS .NE. 3) THEN
C
120   CONTINUE
C      WRITE (SCRN,1120) RF1
1120  FORMAT (' ',20('/),' ',
.      'The fraction of total roots in top 15 cm of the soil is ',
.      1PG10.3,/
.      '      (range = 0.0 to 1.0)')
C      CALL CHANGE ((2), ICFLAG, IX, IL, IH, RX, (0.0), (1.0), R8X)
C      IF (ICFLAG.EQ.1) RF1 = RX
C
C      WRITE (SCRN,1130) RF2
1130  FORMAT (' ',
.      'The fraction of total roots entering the buried waste '/
.      ' below the top 15 cm plow layer of soil is ', 1PG10.3,
.      '      (range = 0.0 to 1.0)')
C      CALL CHANGE ((2), ICFLAG, IX, IL, IH, RX, (0.0), (1.0), R8X)
C      IF (ICFLAG.EQ.1) RF2 = RX
C
C      RF = RF1 + RF2
C      IF (RF .GT. 1.0) WRITE (SCRN,1140)

```

```

1140  FORMAT (///' !!! The sum of the previous two fractions cannot '/
.    ' be greater than 1.0: REENTER !!!')
      IF (RF .GT. 1.0) GO TO 120
      ENDIF
C
      WRITE (SCRN,1166) IDT
1166  FORMAT (' ',20('/),' ',
.    'The R.G. 1.109 diet raised onsite may be either: '//
.    9X, ' 1 - Total diet          (plant and animal products)'/,
.    9X, ' 2 - Vegetable product diet (plant only)'/,
.    9X, ' 3 - Animal product diet   (milk, eggs, and meat only)',
.    '//, 'The default selection is ',I2,'.')
      CALL CHANGE ((1),ICFLAG, IX, (1), (3), RX,RL,RH,R8X)
      IF (ICFLAG.EQ.1) IDT = IX
C
      IF (IDT .EQ. 2) THEN
        DO 400 I = 6, 10
          CON(I) = 0.0
400    CONTINUE
      ELSEIF (IDT .EQ. 3) THEN
        DO 450 I = 1, 5
          CON(I) = 0.0
450    CONTINUE
      ENDIF
      DO 475 I = 1,10
        write (*,*) 'con(' , i,') = ', con(i)
475    continue
C
      IF (FRSIZ .LT. 1.0) GOTO 1161
      WRITE (SCRN,1160) RPF2
1160  FORMAT (' ',20('/),' ',
.    'The fraction of the selected diet grown on the site ',
.    ' is ', 1PG10.3,/' (range = 0.0 to 1.0)')
      CALL CHANGE ((2), ICFLAG, IX, IL, IH, RX, (0.0), (1.0), R8X)
      IF (ICFLAG.EQ.1) RPF2 = RX
1161  CONTINUE
C
      IF (IWAT .EQ. 0) GOTO 100
      WRITE (SCRN,1100) RIRR
1100  FORMAT (' ',
.    'The irrigation rate in liters per square meter per month is ',
.    1PG10.3, /
.    ' (range = 0.0 to 1000.)')
      CALL CHANGE ((2), ICFLAG, IX, IL, IH, RX, (0.0), (1000.0), R8X)
      IF (ICFLAG.EQ.1) RIRR = RX
C
      IF (RIRR .EQ. 0.0) GO TO 110
      WRITE (SCRN,1110) IMO
1110  FORMAT (' ',
.    'The number of months per year that crops are irrigated is ',
.    I2, /
.    ' (range = 0 to 12)')

```

```

        CALL CHANGE ((1), ICFLAG, IX, (0), (12), RX, RL, RH, R8X)
        IF (ICFLAG.EQ.1) IMO=IX
110  CONTINUE
C
        WRITE (SCRN,1111) IRR
1111  FORMAT (' ',
. 'The number of years prior to the beginning of dose '/
. ' calculations that irrigation accumulates radionuclides'/
. ' is ',I4,' (range = 0 to 1000)')
        CALL CHANGE ((1), ICFLAG, IX, (0), (1000), RX,RL,RH,R8X)
        IF (ICFLAG.EQ.1) IRR=IX
C
100  CONTINUE
C----- review/query/modify external exposure parameters -----
C
        IF (IEXT .EQ. 0 .AND. ISUR .EQ. 0) GO TO 200
C
        GNAME= 'ext. exposure '
        CALL GROUP (IGFLAG)
        IF (IGFLAG .EQ. 0) GO TO 200
        WRITE (SCRN,1200) HREXT
1200  FORMAT (' ',20('/),' ',
. 'The number of hours of exposure to external contamination ',
. '/ per year is ',1PG10.3,' (range = 0.0 to 8766.)')
        CALL CHANGE ((2), ICFLAG, IX, IL, IH, RX, (0.0),(8766.), R8X)
        IF (ICFLAG.EQ.1) HREXT = RX
C
        WRITE (SCRN,1201) IWD
1201  FORMAT (' ',20('/),' ',
. 'The waste density may be either: '//
. 10X, ' 1 - 1.8 g/cu cm (soil) '//
. 10X, ' 2 - 1.0 g/cu cm (water) '//
. 10X, ' 3 - 0.6 g/cu cm (0.5 water + 0.1 carbon) '//
. ' The default selection is ',I2,'.')
        CALL CHANGE ((1), ICFLAG, IX, (1), (3), RX,RL,RH,R8X)
        IF (ICFLAG.EQ.1) IWD = IX
C
200  CONTINUE
C----- review/query/modify inhalation exposure parameters -----
C
        IF (INHA .EQ. 0) GO TO 300
C
        GNAME = 'inhalation '
        CALL GROUP (IGFLAG)
        IF (IGFLAG .EQ. 0) GO TO 300
C
        WRITE (SCRN,1301) HRINH
1301  FORMAT (' ',20('/),' ',
. 'The number of hours of inhalation of contamination ',
. '/ per year is ',1PG10.3,' (range = 0.0 to 8766.)')

```

```

      CALL CHANGE ((2),ICFLAG,IX,IL,IH,RX,(0.0),(8766.),R8X)
      IF (ICFLAG.EQ.1) HRINH = RX
C
      WRITE (SCRN,1300) IRES
1300  FORMAT (' ',20('/),' ',
.      'Two resuspension models are available: '/
.      '          0 - Anspaugh'/
.      '          1 - Mass Loading'/
.      '/ The selected model is ',I1)
      CALL CHANGE ((1), ICFLAG, IX, (0), (1), RX, RL, RH, R8X)
      IF (ICFLAG.EQ.1) IRES = IX
C
      IF (IRES.EQ. 0) THEN
C
      WRITE (SCRN,1310) AGE
1310  FORMAT (' ',
.      'The number of years that contamination existed'/
.      ' on the surface, to account for environmental'/
.      ' weathering, at the start of the scenario '/,
.      ' is ',1PG10.3,' years. (range = 0.0 to 25.0)')
      CALL CHANGE ((2), ICFLAG, IX, IL, IH, RX, (0.0),(25.0), R8X)
      IF (ICFLAG.EQ.1) AGE = RX
C
      WRITE (SCRN,1320) XPDTIN
1320  FORMAT (' ',
.      'The top ',F4.1,' cm. of the contaminated surface soil'/
.      ' layer is available for resuspension (range = 0.0 to 15.0)')
      CALL CHANGE ((2), ICFLAG, IX, IL, IH, RX, (0.0),(15.0), R8X)
      IF (ICFLAG.EQ.1) XPDTIN = RX
C
      ELSE
C
C
      WRITE (SCRN,1330) DEN
1330  FORMAT (' ',
.      'The density of the soil is ',1PG10.1,' grams per cubic ',
.      'meter.'/' (range = 1.E5 to 5.0E7)')
      CALL CHANGE ((2), ICFLAG, IX, IL, IH, RX, (1.E5),(5.E7), R8X)
      IF (ICFLAG.EQ.1) DEN = RX
C
      WRITE (SCRN,1340) XMLF
1340  FORMAT (' ',
.      'The Mass Loading Factor is ',1PG10.1,' grams per cubic ',
.      'meter.'/' (range = 1.E-7 to 0.1)')
      CALL CHANGE ((2), ICFLAG, IX,IL,IH, RX, (1.E-7),(0.1), R8X)
      IF (ICFLAG.EQ.1) XMLF = RX
C
      ENDIF
      300  CONTINUE
      RETURN
C-----
      END

```

\$INCLUDE: 'COMPILE.OPT'

C-----

C

SUBROUTINE OPTION

C

C This subroutine allows the user to select various exposure
C pathways for the construction of a scenario.

C

C Module of ONSITE

C IBM PC/XT/AT Version of 26-Jun-86 RAP

C

C-----

C

\$INCLUDE: 'ONSITE.CMN'

C

CHARACTER*8 ANS(2)

DATA ANS /'(N/Y) ', '(Y/N) '/

C

IA = 1

IF (ISUR .EQ. 1) IA = 2

WRITE (SCRN,2002) ANS(IA)

2002 FORMAT (' ', 24(/), 14X,

. 'Do you wish to consider external exposure to surface'/

.14X, 'contamination? ', A8)

READ (KEY,8004) IDUM

IF (IA .EQ. 1 .AND. (IDUM .EQ. 'Y' .OR. IDUM .EQ. 'y')) ISUR=1

IF (IA .EQ. 2 .AND. (IDUM .EQ. 'N' .OR. IDUM .EQ. 'n')) ISUR=0

C

IA = 1

IF (IEXT .EQ. 1) IA=2

WRITE (SCRN,2004) ANS(IA)

2004 FORMAT (' ', 24(/), 14X,

. 'Do you wish to consider external exposure and crop '/

.14X, 'penetration to deeply buried waste? ', A8)

READ (KEY,8004) IDUM

8004 FORMAT (A1)

IF (IA .EQ. 1 .AND. (IDUM .EQ. 'Y' .OR. IDUM .EQ. 'y')) IEXT=1

IF (IA .EQ. 2 .AND. (IDUM .EQ. 'N' .OR. IDUM .EQ. 'n')) IEXT=0

C

IA = 1

IF (IFOD .EQ. 1) IA=2

WRITE (SCRN,2005) ANS(IA)

2005 FORMAT (' ', 24(/), 14X,

. 'Do you wish to consider farm product ingestion ?'/

. 14X, A8)

READ (KEY,8004) IDUM

IF (IA .EQ. 1 .AND. (IDUM .EQ. 'Y' .OR. IDUM .EQ. 'y')) IFOD=1

IF (IA .EQ. 2 .AND. (IDUM .EQ. 'N' .OR. IDUM .EQ. 'n')) IFOD=0

C


```

      IA = 1
      IF (IWAT .EQ. 1) IA=2

      WRITE (SCRN,2006) ANS(IA)
2006  FORMAT (' ', 24(/), 13X,
      .   'Do you wish to consider drinking water ingestion '/
      . 14X, 'from a contaminated well? ', A8)
      READ (KEY,8004) IDUM
      IF (IA .EQ. 1 .AND. (IDUM .EQ. 'Y' .OR. IDUM .EQ. 'y')) IWAT=1
      IF (IA .EQ. 2 .AND. (IDUM .EQ. 'N' .OR. IDUM .EQ. 'n')) IWAT=0
C
      IA = 1
      IF (IARG .EQ. 1) IA=2

      WRITE (SCRN,2007) ANS(IA)
2007  FORMAT (' ', 24(/), 13X,
      .   'Do you wish to consider consumption of aquatic'/
      . 14X, 'food from a contaminated river? ', A8)
      READ (KEY,8004) IDUM
      IF (IA .EQ. 1 .AND. (IDUM .EQ. 'Y' .OR. IDUM .EQ. 'y')) IARG=1
      IF (IA .EQ. 2 .AND. (IDUM .EQ. 'N' .OR. IDUM .EQ. 'n')) IARG=0
C
2000 CONTINUE
C
      RETURN
C
C-----
      END

```

\$INCLUDE: 'COMPILE.OPT'

C-----

C
C SUBROUTINE QUANTI (I)

C
C This subroutine requests the quantity of the current radionuclide
C for each of the selected pathways.

C
C Module of ONSITE
C IBM PC/XT/AT Version of 1-Oct-86 RAP

C-----

C
C \$INCLUDE: 'ONSITE.CMN'

C
C CHARACTER*8 R8X
C CHARACTER WHERE(2)*12

C
C DATA WHERE /'located at ',
C . 'buried at '/

C
C 202 CONTINUE
C IF (IRS .EQ. 4) GO TO 206
C IF (M3M2 .LT. 0 .OR. M3M2 .GT. 2) M3M2 = 0
C IF (ILOC .EQ. 1 .OR. ILOC .EQ. 5) THEN
C IA = 1
C ELSE
C IA = 2
C ENDIF

C
C WRITE (SCRN,1050) ELTI(I), AWI(I), WHERE(IA),
C NVU(INUT), UNITS(M3M2+1)
C 1050 FORMAT (// ' ',
C . 'Enter the quantity of ', A2, A6, A12, ' the site at',
C . ' start of '/' calculation (units: ', A4, A16, ') :')
C CALL CHANGE((2), (2), IX, IL, IH, RX, (0.), (1.E30), R8X)
C Q(I) = RX

C 206 CONTINUE
C
C IF (IRS .LT. 4) GO TO 301

C
C WRITE (SCRN,1052)
C 1052 FORMAT (' ', 14('/), ' ',
C . ' To consider only irrigation or only drinking water ',
C . 'contamination, '/
C . ' enter zero quantity for the other pathway.')

C
C WRITE (SCRN,1060) ELTI(I), AWI(I)
C 1060 FORMAT (// ' ',
C . 'Enter the concentration of ', A2, A6, ' in the irrigation ',
C . 'water at start of '/' calculation (units: pCi/liter):')

```

      CALL CHANGE ((2),(2), IX,IL,IH, RX, (0.), (1.E30), R8X)
      QI(I) = RX
      IF (QI(I) .GT. 0.) IWRL=1
C
302  CONTINUE
      WRITE (SCRN,1070) ELTI(I), AWI(I)
1070  FORMAT (//' ',
.      'Enter the concentration of ',A2,A6,' in the drinking water',
.      ' at start of '/' calculation (units: pCi/liter):')
      CALL CHANGE ((2),(2), IX,IL,IH, RX, (0.0), (1.E30), R8X)
      QJ(I) = RX
      IF (QJ(I) .GT. 0.) IWRL=1
301  CONTINUE
C
C
      RETURN
C
C-----
      END

```

\$INCLUDE: 'COMPILE.OPT'

C-----

C

SUBROUTINE RADIN

C

This subroutine controls input of the radionuclide master library
and user radiological inventory input

C

Module of ONSITE

C

IBM PC/XT/AT Version of 1-Oct-86 RAP

C

C-----

C

\$INCLUDE: 'ONSITE.CMN'

C

CHARACTER*8 R8X

DIMENSION EMAS(300), AMAS(300), IDORG(5)

CHARACTER AMAS*8, EMAS*2, ORG(23)*8, CL(3)*8, IZ*2, IS(2)*2

C

DATA ORG / 'tot body', 'body H2O', 'kidneys ', 'liver ', 'spleen ',
'bone ', 'fat ', 'lungs ', 'adrenals', 'testes ',
'ovaries ', 'skin ', 'brain ', 'muscle ', 'prostrat',
'thyroid ', 'pancreas', 'heart ', 'GI ', 'stomach ',
'sm. int.', 'ULI ', 'LLI ' /

C

DATA IDORG / 1,6,8,16,23/

DATA I / 0/

DATA IS / ' ', 'in' /

DATA CL / 'Class D ', 'Class W ', 'Class Y ' /

DATA FIRTIM / 0/

C

C

C---- read in radionuclide library -----

C

IF (FIRTIM .EQ. 0) THEN

C

NIN = 0

NUC = 1

READ(10, '(A)') IDUM

C

100 CONTINUE

READ(10,1001,END=992) EMAS(NUC), AMAS(NUC), IM

1001 FORMAT(A2,A8,8X,I2)

IF (IM .EQ. 0) GO TO 200

NUC = NUC + 1

GO TO 100

C

200 CONTINUE

ENDIF

```

C
C--- test if this is original or additional inventory and set flags -----
C
      IF (FIRTIM .EQ. 0) THEN
        NIN = 0
        I = 0
      ELSE
        I = NIN
      ENDIF
C
C---- initialize quantity arrays -----
C
      IF (FIRTIM .EQ. 0) THEN
        DO 610 IQ = 1, 50
          Q(IQ) = 0.
          QI(IQ) = 0.
          QJ(IQ) = 0.
          QK(IQ) = 0.
        610 CONTINUE
      ENDIF
C
C
C---- display list of radionuclides -----
C
      CALL RDLIST (EMAS,AMAS)
C
C
C---- signal beginning of inventory input -----
C
      208 CONTINUE
        WRITE (SCRN,1100)
      1100  FORMAT (' ',20('/),' ',
        . 'The following questions pertain to the radionuclide '/
        . ' inventory. After inputting the inventory, enter'/
        . ' "99" for element name to signal to the program that '/
        . ' you are finished.'///, ' ',70('#')//
        . ' Press <return> when you have finished reading:')
        READ (KEY,'(A)') IDUM
C
C---- input name and source terms for each radionuclide -----
C
      149  CONTINUE
C
        WRITE (SCRN,2400)
      2400  FORMAT (' ',10('/),' ',70('#'),///)
      300  CONTINUE
          ICFLAG = 1

```

```

        WRITE (SCRN, 1010)
1010    FORMAT (///' Enter new 2-character element ',
        .    ' (98=list, 99=finished): ')
        READ (KEY,8005) IZ
8005    FORMAT (A2)
        IF (IZ .EQ. ' ') GO TO 149
        IF (IZ .EQ. '99') GO TO 148
        IF (IZ .EQ. '98') THEN
            CALL RDLIST (EMAS,AMAS)
            GOTO 149
        ENDIF
C
        WRITE (SCRN, 1011)
1011    FORMAT ('OMass number input can be up to ',
        .    '6 characters long.')
        .    ' Include metastable (M) and daughter (+D) designation,',
        .    ' (i.e., TE127M+D)')
        .    ' Enter mass number: ')
        READ (KEY,'(A)') R8X
C
        DO 140 IX = 1, NUC
            IF (IZ .EQ. EMAS(IX) .AND. R8X .EQ. AMAS(IX)) GO TO 142
140        CONTINUE
        WRITE (SCRN,2401)
2401    FORMAT (///' ??? Radionuclide not found in library, ',
        .    'try again ???')
        GOTO 300
C
142    CONTINUE
C
        DO 144 IN = 1, NIN
            IF (ELTI(IN) .EQ. IZ .AND. AWI(IN) .EQ. R8X) THEN
                WRITE (SCRN,2402)
2402    FORMAT (///' ??? Radionuclide already included, try ',
                .    'again ???')
                GO TO 300
            ENDIF
144    CONTINUE
C
        IXS = IX
        NIN = NIN + 1
        I = I + 1
        ELTI(I)=IZ
        AWI(I)=R8X
        CALL QUANTI (I)
        GO TO 149
C
148 CONTINUE
        FIRTIM = 1
C
C
        RETURN

```

```
C
C----- error messages -----
C
  990 WRITE (SCRN,9000)
  9000 FORMAT (' Error opening radionuclide library.')
      STOP
C
  992 WRITE (SCRN,9002)
  9002 FORMAT (' Premature end-of-file discovered in library')
C
C
C-----
      END
```

```
$INCLUDE: 'COMPILE.OPT'
```

```
C-----
```

```
C
```

```
      SUBROUTINE RDLIST (EMAS,AMAS)
```

```
C
```

```
C      This subroutine displays the radionuclide master list  
C      when requested.
```

```
C
```

```
C      Module of ONSITE
```

```
C      IBM PC/XT/AT Version of 1-Oct-86 RAP
```

```
C
```

```
C-----
```

```
C
```

```
$INCLUDE: 'ONSITE.CMN'
```

```
      CHARACTER EMAS(300)*2, AMAS(300)*8
```

```
C
```

```
      300 CONTINUE
```

```
C
```

```
      WRITE (SCRN,1000)
```

```
1000  FORMAT(///' Radionuclide inventory must be from the ',  
           'following list:')
```

```
C
```

```
C
```

```
      DO 100 IN = 1, 107, 5
```

```
        WRITE (SCRN,1001) (EMAS(I), AMAS(I), I=IN, IN+4)
```

```
100  CONTINUE
```

```
1001  FORMAT( 5(5X,A2,A6))
```

```
C
```

```
C
```

```
      WRITE (SCRN,1020)
```

```
1020  FORMAT (' Press any key to continue...')
```

```
      READ (KEY,'(A)') IDUM
```

```
C
```

```
      RETURN
```

```
C
```

```
C-----
```

```
      END
```


\$INCLUDE: 'COMPILE.OPT'

C-----

C

SUBROUTINE RITFIL (FNAME)

C

This subroutine writes a file with input parameters for MAXI1.

C

Module of ONSITE

C

IBM PC/XT/AT Version of 1-Oct-86 RAP

C

C-----

C

\$INCLUDE: 'ONSITE.CMN'

C

CHARACTER LINE*78, NUKE*2, END*5, SEA*4, BUG*1, FNAME*40

C

IDUM = 'N'

C

READ (8,'(A)') LINE
WRITE (7,1025) LINE,FNAME
WRITE (7,1030) TITL
READ (8,'(A)') LINE
WRITE (7,'(A)') LINE
READ (8,'(A)') LINE
WRITE (7,'(A)') LINE

C

READ (8,'(A)') LINE
WRITE (7,1000) IEXT,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,'(A)') LINE
READ (8,'(A)') LINE
WRITE (7,1000) ISUR,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,'(A)') LINE
READ (8,'(A)') LINE
WRITE (7,1000) INHA,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,1000) IFOD,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,1000) IARG,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,1000) IWAT,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,1000) IAIR,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,1000) IEDE,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,1000) IDKAIR,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,1000) IDKWAT,LINE(9:)

```

      READ (8,'(A)') LINE
      WRITE (7,1000) INTRUD,LINE(9:)
C
      READ (8,'(A)') LINE
      WRITE (7,'(A)') LINE
      READ (8,'(A)') LINE
      WRITE (7,'(A)') LINE
      READ (8,'(A)') LINE
      WRITE (7,1000) IOUT,LINE(9:)
C
      IF (DEBUG(4)) THEN
        BUG = 'T'
      ELSE
        BUG = 'F'
      ENDIF
      READ (8,'(A)') LINE
      WRITE (7,1020) BUG,LINE(9:)
C
      READ (8,'(A)') LINE
      WRITE (7,'(A)') LINE
      READ (8,'(A)') LINE
      WRITE (7,'(A)') LINE
      READ (8,'(A)') LINE
      WRITE (7,1000) IT1,LINE(9:)
      READ (8,'(A)') LINE
      WRITE (7,1000) IT2,LINE(9:)
C
      READ (8,'(A)') LINE
      WRITE (7,'(A)') LINE
      READ (8,'(A)') LINE
      WRITE (7,'(A)') LINE
      READ (8,'(A)') LINE
      WRITE (7,1000) INUT,LINE(9:)
      READ (8,'(A)') LINE
      WRITE (7,1000) M3M2,LINE(9:)
      READ (8,'(A)') LINE
      WRITE (7,1000) NIN,LINE(9:)
C
      DO 200 I = 1,5
        READ (8,'(A)') LINE
        WRITE (7,'(A)') LINE
200  CONTINUE
C
      DO 600 I = 1,NIN
        IF (I.EQ. 1) NUKE = 'QJ'
        IF (I.EQ. 2) NUKE = 'QK'
        IF (I.GT. 2) NUKE = ' '
        WRITE (7,1100) ELTI(I),AWI(I),Q(I),QI(I),QJ(I),QK(I),NUKE
1100  FORMAT (14X,A2,A6,2X,1PE11.2,2X,1PE11.2,2X,1PE11.2,2X,
        . 1PE11.2,2X,A2)
      600  CONTINUE
C

```

```

READ (8,'(A)') LINE
WRITE (7,'(A)') LINE
READ (8,'(A)') LINE
WRITE (7,'(A)') LINE
READ (8,'(A)') LINE
WRITE (7,1005) SRDIL,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,1005) DILF,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,1005) FRSIZ,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,1010) RPF2,LINE(9:)

```

C

```

READ (8,'(A)') LINE
WRITE (7,'(A)') LINE
READ (8,'(A)') LINE
WRITE (7,'(A)') LINE
READ (8,'(A)') LINE
WRITE (7,1010) HREXT,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,1010) HRINH,LINE(9:)
READ (8,'(A)') LINE
WRITE (7,1015) PLANAM,LINE(13:)
READ (8,'(A)') LINE
WRITE (7,1015) VOLNAM,LINE(13:)
READ (8,'(A)') LINE
WRITE (7,1010) BRATE,LINE(9:)

```

C

```

READ (8,'(A)') LINE
WRITE (7,'(A)') LINE
READ (8,'(A)') LINE
WRITE (7,'(A)') LINE
READ (8,'(A)') LINE
WRITE (7,1000) IRES,LINE(9:)
IF (IRES .EQ. 0) THEN
  READ (8,'(A)') LINE
  WRITE (7,1010) AGE,LINE(9:)
  READ (8,'(A)') LINE
  WRITE (7,1010) XDPTIN,LINE(9:)
ELSE
  READ (8,'(A)') LINE
  WRITE (7,1005) DEN,LINE(9:)
  READ (8,'(A)') LINE
  WRITE (7,1005) XMLF,LINE(9:)
ENDIF
READ (8,'(A)') LINE
WRITE (7,'(A)') LINE

```

C

```

READ (8,'(A)') LINE
WRITE (7,'(A)') LINE
READ (8,'(A)') LINE
WRITE (7,1000) ISLOW,LINE(9:)

```

```

      READ (8,'(A)') LINE
      WRITE (7,'(A)') LINE
      READ (8,'(A)') LINE
      WRITE (7,1010) XQSITE,LINE(9:)
      READ (8,'(A)') LINE
      WRITE (7,1000) ICLNUP,LINE(9:)
      READ (8,'(A)') LINE
      WRITE (7,1000) I1109,LINE(9:)
C
      READ (8,'(A)') LINE
      WRITE (7,'(A)') LINE
      READ (8,'(A)') LINE
      WRITE (7,'(A)') LINE
      READ (8,'(A)') LINE
      WRITE (7,1010) RF1,LINE(9:)
      READ (8,'(A)') LINE
      WRITE (7,1010) RF2,LINE(9:)
      READ (8,'(A)') LINE
      WRITE (7,1010) RPF1,LINE(9:)
      READ (8,'(A)') LINE
      WRITE (7,1000) IMO,LINE(9:)
      READ (8,'(A)') LINE
      WRITE (7,1010) RIRR,LINE(9:)
      READ (8,'(A)') LINE
      WRITE (7,1000) IRR,LINE(9:)
      READ (8,'(A)') LINE
      WRITE (7,'(A)') LINE
      READ (8,'(A)') LINE
      WRITE (7,1000) NFT,LINE(9:)
C
      DO 300 I = 1,5
        READ (8,'(A)') LINE
        WRITE (7,'(A)') LINE
300  CONTINUE
C
      DO 700 I = 1,NFT
        IF (I .EQ. 1) END = 'HLDUP'
        IF (I .EQ. 2) END = ' CON'
        IF (I .EQ. 3) END = 'TRANS'
        IF (I .GT. 3) END = ' '
        WRITE (7,1200) KFD TYP(I),FODLAB(I),GRWP(I),YELD(I),HLDUP(I),
          . CON(I),TRANS(I),END
1200  FORMAT (I5,6X,A11,2X,F7.2,2X,F9.2,2X,F6.2,2X,F9.2,1X,
          . F8.2,3X,A5)
700  CONTINUE
C
      READ (8,'(A)') LINE
      WRITE (7,'(A)') LINE
      READ (8,'(A)') LINE
      WRITE (7,'(A)') LINE
      READ (8,'(A)') LINE
      WRITE (7,1000) NPT,LINE(9:)

```

```

C      DO 400 I = 1,4
        READ (8,'(A)') LINE
        WRITE (7,'(A)') LINE
400    CONTINUE
C
      DO 800 I = 1,NPT
        IF (I .EQ. 1) SEA = 'USAG'
        IF (I .GT. 1) SEA = ' '
        WRITE (7,1300) KPTHWY(I),AQULAB(I),HLDUP2(I),USAG(I),SEA
1300    FORMAT (I5,6X,A11,2X,F6.2,2X,F9.2,33X,A4)
800    CONTINUE
C
      DO 500 I = 1,3
        READ (8,'(A)') LINE
        WRITE (7,'(A)') LINE
500    CONTINUE
C
1000   FORMAT (I8,A70)
1005   FORMAT (1PE8.1,A70)
1010   FORMAT (F8.1,A70)
1015   FORMAT (A12,A66)
1020   FORMAT (A8,A70)
1025   FORMAT (A38,A40)
1030   FORMAT (A78)
C
      RETURN
C
C--- error routines -----
C
992   WRITE (SCRN,9920)
9920  FORMAT ('0Error in opening output file')
      STOP
C
994   WRITE (SCRN,9940)
9940  FORMAT ('0Error in closing output file')
      STOP
C
C
C-----
      END

```

\$INCLUDE: 'COMPILE.OPT'

C-----

C

SUBROUTINE SCENR

C

C This subroutine establishes default parameter values for the
C selected scenario.

C

C Module of ONSITE

C IBM PC/XT/AT Version of 26-Jun-86 RAP

C

C-----

C

\$INCLUDE: 'ONSITE.CMN'

C

IF (IRS .EQ. 5) IARG= 1

IF (IRS .EQ. 5) HREXT= 8766.0

IF (IRS .EQ. 5) IRES= 1

IF (IRS .EQ. 3 .OR. IRS .EQ. 4) IEXT= 0

IF (IRS .GT. 3) IWAT= 1

IF (IRS .EQ. 1) INHA= 0

IF (IRS .LT. 3) THEN

ISUR= 0

IFOD= 0

ENDIF

IF (IRS .EQ. 1 .OR. IRS .EQ. 5) THEN

RPF1= 0.0

ENDIF

IF (IRS .EQ. 1) HRINH= 0.0

IF (IRS .EQ. 5) HRINH= 8766.0

IF (IRS .EQ. 3 .OR. IRS .EQ. 4) ILOC = 1

C

RETURN

C

END

C-----

\$INCLUDE: 'COMPILE.OPT'

C-----

C

SUBROUTINE SELECT

C

C This subroutine prints a menu of scenario selection for the
C user and then test validity of the user input.

C

C Module of ONSITE

C IBM PC/XT/AT Version of 26-Jun-86 RAP

C

C-----

C

\$INCLUDE: 'ONSITE.CMN'

C

WRITE (SCRN,2004)

2004 FORMAT (' ', 24(/), 13X,

. 'The following scenarios have been defined: '//

.14X,'1 - External exposure'/

.14X,'2 - External exposure plus inhalation from resuspension'/

.14X,'3 - Agricultural activities '/

.14X,'4 - Use of well water for irrigation and drinking water'/

.14X,'5 - User-created scenario'//)

C

100 CONTINUE

WRITE (SCRN,2006)

2006 FORMAT(14X,'To select a scenario or for additional information'/

.14X,'on a scenario enter 1, 2, 3, 4, or 5: ')

C

CALL CHANG2 (IRS)

IF (IRS .LT. 1 .OR. IRS .GT. 5) GO TO 100

C

RETURN

C

C-----

END

\$INCLUDE: 'COMPILE.OPT'

C-----
C
C SUBROUTINE WASTE (WLOC)
C
C WASTE is called to determine the data file needed
C depending on the waste configuration and waste density.
C There are 15 different files that can be used to describe
C a particular waste site.

C
C This subroutine is much like CHANGE in how it handles
C character strings. See CHANGE for documentation.

C
C Module of ONSITE
C IBM PC/XT/AT Version of 1-Oct-86 RAP

C-----
C
C \$INCLUDE: 'ONSITE.CMN'

C
C CHARACTER WLOC*12, WSAM*12
C CHARACTER*1 LETTER(12)
C EQUIVALENCE (WSAM, LETTER(1))
C INTEGER IVL

C
C IF (ILOC .EQ. 1) THEN
C IF (IWD .EQ. 2) THEN
C PLANAM = 'PLANE.B.DAT '
C ELSEIF (IWD .EQ. 3) THEN
C PLANAM = 'PLANE.C.DAT '
C ELSE
C PLANAM = 'PLANE.A.DAT '
C ENDIF
C WLOC = PLANAM
C GOTO 100
C ENDIF

C
C IF (ILOC .EQ. 2) VOLNAM = 'VOLS .OAT '
C IF (ILOC .EQ. 3) VOLNAM = 'BURHF .DAT '
C IF (ILOC .EQ. 4) VOLNAM = 'BURI .DAT '
C IF (ILOC .EQ. 5) VOLNAM = 'STORED .DAT '
C WSAM = VOLNAM

C
C DO 101 I = 1, 12
C IVL = ICHAR (LETTER(I))
C IF (IVL .EQ. 32) THEN
C IF (IWD .EQ. 2) THEN
C LETTER (I) = 'B'
C ELSEIF (IWD .EQ. 3) THEN
C LETTER (I) = 'C'


```

        ELSE
            LETTER (I) = 'A'
        ENDIF
        ELSEIF (IVL .EQ. 84) THEN
            IF (I .GT. 2) GOTO 102
        ENDIF
101 CONTINUE
C
102 CONTINUE
    WLDC = WSAM
    VOLNAM = WLOC
C
100 CONTINUE
C
C
    RETURN
C
    END
C-----

```

FILE: ONSITE.CMN

```
C
COMMON /VARYBL/ IFOD, RIRR, IMO, RF1, RF2, IARG, IWAT,
.           IDKWAT, IEXT, IAIR, XQSITE, IDKAIR,
.           ISUR,
.           AGE, DEN, XMLF, DILF, M3M2, INTRUD,
.           IT1, IT2, IOUT,
.           RPF1, RPF2, IRR, SRDIL, NVUNIT(4)
REAL NVUNIT

C
C
COMMON /INV/ NIN,
.           Q(50), QI(50), QJ(50), QK(50)

C
C
COMMON /FLAG/ IRS, ILOC, INUT, IARL, IWRL, IWD, IDT, IMOD, IBS

C
C   IRS - INDEX OF SELECTED SCENARIO
C   ILOC - INDEX OF LOCATION OF THE WASTE:
C           1) ON SURFACE (15 cm thick)
C           2) ON SURFACE (1 m thick)
C           3) OVERBURDEN OF 0.5 m (1 m thick)
C           4) OVERBURDEN OF 1.0 m (1 m thick)
C           5) STORED (1 m thick)
C   INUT - INDEX OF RADIOLOGICAL UNITS INPUT FOR ARRAYS
C           NVU (DESCRIPTION) AND NVUNIT(MOD. FACTOR)
C   IARL - SET IF SURFACE/BURIED CONTAMINATION
C   IWRL - SET IF LIQUID CONTAMINATION
C   IWD  - INDEX OF SELECTED WASTE DENSITY
C   IDT  - INDEX OF SELECTED DIET
C
C
COMMON /AREA/ FRSIZ

C
C   FRSIZ - SIZE OF THE SITE IN FRACTIONAL HECTARES
C
C-----
C
COMMON /IOVAR/  SCRIN, OUT, KEY
INTEGER SCRIN, OUT
C
C-----
C
COMMON /CHAR/ TITL, UNITS(3), NVU(4), AWI(50), ELTI(50), OUTFIL,
.           GNAME, IDUM, IY
C
C   CHARACTER  UNITS*16, TITL*80, NVU*4, AWI*8, ELTI*2, OUTFIL*16,
.           GNAME*16, IDUM*1, IY*1
C
```

```

C-----
C
COMMON /FOOD/ KFD TYP(15), GRWP(15), YELD(15), HLDUP(15), CON(15),
.      TRANS(15), KPTHWY(5), HLDUP2(5), USAG(5),
.      FODLAB(15), AQULAB(5), NPT, NFT
C
CHARACTER FODLAB*12, AQULAB*12
C
C-----
C
COMMON /NEW/ INHA, IEDE, DEBUG(4), HREXT, HRINH, PLANAM, VOLNAM,
.      BRATE, IRES, XPDTIN, IBLOW, ICLNUP, I1109
C
CHARACTER PLANAM*12, VOLNAM*12
LOGICAL DEBUG
C
C
C      VERSION OF 26-Jun-86  RAP
C-----

```

FILE: COMPILE.OPT

\$DEBUG

\$LIST

\$STORAGE: 2

\$PAGESIZE: 60

\$TITLE: 'ONSITE Source Code'

\$SUBTITLE: 'IBM PC Version'

FILE: DEFAULT.IN

MAXI Input File

Filename here/Title on next line:

DO YOU WISH TO CONSIDER:

External exposure and root penetration for waste modeled as a slab (volume) source? (0-no 1-yes)	IEXT
External exposure to surface contamination modeled as a plane source? (0-no 1-yes)	ISUR
Inhalation of resuspended material? (0-no 1-yes)	INHA
Farm product ingestion? (0-no 1-yes)	IFOD
Aquatic foods ingestion? (0-no 1-yes)	IARG
Drinking water ingestion? (0-no 1-yes)	IWAT
Off site atmospheric source? (0-no, 1-yes)	IAIR
ICRP-26/30 as well as ICRP-2 methodology? (0-no 1-yes)	IEDE
Decay of air release source term? (0-no 1-yes)	IDKAIR
Decay of water release source term? (0-no 1-yes)	IDKWAT
Use the One-Year-of-Exposure Model? (0-no 1-yes)	INTRUD

MONITORING AND OUTPUT OPTIONS

Level of detail in reports (0-least to 3)	IOUT
Monitor and print hand calculation report	DEBUG(4)

NUMBER OF YEARS AFTER WASTE IS DISPOSED THAT:

Scenario begins:	IT1
Scenario ends:	IT2

INVENTORY:

Release Term Input units: (1-pCi 2-uCi 3-mCi 4-Ci)	INUT
Soil source units (0- m**2 1- m**3 2- kg)	M3M2
Number of radionuclides in inventory:	NIN

Release Terms	Soil Source (per unit)	Irrigation /Aquatic (per L)	Drinking Water (per L)	Atmospheric Release (per yr)	E A Q QI
-----	-----	-----	-----	-----	

INVENTORY MODIFICATION FACTORS: (multipliers)

Surface inventory modification factor:	SRDIL
Irrigation/aquatic inventory modification factor:	DILF
Size of site (fractional ha):	FRSIZ
Fraction of total diet grown on site:	RPF2

EXTERNAL/INHALATION EXPOSURE:

Hours of external exposure to contamination (h/yr):	HREXT
Hours of inhalation of airborne contamination (h/yr):	HRINH
Ext. exp. dose rate factors (plane source) filename:	PLANAM
Ext. exp. dose rate factors (volume source) filename:	VOLNAM
Breathing rate (cm**3/sec):	BRATE

SELECT RESUSPENSION MODEL:

0-Anspaugh	1-Mass Loading	IRES
Age of contamination (yr)	Soil density (g/m**3)	AGE/DEN
Top soil available (cm)	Mass loading factor (g/m**3)	XDPTIN/XMLF

SPECIAL PURPOSE PARAMETERS:

No. of years contamination blew onto the site prior to the beginning of the scenario:	IBLOW
Chi/q value at the site:	XQSITE
Use drinking water cleanup factors (0-no, 1-yes)	ICLNUP
Use Reg. Guide 1.109 H-3, C-14 plant/soil uptake factors	I1109

AGRICULTURAL PARAMETERS:

Fraction of roots in upper soil:	RF1
Fraction of roots in deeply buried waste:	RF2
Ratio of ext. contamination in surface/subsurface soil:	RPF1
Months per year irrigated:	IMO
Irrigation rate (L/m**2/mo):	RIRR
Years of irrigation w/ contaminated water prior to the beginning of the dose calculation period:	IRR
Number of food types: (1-15)	NFT

FOOD TYPE INDEX	FOOD TYPE	GROWING PERIOD (days)	YIELD (kg/m**3)	HOLDUP (days)	CONSUMP- TION (kg/yr)	TRANS- LOCATION FACTOR	KFDTYP --- GRWP YELD
-----------------------	-----------	-----------------------------	--------------------	------------------	-----------------------------	------------------------------	-------------------------------

DRINKING WATER/AQUATIC FOOD PARAMETERS:

2	Number of water/food types: (1-5)	NPT
---	-----------------------------------	-----

TYPE INDEX	FOOD TYPE	HOLDUP (days)	CONSUMPTION (kg/yr)	KPTHWY --- HLDUP2
---------------	-----------	------------------	------------------------	-------------------------

APPENDIX B
COMPLETE DATA BASE LISTING

APPENDIX B

COMPLETE DATA BASE LISTING

CONTENTS - APPENDIX B

Radionuclide Master List for ONSITE/MAXI - RMDONS.....	B.3
Radionuclide Master Library - RMDLIB.....	B.6
Organ Data Library - ORGLIB.....	B.11
Food Transfer Factor Library - FTRANS.....	B.34
Bioaccumulation Factor Library - BIOAC1.....	B.36
External Exposure Dose Rate Factors - Waste Modeled as a Plane Source.....	B.38
PLANEA.....	B.38
PLANE8.....	B.41
PLANEC.....	B.44
External Exposure Dose Rate Factors - Waste Modeled as a Slab Source.....	B.47
VOLSA.....	B.47
VOLSB.....	B.50
VOLSC.....	B.53
BURHFA.....	B.56
BURHFB.....	B.59
BURHFC.....	B.62
BUR1A.....	B.65
BUR1B.....	B.68
BUR1C.....	B.71
STOREDA.....	B.74
STOREDB.....	B.77
STOREDC.....	B.80
Inhalation Dose Rate Factors - FILE23.....	B.83
ICRP Publication 30 Dose Rate Factors - LB30SVBQ.....	B.129

Appendix B - Radionuclide Master List for ONSITE/MAXI - RMDONS

RMDONS: Radionuclide Master List for ONSITE/MAXI 8-Jul-86 RAP

H 3	4.51E+3	1	0	0.0000	0	0.0000	1/HYDROGEN/3	ND
C 14	2.09E+6	1	0	0.0000	0	0.0000	6/CARBON/14	ND
NA22	9.50E+2	1	0	0.0000	0	0.0000	11/SODIUM/22	VD
P 32	1.43E+1	1	0	0.0000	0	0.0000	15/PHOSPHORUS/32	SD
P 33	2.44E+1	1	0	0.0000	0	0.0000	15/PHOSPHORUS/33	VD
S 35	8.72E+1	1	0	0.0000	0	0.0000	16/SULFUR/35	NW
CL36	1.1E+8	1	0	0.0000	0	0.0000	17/CHLORINE/36	ND
K 40	4.67E+11	1	0	0.0000	0	0.0000	19/POTASSIUM/40	ND
CA45	2.77E+1	1	0	0.0000	0	0.0000	20/CALCIUM/45	VW
SC46	8.38E+1	1	0	0.0000	0	0.0000	21/SCANDIUM/46	VY
CR51	2.77E+1	1	0	0.0000	0	0.0000	24/CHROMIUM/51	VY
MN54	3.12E+2	1	0	0.0000	0	0.0000	25/MANGANESE/54	SW
FE55	9.86E+2	1	0	0.0000	0	0.0000	26/IRON/55	NW
FE59	4.46E+1	1	0	0.0000	0	0.0000	26/IRON/59	NW
CO57	2.71E+2	1	0	0.0000	0	0.0000	27/COBALT/57	NY
CO60	1.92E+3	1	0	0.0000	0	0.0000	27/COBALT/60	NY
NI59	2.74E+7	1	0	0.0000	0	0.0000	28/NICKEL/59	NW
NI63	3.51E+4	1	0	0.0000	0	0.0000	28/NICKEL/63	NW
ZN65	2.44E+2	1	0	0.0000	0	0.0000	30/ZINC/65	VY
SE75	1.2E+2	1	0	0.0000	0	0.0000	34/SELENIUM/75	NW
SR85	6.5E+1	1	0	0.0000	0	0.0000	38/STRONTIUM/85	D
SR89	5.06E+1	1	0	0.0000	0	0.0000	38/STRONTIUM/89	VD
Y 89M	1.86E-4	2	1	0.0002	0	0.0000	39/YTTRIUM/89/M	SY
SR90	1.04E+4	1	0	0.0000	0	0.0000	38/STRONTIUM/90	VD
Y 90	2.67E+0	2	1	1.0000	0	0.0000	39/YTTRIUM/90	SY
NB94	7.30E+6	1	0	0.0000	0	0.0000	41/NIOBIUM/94	VY
MO93	3.65E+4	1	0	0.0000	0	0.0000	42/MOLYBDENUM/93	SD
MO99	2.75E+0	1	0	0.0000	0	0.0000	42/MOLYBDENUM/99	SD
TC99M	2.51E-1	2	1	0.8680	0	0.0000	43/TECHNETIUM/99/M	NW
TC99	7.78E+7	3	2	1.0000	1	0.1320	43/TECHNETIUM/99	NW
RU103	3.94E+1	1	0	0.0000	0	0.0000	44/RUTHENIUM/103	NY
PD103	1.70E+1	2	0	0.0000	0	0.0000	46/PALLADIUM/103	VY
RH103M	3.90E-2	3	1	0.9974	2	0.9997	45/RHODIUM/103/M	NY
RU106	3.68E+2	1	0	0.0000	0	0.0000	44/RUTHENIUM/106	NY
RH106	3.46E-4	2	1	1.0000	0	0.0000	45/RHODIUM/106	NY
AG110M	2.52E+2	1	0	0.0000	0	0.0000	47/SILVER/110/M	ND
AG110	2.85E-4	2	1	0.0113	0	0.0000	47/SILVER/110	ND
IN111	2.8E+0	1	0	0.0000	0	0.0000	49/INDIUM/111	VD
I 125	5.97E+1	1	0	0.0000	0	0.0000	52/IODINE/125	D
S8125	1.01E+3	1	0	0.0000	0	0.0000	51/ANTIMONY/125	SW
TE125M	5.80E+1	2	1	0.2300	0	0.0000	52/TELLURIUM/125/M	SW
SB124	6.02E+1	1	0	0.0000	0	0.0000	51/ANTIMONY/124	SW
I 129	5.73E+9	1	0	0.0000	0	0.0000	53/IODINE/129	ND
I 131	8.04E+0	1	0	0.0000	0	0.0000	53/IODINE/131	ND
XE131M	1.19E+1	2	1	0.0109	0	0.0000	54/XENON/131/M	ND
CS134	7.53E+2	1	0	0.0000	0	0.0000	55/CESIUM/134	ND
CS135	8.40E+8	1	0	0.0000	0	0.0000	55/CESIUM/135	ND
CS137	1.10E+4	1	1	1.0000	0	0.0000	55/CESIUM/137	ND
BA137M	1.77E-3	2	1	0.9460	0	0.0000	56/BARIUM/137/M	SD

Appendix B - Radionuclide Master List for ONSITE/MAXI - RMDONS

CE141	3.25E+1	1	0	1.0000	0	0.0000	58/CERIUM/141	SY
CE144	2.84E+2	1	0	0.0000	0	0.0000	58/CERIUM/144	SY
PR144	1.20E-2	2	1	1.0000	0	0.0000	59/PRASEODYMIUM/144	SY
ND144	8.77E17	3	2	1.0000	0	0.0000	60/NEODYMIUM/144	SY
EU152	4.97E+3	1	0	0.0000	0	0.0000	63/EUROPIUM/152	SW
EU154	3.14E+3	1	0	0.0000	0	0.0000	63/EUROPIUM/154	SW
TB160	7.23E+1	1	0	0.0000	0	0.0000	65/TERBIUM/160	SW
OS185	9.40E+1	1	0	0.0000	0	0.0000	76/OSMIUM/185	ND
OS191	1.5E+1	1	0	0.0000	0	0.0000	76/OSMIUM/191	ND
IR192	7.3E+1	1	0	0.0000	0	0.0000	77/IRIDIUM/192	NY
HG203	4.66E+1	1	0	0.0000	0	0.0000	80/MERCURY/203	ND
TH230	2.81E+7	1	0	0.0000	0	0.0000	90/THORIUM/230	SY
RA226	5.84E+5	2	1	1.0000	0	0.0000	88/RADIUM/226	VW
RN222	3.82E+0	3	2	1.0000	0	0.0000	86/RADON/222	ND
PB210	8.14E+3	4	3	1.0000	0	0.0000	82/LEAD/210	VD
BI210	5.01E+0	5	4	1.0000	0	0.0000	83/BISMUTH/210	NW
PO210	1.38E+2	6	5	1.0000	0	0.0000	84/POLONIUM/210	NW
TH232	4.16E13	1	0	0.0000	0	0.0000	90/THORIUM/232	SY
RA228	2.10E+3	2	2	1.0000	0	0.0000	88/RADIUM/228	VW
AC228	2.55E-1	3	2	1.0000	0	0.0000	89/ACTINIUM/228	SY
TH228	6.99E+2	4	3	1.0000	0	0.0000	90/THORIUM/228	SY
RA224	3.66E+0	5	4	1.0000	0	0.0000	88/RADIUM/224	SW
PB212	4.43E-1	6	5	1.0000	0	0.0000	82/LEAD/212	SD
BI212	4.20E-2	7	6	1.0000	0	0.0000	83/BISMUTH/212	NW
U 234	8.91E+7	1	0	0.0000	0	0.0000	92/URANIUM/234	VY
U 235	2.59E11	1	0	0.0000	0	0.0000	92/URANIUM/235	VY
TH231	1.06E+0	2	1	1.0000	0	0.0000	90/THORIUM/231	SY
PA231	1.19E+7	3	2	1.0000	0	0.0000	91/PROTACTINIUM/231	SY
AC227	7.95E+3	4	3	1.0000	0	0.0000	89/ACTINIUM/227	SY
TH227	1.87E+1	5	4	0.9862	0	0.0000	90/THORIUM/227	SY
FR223	1.51E-2	6	4	0.0138	0	0.0000	87/FRANCIUM/223	ND
RA223	1.14E+1	7	5	1.0000	6	1.0000	88/RADIUM/223	SW
NP237	7.82E+8	1	0	0.0000	0	0.0000	93/NEPTUNIUM/237	SW
PA233	2.70E+1	2	1	1.0000	0	0.0000	91/PROTACTINIUM/233	SY
U 233	5.79E+7	3	2	1.0000	0	0.0000	92/URANIUM/233	VY
TH229	2.68E+6	4	3	1.0000	0	0.0000	90/THORIUM/229	SY
RA225	1.48E+1	5	4	1.0000	0	0.0000	88/RADIUM/225	SW
AC225	1.00E+1	6	5	1.0000	0	0.0000	89/ACTINIUM/225	SY
U 238	1.65E12	1	0	0.0000	0	0.0000	92/URANIUM/238	VY
TH234	2.41E+1	2	1	1.0000	0	0.0000	90/THORIUM/234	SY
PA234M	8.13E-4	3	2	1.0000	0	0.0000	91/PROTACTINIUM/234/M	SY
PA234	2.81E-1	4	3	0.0013	0	0.0000	91/PROTACTINIUM/234	SY
PU242	1.41E+8	1	0	0.0000	0	0.0000	94/PLUTONIUM/242	SY
NP238	2.18E+0	1	0	0.0000	0	0.0000	93/NEPTUNIUM/238	SW
PU238	3.21E+4	2	1	1.0000	0	0.0000	94/PLUTONIUM/238	SY
CM244	6.61E+3	1	0	0.0000	0	0.0000	96/CURIUM/244	SW
PU244	3.02E10	2	0	0.0000	0	0.0000	94/PLUTONIUM/244	SY
U 240	5.88E-1	3	2	0.9990	0	0.0000	92/URANIUM/240	SY
PU240	2.39E+6	4	3	1.0000	1	1.0000	94/PLUTONIUM/240	SY
PU241	5.26E+3	1	0	0.0000	0	0.0000	94/PLUTONIUM/241	SY

Appendix B - Radionuclide Master List for ONSITE/MAXI - RMDONS

AM241	1.58E+5	2	1	1.0000	0	0.0000	95/AMERICIUM/241	SW
CM243	1.04E+4	1	0	0.0000	0	0.0000	96/CURIUM/243	SW
PU243	2.06E-1	2	0	0.0000	0	0.0000	94/PLUTONIUM/243	SY
AM243	2.70E+6	3	2	1.0000	1	0.0024	95/AMERICIUM/243	SW
NP239	2.36E+0	4	3	1.0000	0	0.0000	93/NEPTUNIUM/239	SW
PU239	8.91E+6	5	4	1.0000	1	0.9976	94/PLUTONIUM/239	SY
		0	0	0.0000	0	0.0000		

Appendix B - Radionuclide Master Library - RMDLIB

RMDLIB - Radionuclide Master Library (24-Sep-86 RAP)

H 3	4.51E+3	1	0	0.0000	0	0.0000	1/HYDROGEN/3	ND
BE10	5.84E+8	1	0	0.0000	0	0.0000	4/BERYLLIUM/10	VY
C 14	2.09E+6	1	0	0.0000	0	0.0000	6/CARBON/14	ND
N 13	6.92E-3	1	0	0.0000	0	0.0000	7/NITROGEN/13	ND
F 18	7.62E-2	1	0	0.0000	0	0.0000	9/FLUORINE/18	SD
NA22	9.50E+2	1	0	0.0000	0	0.0000	11/SODIUM/22	VD
NA24	6.25E-1	1	0	0.0000	0	0.0000	11/SODIUM/24	VD
P 32	1.43E+1	1	0	0.0000	0	0.0000	15/PHOSPHORUS/32	SD
P 33	2.44E+1	1	0	0.0000	0	0.0000	15/PHOSPHORUS/33	VD
S 35	8.72E+1	1	0	0.0000	0	0.0000	16/SULFUR/35	NW
CL36	1.1E+8	1	0	0.0000	0	0.0000	17/CHLORINE/36	ND
K 40	4.67E11	1	0	0.0000	0	0.0000	19/POTASSIUM/40	ND
AR39	9.83E+4	1	0	0.0000	0	0.0000	18/ARGON/39	ND
AR41	7.61E-2	1	0	0.0000	0	0.0000	18/ARGON/41	ND
CA41	5.11E+7	1	0	0.0000	0	0.0000	20/CALCIUM/41	VW
CA45	2.77E+1	1	0	0.0000	0	0.0000	20/CALCIUM/45	VW
SC46	8.38E+1	1	0	0.0000	0	0.0000	21/SCANDIUM/46	VY
CR51	2.77E+1	1	0	0.0000	0	0.0000	24/CHROMIUM/51	VY
MN54	3.12E+2	1	0	0.0000	0	0.0000	25/MANGANESE/54	SW
MN56	1.07E-1	1	0	0.0000	0	0.0000	25/MANGANESE/56	SW
FE55	9.86E+2	1	0	0.0000	0	0.0000	26/IRON/55	NW
FE59	4.46E+1	1	0	0.0000	0	0.0000	26/IRON/59	NW
CO57	2.71E+2	1	0	0.0000	0	0.0000	27/COBALT/57	NY
CO58	7.08E+1	1	0	0.0000	0	0.0000	27/COBALT/58	NY
CO60	1.92E+3	1	0	0.0000	0	0.0000	27/COBALT/60	NY
NI59	2.74E+7	1	0	0.0000	0	0.0000	28/NICKEL/59	NW
NI63	3.51E+4	1	0	0.0000	0	0.0000	28/NICKEL/63	NW
NI65	1.05E-1	1	0	0.0000	0	0.0000	28/NICKEL/65	NW
CU64	5.29E-1	1	0	0.0000	0	0.0000	29/COPPER/64	ND
ZN65	2.44E+2	1	0	0.0000	0	0.0000	30/ZINC/65	VY
ZN69M	5.73E-1	1	0	0.0000	0	0.0000	30/ZINC/69/M	SY
ZN69	3.96E-2	2	1	1.0000	0	0.0000	30/ZINC/69	SY
AS76	1.10E+0	1	0	0.0000	0	0.0000	33/ARSENIC/76	NW
SE75	1.2E+2	1	0	0.0000	0	0.0000	34/SELENIUM/75	NW
SE79	2.37E+7	1	0	0.0000	0	0.0000	34/SELENIUM/79	NW
BR82	1.47E+0	1	0	0.0000	0	0.0000	35/BROMINE/82	ND
BR83	9.96E-2	1	0	0.0000	0	0.0000	35/BROMINE/83	ND
KR83M	7.62E-2	2	1	1.0000	0	0.0000	36/KRYPTON/83/M	ND
BR84	2.21E-2	1	0	0.0000	0	0.0000	35/BROMINE/84	ND
BR85	1.99E-3	1	0	0.0000	0	0.0000	35/BROMINE/85	ND
KR85M	1.87E-1	2	1	1.0000	0	0.0000	36/KRYPTON/85/M	ND
KR85	3.92E+3	3	2	0.2110	0	0.0000	36/KRYPTON/85	ND
KR87	5.30E-2	1	0	0.0000	0	0.0000	36/KRYPTON/87	ND
RB87	1.72E13	2	1	1.0000	0	0.0000	37/RUBIDIUM/87	VD
KR88	1.18E-1	1	0	0.0000	0	0.0000	36/KRYPTON/88	ND
RB88	1.24E-2	2	1	1.0000	0	0.0000	37/RUBIDIUM/88	VD
KR89	2.20E-3	1	0	0.0000	0	0.0000	36/KRYPTON/89	ND
RB89	1.06E-2	2	1	1.0000	0	0.0000	37/RUBIDIUM/89	VD
SR89	5.06E+1	3	2	1.0000	0	0.0000	38/STRONTIUM/89	VD

Appendix B - Radionuclide Master Library - RMDLIB

Y 89M	1.86E-4	4	3	0.0002	0	0.0000	39/YTTRIUM/89/M	SY
KR90	3.74E-4	1	0	0.0000	0	0.0000	36/KRYPTON/90	ND
KR91	1.13E-4	1	0	0.0000	0	0.0000	36/KRYPTON/91	ND
RB86	1.87E+1	1	0	0.0000	0	0.0000	37/RUBIDIUM/86	VD
SR85	6.5E+1	1	0	0.0000	0	0.0000	38/STRONTIUM/85	VD
SR90	1.04E+4	1	0	0.0000	0	0.0000	38/STRONTIUM/90	VD
Y 90	2.67E+0	2	1	1.0000	0	0.0000	39/YTTRIUM/90	SY
SR91	3.96E-1	1	0	0.0000	0	0.0000	38/STRONTIUM/91	SD
Y 91M	3.45E-2	2	1	0.5800	0	0.0000	39/YTTRIUM/91/M	SY
Y 91	5.85E+1	3	2	1.0000	1	0.4200	39/YTTRIUM/91	SY
SR92	1.13E-1	1	0	0.0000	0	0.0000	38/STRONTIUM/92	SD
Y 92	1.48E-1	2	1	1.0000	0	0.0000	39/YTTRIUM/92	SY
Y 93	4.21E-1	1	0	0.0000	0	0.0000	39/YTTRIUM/93	SY
ZR93	5.59E+8	2	1	1.0000	0	0.0000	40/ZIRCONIUM/93	SW
NB93M	4.97E+3	3	2	0.2500	0	0.0000	41/NIOBIUM/93/M	VY
ZR95	6.40E+1	1	0	0.0000	0	0.0000	40/ZIRCONIUM/95	SW
NB95M	3.61E+0	2	1	0.0070	0	0.0000	41/NIOBIUM/95/M	SY
NB95	3.52E+1	3	2	1.0000	1	0.9930	41/NIOBIUM/95	SY
ZR97	7.04E-1	1	0	0.0000	0	0.0000	40/ZIRCONIUM/97	SW
NB97M	6.94E-4	2	1	0.9460	0	0.0000	41/NIOBIUM/97/M	SY
NB97	5.01E-2	3	2	1.0000	1	0.0540	41/NIOBIUM/97	SY
NB94	7.30E+6	1	0	0.0000	0	0.0000	41/NIOBIUM/94	VY
M093	3.65E+4	1	0	0.0000	0	0.0000	42/MOLYBDENUM/93	SD
M099	2.75E+0	1	0	0.0000	0	0.0000	42/MOLYBDENUM/99	SD
TC99M	2.51E-1	2	1	0.86B0	0	0.0000	43/TECHNETIUM/99/M	NW
TC99	7.78E+7	3	2	1.0000	1	0.1320	43/TECHNETIUM/99	NW
TC101	9.86E-3	1	0	0.0000	0	0.0000	43/TECHNETIUM/101	NW
RU103	3.94E+1	1	0	0.0000	0	0.0000	44/RUTHENIUM/103	NY
PD103	1.70E+1	2	0	0.0000	0	0.0000	46/PALLADIUM/103	VY
RH103M	3.90E-2	3	1	0.9974	2	0.9997	45/RHODIUM/103/M	NY
RU105	1.85E-1	1	0	0.0000	0	0.0000	44/RUTHENIUM/105	NY
RH105M	5.21E-4	2	1	0.2800	0	0.0000	45/RHODIUM/105/M	NY
RH105	1.47E+0	3	2	1.0000	1	0.7200	45/RHODIUM/105	NY
RU106	3.68E+2	1	0	0.0000	0	0.0000	44/RUTHENIUM/106	NY
RH106	3.46E-4	2	1	1.0000	0	0.0000	45/RHODIUM/106	NY
PD107	2.37E+9	1	0	0.0000	0	0.0000	46/PALLADIUM/107	VY
PD109M	5.43E-5	1	0	0.0000	0	0.0000	46/PALLADIUM/109/M	VY
PD109	5.61E-1	2	1	1.0000	0	0.0000	46/PALLADIUM/109	VY
AG109M	4.58E-4	3	2	1.0000	0	0.0000	47/SILVER/109/M	ND
AG110M	2.52E+2	1	0	0.0000	0	0.0000	47/SILVER/110/M	ND
AG110	2.85E-4	2	1	0.0113	0	0.0000	47/SILVER/110	ND
AG111	7.45E+0	1	0	0.0000	0	0.0000	47/SILVER/111	ND
CD109	4.4E+2	1	0	0.0000	0	0.0000	48/CADMIUM/109	ND
CD113M	4.97E+3	1	0	0.0000	0	0.0000	48/CADMIUM/113/M	ND
CD115M	4.46E+0	1	0	0.0000	0	0.0000	48/CADMIUM/115/M	ND
CD115	2.23E+0	2	0	0.0000	0	0.0000	48/CADMIUM/115	ND
IN115M	1.88E-1	3	2	1.0000	0	0.0000	49/INDIUM/115/M	VD
IN115	2.19E17	4	3	0.9630	1	1.0000	49/INDIUM/115	VD
IN111	2.8E+0	1	0	0.0000	0	0.0000	49/INDIUM/111	VD
IN114M	5.00E+1	1	0	0.0000	0	0.0000	49/INDIUM/114/M	VD

Appendix B - Radionuclide Master Library - RMDLIB

IN114	8.33E-4	2	1	1.0000	0	0.0000	49/INDIUM/114	VD
SN117M	1.40E+1	1	0	0.0000	0	0.0000	50/TIN/117/M	SW
SN119M	2.50E+2	1	0	0.0000	0	0.0000	50/TIN/119/M	VW
SN121M	2.78E+4	1	0	0.0000	0	0.0000	50/TIN/121/M	VW
SN123	1.29E+2	1	0	0.0000	0	0.0000	50/TIN/123	VW
I 125	5.97E+1	1	0	0.0000	0	0.0000	53/IODINE/125	ND
SN125	9.64E+0	1	0	0.0000	0	0.0000	50/TIN/125	SW
SB125	1.01E+3	2	1	1.0000	0	0.0000	51/ANTIMONY/125	SW
TE125M	5.80E+1	3	2	0.2300	0	0.0000	52/TELLURIUM/125/M	SW
SN126	3.65E+7	1	0	0.0000	0	0.0000	50/TIN/126	VW
SB126M	1.32E-2	2	1	1.0000	0	0.0000	51/ANTIMONY/126/M	SW
SB126	3.75E-1	3	2	0.1400	0	0.0000	51/ANTIMONY/126	SW
SB124	6.02E+1	1	0	0.0000	0	0.0000	51/ANTIMONY/124	SW
SB127	3.85E+0	1	0	0.0000	0	0.0000	51/ANTIMONY/127	SW
TE127M	1.09E+2	2	1	0.1390	0	0.0000	52/TELLURIUM/127/M	SW
TE127	3.90E-1	3	2	0.9760	1	0.8610	52/TELLURIUM/127	SW
TE123M	1.17E+2	1	0	0.0000	0	0.0000	52/TELLURIUM/123/M	SW
TE129M	3.36E+1	1	0	0.0000	0	0.0000	52/TELLURIUM/129/M	SW
TE129	4.83E-2	2	1	1.0000	0	0.0000	52/TELLURIUM/129	SW
I 129	5.73E+9	3	2	1.0000	0	0.0000	53/IODINE/129	ND
TE131M	1.25E+0	1	0	0.0000	0	0.0000	52/TELLURIUM/131/M	SW
TE131	1.74E-2	2	1	0.2220	0	0.0000	52/TELLURIUM/131	SW
I 131	8.04E+0	3	2	1.0000	1	0.7780	53/IODINE/131	ND
XE131M	1.19E+1	4	3	0.0109	0	0.0000	54/XENON/131/M	ND
TE132	3.26E+0	1	0	0.0000	0	0.0000	52/TELLURIUM/132	SW
I 132	9.58E-2	2	1	1.0000	0	0.0000	53/IODINE/132	ND
TE133M	3.85E-2	1	0	0.0000	0	0.0000	52/TELLURIUM/133/M	SW
TE133	8.64E-3	2	1	0.1300	0	0.0000	52/TELLURIUM/133	SW
I 133	8.67E-1	3	2	1.0000	1	0.8700	53/IODINE/133	ND
XE133M	2.19E+0	4	3	0.0290	0	0.0000	54/XENON/133/M	ND
XE133	5.24E+0	5	4	1.0000	3	0.9710	54/XENON/133	ND
TE134	2.90E-2	1	0	0.0000	0	0.0000	52/TELLURIUM/134	SW
I 134	3.65E-2	2	1	1.0000	0	0.0000	53/IODINE/134	NO
CS134	7.53E+2	1	1	1.0000	0	0.0000	55/CESIUM/134	ND
I 130	5.15E-1	1	0	0.0000	0	0.0000	53/IODINE/130	ND
I 135	2.75E-1	1	0	0.0000	0	0.0000	53/IODINE/135	ND
XE135M	1.09E-2	2	1	0.1660	0	0.0000	54/XENON/135/M	ND
XE135	3.78E-1	3	2	1.0000	1	0.8340	54/XENON/135	ND
CS135	8.40E+8	4	3	1.0000	0	0.0000	55/CESIUM/135	ND
XE137	2.66E-3	1	0	0.0000	0	0.0000	54/XENON/137	ND
CS137	1.10E+4	2	1	1.0000	0	0.0000	55/CESIUM/137	ND
BA137M	1.77E-3	3	2	0.9460	0	0.0000	56/BARIUM/137/M	SD
XE138	9.84E-3	1	0	0.0000	0	0.0000	54/XENON/138	ND
CS138	2.24E-2	2	1	1.0000	0	0.0000	55/CESIUM/138	ND
XE139	4.98E-4	1	0	0.0000	0	0.0000	54/XENON/139	ND
CS139	6.53E-3	2	1	1.0000	0	0.0000	55/CESIUM/139	ND
BA139	5.74E-2	3	2	1.0000	0	0.0000	56/BARIUM/139	SD
XE140	1.85E-4	1	0	0.0000	0	0.0000	54/XENON/140	ND
CS140	7.64E-4	2	1	1.0000	0	0.0000	55/CESIUM/140	ND
BA140	1.28E+1	3	2	1.0000	0	0.0000	56/BARIUM/140	SD

Appendix B - Radionuclide Master Library - RMDLIB

LA140	1.68E+0	4	3	1.0000	0	0.0000	57/LANTHANUM/140	SD
CS134M	1.21E-1	1	0	0.0000	0	0.0000	55/CESIUM/134/M	ND
CS136	1.31E+1	1	0	0.0000	0	0.0000	55/CESIUM/136	ND
BA141	1.27E-2	1	0	0.0000	0	0.0000	56/BARIUM/141	SD
LA141	1.64E-1	2	1	1.0000	0	0.0000	57/LANTHANUM/141	SD
CE141	3.25E+1	3	2	1.0000	0	0.0000	58/CERIUM/141	SY
BA142	7.43E-3	1	0	0.0000	0	0.0000	56/BARIUM/142	SD
LA142	6.44E-2	2	1	1.0000	0	0.0000	57/LANTHANUM/142	SD
CE143	1.38E+0	1	0	0.0000	0	0.0000	58/CERIUM/143	SY
PR143	1.36E+1	2	1	1.0000	0	0.0000	59/PRASEODYMIUM/143	SY
CE144	2.84E+2	1	0	0.0000	0	0.0000	58/CERIUM/144	SY
PR144	1.20E-2	2	1	1.0000	0	0.0000	59/PRASEODYMIUM/144	SY
ND144	8.77E17	3	2	1.0000	0	0.0000	60/NEODYMIUM/144	SY
ND147	1.11E+1	1	0	0.0000	0	0.0000	60/NEODYMIUM/147	SY
PM147	9.58E+2	2	1	1.0000	0	0.0000	61/PROMETHIUM/147	SY
SM147	3.91E13	3	2	1.0000	0	0.0000	62/SAMARIUM/147	SW
PM148M	4.13E+1	1	0	0.0000	0	0.0000	61/PROMETHIUM/148/M	SY
PM148	5.37E+0	2	1	1.0000	0	0.0000	61/PROMETHIUM/148	SY
PM149	2.21E+0	1	0	0.0000	0	0.0000	61/PROMETHIUM/149	SY
PM151	1.18E+0	1	0	0.0000	0	0.0000	61/PROMETHIUM/151	SY
SM151	3.29E+4	2	1	1.0000	0	0.0000	62/SAMARIUM/151	SW
SM153	1.95E+0	1	0	0.0000	0	0.0000	62/SAMARIUM/153	SW
EU152	4.97E+3	1	0	0.0000	0	0.0000	63/EUROPIUM/152	SW
EU153	1.94E+0	1	0	0.0000	0	0.0000	63/EUROPIUM/153	SW
EU154	3.14E+3	1	0	0.0000	0	0.0000	63/EUROPIUM/154	SW
EU155	1.81E+3	1	0	0.0000	0	0.0000	63/EUROPIUM/155	SW
EU156	1.52E+1	1	0	0.0000	0	0.0000	63/EUROPIUM/156	SW
GD153	2.42E+2	1	0	0.0000	0	0.0000	64/GADOLINIUM/153	SD
TB160	7.23E+1	1	0	0.0000	0	0.0000	65/TERBIUM/160	SW
HO166M	4.38E+5	1	0	0.0000	0	0.0000	67/HOLMIUM/166/M	SW
W 181	1.40E+2	1	0	0.0000	0	0.0000	74/TUNGSTEN/181	VD
W 185	7.51E+1	1	0	0.0000	0	0.0000	74/TUNGSTEN/185	VD
W 187	9.95E-1	1	0	0.0000	0	0.0000	74/TUNGSTEN/187	SD
RE187	1.83E13	2	1	1.0000	0	0.0000	75/RHENIUM/187	NW
OS185	9.40E+1	1	0	0.0000	0	0.0000	76/OSMIUM/185	ND
OS191	1.5E+1	1	0	0.0000	0	0.0000	76/OSMIUM/191	ND
IR192	7.3E+1	1	0	0.0000	0	0.0000	77/IRIDIUM/192	NY
HG203	4.66E+1	1	0	0.0000	0	0.0000	80/MERCURY/203	ND
TH230	2.81E+7	1	0	0.0000	0	0.0000	90/THORIUM/230	SY
RA226	5.84E+5	2	1	1.0000	0	0.0000	88/RADIUM/226	VW
RN222	3.82E+0	3	2	1.0000	0	0.0000	86/RADON/222	ND
PB210	8.14E+3	4	3	1.0000	0	0.0000	82/LEAD/210	VD
BI210	5.01E+0	5	4	1.0000	0	0.0000	83/BISMUTH/210	NW
PO210	1.38E+2	6	5	1.0000	0	0.0000	84/POLONIUM/210	NW
U 232	2.62E+4	1	0	0.0000	0	0.0000	92/URANIUM/232	VY
TH232	4.16E13	2	0	0.0000	0	0.0000	90/THORIUM/232	SY
RA228	2.10E+3	3	2	1.0000	0	0.0000	88/RADIUM/228	VW
AC228	2.55E-1	4	3	1.0000	0	0.0000	89/ACTINIUM/228	SY
TH228	6.99E+2	5	4	1.0000	1	1.0000	90/THORIUM/228	SY
RA224	3.66E+0	6	5	1.0000	0	0.0000	88/RADIUM/224	SW

Appendix B - Radionuclide Master Library - RMDLIB

PB212	4.43E-1	7	6	1.0000	0	0.0000	82/LEAD/212	SD
BI212	4.20E-2	8	7	1.0000	0	0.0000	83/BISMUTH/212	NW
U 234	8.91E+7	1	0	0.0000	0	0.0000	92/URANIUM/234	VY
U 236	8.55E+9	1	0	0.0000	0	0.0000	92/URANIUM/236	VY
U 235	2.59E11	1	0	0.0000	0	0.0000	92/URANIUM/235	VY
TH231	1.06E+0	2	1	1.0000	0	0.0000	90/THORIUM/231	SY
PA231	1.19E+7	3	2	1.0000	0	0.0000	91/PROTACTINIUM/231	SY
AC227	7.95E+3	4	3	1.0000	0	0.0000	89/ACTINIUM/227	SY
TH227	1.87E+1	5	4	0.9862	0	0.0000	90/THORIUM/227	SY
FR223	1.51E-2	6	4	0.0138	0	0.0000	87/FRANCIUM/223	ND
RA223	1.14E+1	7	5	1.0000	6	1.0000	88/RADIUM/223	SW
U 237	6.75E+0	1	0	0.0000	0	0.0000	92/URANIUM/237	SY
NP237	7.82E+8	2	1	1.0000	0	0.0000	93/NEPTUNIUM/237	SW
PA233	2.70E+1	3	2	1.0000	0	0.0000	91/PROTACTINIUM/233	SY
U 233	5.79E+7	4	3	1.0000	0	0.0000	92/URANIUM/233	VY
TH229	2.68E+6	5	4	1.0000	0	0.0000	90/THORIUM/229	SY
RA225	1.48E+1	6	5	1.0000	0	0.0000	88/RADIUM/225	SW
AC225	1.00E+1	7	6	1.0000	0	0.0000	89/ACTINIUM/225	SY
U 238	1.65E12	1	0	0.0000	0	0.0000	92/URANIUM/238	VY
TH234	2.41E+1	2	1	1.0000	0	0.0000	90/THORIUM/234	SY
PA234M	8.13E-4	3	2	1.0000	0	0.0000	91/PROTACTINIUM/234/M	SY
PA234	2.81E-1	4	3	0.0013	0	0.0000	91/PROTACTINIUM/234	SY
PU236	1.04E+3	1	0	0.0000	0	0.0000	94/PLUTONIUM/236	SY
PU237	4.56E+1	1	0	0.0000	0	0.0000	94/PLUTONIUM/237	SY
AM242M	5.55E+4	1	0	0.0000	0	0.0000	95/AMERICIUM/242/M	SW
AM242	6.68E-1	2	1	1.0000	0	0.0000	95/AMERICIUM/242	SW
CM242	1.63E+2	3	2	0.8270	0	0.0000	96/CURIUM/242	SW
PU242	1.41E+8	4	2	0.1730	0	0.0000	94/PLUTONIUM/242	SY
NP238	2.18E+0	5	0	0.0000	0	0.0000	93/NEPTUNIUM/238	SW
PU238	3.21E+4	6	5	1.0000	3	1.0000	94/PLUTONIUM/238	SY
CM244	6.61E+3	1	0	0.0000	0	0.0000	96/CURIUM/244	SW
PU244	3.02E10	2	0	0.0000	0	0.0000	94/PLUTONIUM/244	SY
U 240	5.88E-1	3	2	0.9990	0	0.0000	92/URANIUM/240	SY
PU240	2.39E+6	4	3	1.0000	1	1.0000	94/PLUTONIUM/240	SY
CM245	3.10E+6	1	0	0.0000	0	0.0000	96/CURIUM/245	SW
PU241	5.26E+3	2	1	1.0000	0	0.0000	94/PLUTONIUM/241	SY
AM241	1.58E+5	3	2	1.0000	0	0.0000	95/AMERICIUM/241	SW
CM246	1.73E+6	1	0	0.0000	0	0.0000	96/CURIUM/246	SW
CM247	5.70E+9	1	0	0.0000	0	0.0000	96/CURIUM/247	SW
CM243	1.04E+4	2	0	0.0000	0	0.0000	96/CURIUM/243	SW
PU243	2.06E-1	3	1	1.0000	0	0.0000	94/PLUTONIUM/243	SY
AM243	2.70E+6	4	3	1.0000	2	0.0024	95/AMERICIUM/243	SW
NP239	2.36E+0	5	4	1.0000	0	0.0000	93/NEPTUNIUM/239	SW
PU239	8.91E+6	6	5	1.0000	2	0.9976	94/PLUTONIUM/239	SY
CM248	1.24E+8	1	0	0.0000	0	0.0000	96/CURIUM/248	SW
CF252	9.64E+2	1	0	0.0000	0	0.0000	98/CALIFORNIUM/252	SW
		0	0	0.0000	0	0.0000		

Appendix B - Organ Data Library - ORGLIB

ORGAN DATA LIBRARY UPDATED BY RA PELOQUIN 8-Jul-86

H 3	1	1.0+1	1.0	1.0	.0058
H 3	8				.0058
BE10	1	1.8+2	2.00-3	1.0	.209
BE10	3	1.2 +2	6.00 -5	0.03	.209
BE10	4	2.7+2	2.00-4	0.1	.209
BE10	6	4.5+2	6.40-4	0.32	1.045
BE10	8				.209
BE10	23				.209
C 14	1	10.	1.0	1.0	.054
C 14	6	40.	0.025	0.025	.27
C 14	7	12.	0.5	0.5	.054
C 14	23				.054
N 13	1	90.	1.0		1.143
F 18	1	8.08+2	1.0	1.0	0.86
F 18	6	1.45+3	0.53	0.53	1.462
F 18	8				0.54
F 18	23				0.39
NA22	1	1.10+1	1.0	1.0	1.513
NA22	8				0.8
NA22	23				1.513
NA24	1	1.10+1	1.0	1.0	2.725
NA24	8				1.5
NA24	23				1.0
P 32	1	257.	.75	1.0	.696
P 32	4	18.	.05	0.07	.696
P 32	6	1.15+3	.375	0.50	3.459
P 32	8				.690
P 32	23				.696
P 33	1	257.	.75	1.0	.0853
P 33	4	18.	.05	0.07	.0853
P 33	6	1.15+3	.38	0.20	0.426
P 33	8				.0853
P 33	23				.0853
S 35	1	90.	1.0	1.0	.0560
S 35	6	600.	.03	.03	.28
S 35	8				.056
CL36	1	29.0	1.0	1.0	.26
CL36	8				.26
CL36	23				.26
K 40	1	58.0	1.0	1.0	.251
K 40	6				.843
K 40	8				.200
K 40	23				.182
CA41	1	1.64+4	.60	1.0	.0036
CA41	6	1.8+4	.54	0.9	.0036
CA41	8				.0036
CA41	23				.0036
CA45	1	1.64+4	.60	1.0	.086
CA45	6	1.8+4	.54	0.9	.430

Appendix B - Organ Data Library - ORGLIB

CA45	8				.086
CA45	23				.086
SC46	1	30.0	.10-3	1.0	1.333
SC46	3	75.0	.20-5	.02	.512
SC46	4	36.0	.15-4	.15	.654
SC46	6	33.0	.20-4	.20	1.101
SC46	8				.640
SC46	23				.409
CR51	1	616.	.005	1.0	.019
CR51	3	616.	.13-4	.27-2	.007
CR51	8	616.	.20-3	.04	.014
CR51	15	616.	.45-5	.90-3	.084-1
CR51	16	616.	0.45-5	.90-3	3.6-3
CR51	23				.0053
MN54	1	17.	.10	1.0	.512
MN54	4	25.	.02	.24	.227
MN54	8				.230
MN54	17	5.70	.003	.03	.130
MN54	23				.122
MN56	1	17.	.10	1.0	1.810
MN56	4	25.	.02	.24	1.236
MN56	8				1.30
MN56	17	5.70	.003	.03	1.10
MN56	23				1.03
FE55	1	800.	.10	1.0	9.5 -3
FE55	4	554.	.013	.13	9.5 -3
FE55	5	600.	.002	.02	6.5 -3
FE55	6	1680.	.010	.10	4.2 -2
FE55	8	3200.	.002	.02	9.5-3
FE55	23				9.5-3
FE59	1	800.	.10	1.0	.835
FE59	4	554.	.013	.13	.439
FE59	5	600.	.002	.02	.340
FE59	6	1680.	.01	.10	.946
FE59	8	3200.	.002	.02	.420
FE59	23				.298
C057	1	9.50	.300	1.0	.10
C057	4	9.50	.007	.04	.063
C057	5	9.50	.420 -3	.14-2	.045
C057	8				.053
C057	17	9.50	.600 -3	.002	.040
C057	23				4.96-2
C058	1	9.50	.300	1.0	.628
C058	4	9.50	.007	.040	.292
C058	5	9.50	.420-3	.140-2	.220
C058	8				.290
C058	17	9.50	.600-3	.002	.170
C058	23				.169
C060	1	9.50	.300	1.0	1.575
C060	4	9.50	.007	.040	.745

Appendix B - Organ Data Library - ORGLIB

C060	5	9.50	.420-3	.140-2	.560		
C060	8				.720		
C060	17	9.50	.600-3	.200-2	.440		
C060	23				.449		
NI59	1	667.	.300	1.0	7.7-3		
NI59	4	500.	.020	.070	7.7-3		
NI59	6	800.	.150	.500	7.7-3		
NI59	8				.770-2		
NI59	23				7.7-3		
NI63	1	667.	.300	1.0	.021		
NI63	4	500.	.020	.070	.021		
NI63	6	800.	.150	.500	.105		
NI63	8				.021		
NI63	23				.021		
NI65	1	667.	.300	1.0	.940		
NI65	4	500.	.020	.070	.752		
NI65	6	800.	.150	.500	3.176		
NI65	8				1.20		
NI65	23				.686		
CU64	1	80.	.280	1.0	.251		
CU64	3	16.	.010	.050	.166		
CU64	4	150.	.020	.080	.181		
CU64	5	2.	.020	.070	.170		
CU64	8				.190		
CU64	13	800.	.003	.010	.210		
CU64	18	80.	.003	.010	.170		
CU64	23				.156		
ZN65	1	933.	.100	1.0	.341		
ZN65	3	149.	.004	.04	.113		
ZN65	4	91.	.035	.350	.153		
ZN65	6	1300.	.015	.150	.149		
ZN65	8				.150		
ZN65	10	270.	.900-4	.900-3	.056		
ZN65	11	107.	.400-4	.400-3	.056		
ZN65	14	1960.	.030	.300	.320		
ZN65	15	14.	.006	.060	.056		
ZN65	17	25.	.003	.030	.084		
ZN65	23				.084		
ZN69M	1	933.	.100	1.0	.610		
ZN69M	3	149.	.004	.040	.435		
ZN69M	4	91.	.035	.350	.466		
ZN69M	6	1300.	.015	.150	1.852		
ZN69M	8				.487	.50	.50
ZN69M	10	270.	.900-4	.900-3	.430		
ZN69M	11	107.	.400-4	.400-3	.430		
ZN69M	14	1960.	.030	.300	.640		
ZN69M	15	14.	.006	.060	.430		
ZN69M	17	25.	.003	.030	.450		
ZN69M	23				.412		
ZN69	1	933.	.100	1.0	.328		

Appendix B - Organ Data Library - ORGLIB

ZN69	3	149.	.004	.040	.328		
ZN69	4	91.	.035	.350	.328		
ZN69	6	1300.	.015	.150	1.638		
ZN69	8				.370		
ZN69	10	270.	.900-4	.900-3	.370		
ZN69	11	107.	.400-4	.400-3	.370		
ZN69	14	1960.	.030	.300	.370		
ZN69	15	14.	.006	.060	.370		
ZN69	17	25.	.003	.030	.370		
ZN69	23				.328		
SE75	1	11.	.9	1.	.2		
SE75	8				9.4		
AS76	1	280.	.030	1.0	1.3		
AS76	3	550.	.300-3	.010	1.1		
AS76	4	550.	.900-3	.030	1.1		
AS76	8				1.10		
AS76	23				1.1		
SE79	1	11.	.9	1.	.042		
SE79	3	11.	.04	.04	.042		
SE79	4	24.	.06	.07	.042		
SE79	8				.042	.042	.042
SE79	23				.042		
BR82	1	8.0	1.0	1.0	1.715		
BR82	8				.850		
BR82	23		5.0-2		.522		
SR85	1	.13E+5	.300	1.0	.33		
SR85	6	.18E+5	.09	.175	.091		
SR85	8				.16		
SR85	23				0.		
RB86	1	45.	1.0	1.0	.706		
RB86	4	63.	.05	.05	.674		
RB86	5	45.	.004	.004	.660		
RB86	8				.660		
RB86	14	80.	.450	.450	.700		
RB86	17	60.	.003	.003	.650		
RB86	23				.663		
RB87	1	45.	1.0	1.0	.090		
RB87	4	63.	.050	.050	.090		
RB87	5	45.	.004	.004	.090		
RB87	8				.090		
RB87	14	80.	.450	.450	.090		
RB87	17	60.	.003	.003	.090		
RB87	23				.090		
SR89	1	.130+5	.300	1.0	.555		
SR89	6	.180+5	.210	.700	2.76		
SR89	8				.550		
SR89	23	.3	1.0	0.0	.555		
SR90	1	4000.	.3	1.0	1.137		
SR90	6	4000.	.0225	.300	5.650		
SR90	8				1.305		

Appendix B - Organ Data Library - ORGLIB

SR90	23					.777		
Y 90	1	.140+5	.100-3	1.0		.917		
Y 90	6	.180+5	.750-4	.750	4.555			
Y 90	8					.890		
Y 90	23					.917		
SR91	1	.130+5	.300	1.0	1.834			
SR91	6	.180+5	.210	.700	6.47			
SR91	8				1.15	1.4	1.7	
SR91	23				0.777			
Y 91M	1	.140+5	.100-3	1.0	.967			
Y 91M	6	.180+5	.750-4	.750	3.325			
Y 91M	8				.160	.42	.68	
Y 91M	23				.107			
Y 91	1	.140+5	.100-3	1.0	.612			
Y 91	6	.180+5	.750-4	.750	3.049			
Y 91	8				.59			
Y 91	23				.61			
SR92	1	.130+5	.300	1.0	2.601			
SR92	6	.180+5	.210	.700	8.602			
SR92	8				1.75	1.9	1.9	
SR92	23				1.867			
Y 92	1	.140+5	.100-3	1.0	1.589			
Y 92	6	.180+5	.750-4	.750	7.257			
Y 92	8				1.50			
Y 92	23				1.475			
Y 93	1	.140+5	.100-3	1.0	1.648			
Y 93	6	.180+5	.750-4	.750	7.967			
Y 93	8				1.50	1.50	1.50	
Y 93	23				1.602			
ZR93	1	450.	.100-3	1.0	.023			
ZR93	3	900.	.200-5	.020	.020			
ZR93	4	320.	.700-5	.070	.024			
ZR93	5	900.	.600-6	.006	.025			
ZR93	6	1000.	.360-4	.360	.110			
ZR93	8				.019	.020	.024	
ZR93	23				.019			
NB93M	1	760.	.100-3	1.0	.030			
NB93M	3	760.	.200-5	.020	.030			
NB93M	4	845.	.900-5	.090	.030			
NB93M	5	95.	.800-6	.008	.038			
NB93M	6	1000.	.380-4	.380	.078			
NB93M	8				.038			
NB93M	23				.030			
ZR95	1	450.	.100-3	1.0	1.09			
ZR95	3	900.	.200-5	.020	.510			
ZR95	4	320.	.700-5	.070	.589			
ZR95	5	900.	.600-6	.006	.460			
ZR95	6	1000.	.360-4	.360	1.30			
ZR95	8				.327	.47	.56	
ZR95	23				.238			

Appendix B - Organ Data Library - ORGLIB

NB95	1	760.	.100-3	1.0	.525		
NB95	3	760.	.200-5	.020	.207		
NB95	4	840.	.900-5	.090	.262		
NB95	5	95.	.800-6	.008	.200		
NB95	6	1000.	.380-4	.380	.457		
NB95	8				.260		
NB95	23				.166		
ZR97	1	450.	.100-3	1.0	2.11		
ZR97	3	900.	.200-5	.020	1.485		
ZR97	4	320.	.700-5	.070	1.594		
ZR97	5	900.	.600-6	.006	1.50		
ZR97	6	1000.	.360-4	.360	6.30		
ZR97	8				1.55	1.6	1.6
ZR97	23				1.406		
NB97	1	760.	.100-3	1.0	.897		
NB97	3	760.	.200-5	.020	.611		
NB97	4	840.	.900-5	.090	.661		
NB97	5	95.	.800-6	.008	.600		
NB97	6	1000.	.380-4	.380	2.546		
NB97	8				.640		
NB97	23				.576		
MO93	1	5.	.8	1.	.048		
MO93	3	3.	.06	.08	.048		
MO93	4	45.	.08	.1	.048		
MO93	8				.048	.048	.048
MO93	23				4.77 -2		
NB94	1	760.	.0001	1.0	1.015		
NB94	6	1000.	.38 -4	.38	.628		
NB94	8				.476		
NB94	23				.279		
MO99	1	5.0	.800	1.0	.547		
MO99	3	3.0	.060	.080	.46		
MO99	4	45.	.080	.1	.478		
MO99	8				.470	.47	.47
MO99	23				.447		
TC99M	1	1.0	.500	1.0	.084		
TC99M	3	20.0	.005	.01	.035		
TC99M	4	30.0	.15 -2	.003	.043		
TC99M	6	25.0	.001	.002	.094		
TC99M	8	5.0	.45 -3	.90-3	.043		
TC99M	23				.029		
TC99	1	1.0	.500	1.0	.095		
TC99	3	20.	.005	.010	.095		
TC99	4	30.	.150-2	.003	.095		
TC99	6	25.	.001	.002	.475		
TC99	8	5.0	.450-3	.90-3	.094		
TC99	12	10.	.005	.010	.470		
TC99	23				.095		
TC101	1	1.0	.500	1.0	.697		
TC101	3	20.0	.005	.01	.543		

Appendix B - Organ Data Library - ORGLIB

TC101	4	30.0	.15	-2	.003	.570		
TC101	6	25.0	.001		.002	2.44		
TC101	8	5.0	.45	-3	.0009	.570		
TC101	23					.524		
RU103	1	7.30	.030		1.0	.408		
RU103	3	2.50	.006		.200	.203		
RU103	6	16.0	.240	-2	.080	.639		
RU103	8					.263	.26	.26
RU103	23					.176		
PD103	1	5.0	.2		1.0	.064		
PD103	3	30.0	.020		.080	.061		
PD103	4	19.0	.020		.090	.063		
PD103	5	15.0	.002		.010	.061		
PD103	8					.062	.064	.064
PD103	23					.019		
RH103M	1	10.4	.200		1.0	.055		
RH103M	3	28.0	.006		.030	.054		
RH103M	4	18.2	.008		.040	.055		
RH103M	5	20.8	.002		.010	.054		
RH103M	6	16.6	.010		.050	.190		
RH103M	8					.055		
RH103M	23					.053		
RU105	1	7.30	.030		1.0	1.063		
RU105	3	2.50	.006		.200	.780		
RU105	6	16.	.240	-2	.080	3.325		
RU105	8					.795	.90	.91
RU105	23					.574		
RH105	1	10.4	.200		1.0	.213		
RH105	3	28.0	.006		.030	.181		
RH105	4	18.2	.008		.040	.186		
RH105	5	20.8	.002		.010	.190		
RH105	6	16.6	.010		.050	.847		
RH105	8					.019		
RH105	23					.177		
RU106	1	7.30	.030		1.0	1.534		
RU106	3	2.50	.006		.200	1.447		
RU106	6	16.0	.240	-2	.080	7.078		
RU106	8					1.40		
RU106	23					1.436		
PD107	1	5.0	.2		1.0	.0089		
PD107	3	30.0	.02		.08	.0089		
PD107	4	19.0	.02		.09	.0089		
PD107	8					.0089	.0089	.0089
PD107	23					.0089		
CD109	1	200.	.0025		1.0	.11		
CD109	8					.1		
PD109	1	5.0	.200		1.0	.375		
PD109	3	30.0	.020		.080	.373		
PD109	4	19.0	.020		.090	.374		
PD109	5	15.0	.002		.010	.420		

Appendix B - Organ Data Library - ORGLIB

PD109	8				.42			
PD109	23				.373			
AG110M	1 5.0	.010	1.0		1.697			
AG110M	310.0	.200-3	.020		.614			
AG110M	415.0	.300-3	.030		.803			
AG110M	630.0	.500-3	.050		1.129			
AG110M	8				.840			
AG110M	23				.477			
AG111	1 5.0	.010	1.0		.383			
AG111	3 10.0	.200-3	.020		.372			
AG111	4 15.0	.300-3	.030		.374			
AG111	6 30.0	.500-3	.050		1.84			
AG111	8				.380			
AG111	23				.370			
IN111	1 48.	.002	1.0		.286			
IN111	6 57.	.34-03	.17		.302			
IN111	8				.155			
IN111	16 8.4	.80E-6	.40-03		.104			
IN111	23				.104			
CD113M	1 200.	.0025	1.0		.200			
CD113M	3 300.	2.5 -4	0.1		.200			
CD113M	4 200.	1.9 -3	0.75		.200			
CD113M	8				.184	.184		.184
CD113M	23				.200			
IN114M	1 48.0	.002	1.0		.970			
IN114M	3 60.0	.800-4	.040		.930			
IN114M	4 58.0	.280-3	.140		.940			
IN114M	5 48.0	.400-4	.020		.930			
IN114M	6 57.0	.340-3	.170		4.50			
IN114M	8				.940			
IN114M	12 67.0	.360-3	.180		.900			
IN114M	16 8.40	.800-6	.400-3		.920			
IN114M	23				.93			
CD115M	1 200.	.250-2	1.0		.610			
CD115M	3 300.	.250-3	.10		.610			
CD115M	4 200.	.190-2	.750		.610			
CD115M	8				.610	.610		.610
CD115M	23				.61			
CD115	1 200.	.250-2	1.0		.710			
CD115	3 300.	.250-3	.1		.560			
CD115	4 200.	.190-2	.750		.580			
CD115	8				.650-18	.38-16		.39-15
CD115	23				.36			
IN115M	01 48.0	.002	1.0		.260			
IN115M	3 60.0	.800-4	.040		.190			
IN115M	4 58.0	.280-3	.140		.200			
IN115M	05 48.0	.400-4	.020		.190			
IN115M	6 57.0	.340-3	.170		.740			
IN115M	8				.77-18	.39-16		.39-15
IN115M	12 67.0	.360-3	.180		.140			

Appendix B - Organ Data Library - ORGLIB

IN115M	16	8.40	.800-6	.400-3	.160			
IN115M	23				.18			
IN115	1	48.0	.002	1.0	.170			
IN115	3	60.0	.800-4	.040	.170			
IN115	4	58.0	.280-3	.140	.170			
IN115	5	48.0	.400-4	.020	.170			
IN115	6	57.0	.340-3	.170	.850			
IN115	8				.170			
IN115	12	67.0	.360-3	.180	.170			
IN115	16	8.40	.800-6	.400-3	.170			
IN115	23				.17			
SN123	1	.35 +2	.05	1.0	.522			
SN123	4	.70 +2	5.00-4	.01	.522			
SN123	6	.10 +3	.02	.3	2.611			
SN123	8				.522			
SN123	15	.35+2	.8-4	.16-2	.522			
SN123	16	.70+2	.5-5	.10-3	.522			
SN123	23				.522			
SB124	1	38.0	.030	1.0	1.507			
SB124	4	38.0	.600-4	.002	.871			
SB124	6	100.0	.003	.100	2.356			
SB124	8	100.0	.900-3	.030	.920			
SB124	16	4.0	.900-6	.300-4	.544			
SB124	23				.644			
I 125	1	1380.	1.0	1.0	.0721			
I 125	6	14.	0.70	0.07	.197			
I 125	8				.0657			
I 125	16	1380.	.300	.300	.0563			
I 125	23				.0563			
SN125	1	35.0	.050	1.0	.946			
SN125	4	70.0	.500-3	.010	.911			
SN125	6	100.	.02	.300	4.482			
SN125	8				.930	.94	1.0	
SN125	15	35.0	.800-4	.160-2	.940			
SN125	16	70.0	.500-5	.100-3	.880			
SN125	23				.892			
SB125	1	380.	.03	1.0	.367			
SB125	4	380.	.600-4	.002	.221			
SB125	6	1000.	.003	.1	.623			
SB125	8				.211	.23	.26	
SB125	16	4.0	.900-6	.300-4	.137			
SB125	23				.16			
TE125M	1	15.0	.250	1.0	.114			
TE125M	3	30.0	.020	.070	.112			
TE125M	4	30.0	.010	.050	.113			
TE125M	5	30.0	.250-2	.010	.140			
TE125M	6	30.	.023	.090	.558			
TE125M	8				.140			
TE125M	10	30.	.750-3	.003	.110			
TE125M	16	9.	.250-3	.001	.112			

Appendix B - Organ Data Library - ORGLIB

TE125M	23				.112		
SN126	1 35.	.05	1.0		1.3		
SN126	4 70.	.0005	.0100		1.1		
SN126	6100.	.02	.3		4.		
SN126	8				1.1	1.1	1.1
SN126	15 35.	.800-4	.16-2		.38		
SN126	16 70.	5.0 -6	.0001		.38		
SN126	23				0.2		
SB126	1 38.	.03	1.0		1.4		
SB126	4 38.	6.0 -5	.002		.96		
SB126	6100.	.003	0.1		3.3		
SB126	8				.96	.96	.96
SB126	16 4.0	9. -7	3.0 -5		.70		
SB126	23				.78		
SB127	1 38.	.03	1.0		.905		
SB127	4 38.	6.0-5	.002		.627		
SB127	6 100.	.003	.1		2.226		
SB127	8				.627		
SB127	16 4.	9.-7	3.0-5		.479		
SB127	23				.524		
TE127M	1 15.0	.250	1.0		.237		
TE127M	3 30.0	.020	.070		.237		
TE127M	4 30.0	.010	.050		.237		
TE127M	5 30.0	.250-2	.010		.320		
TE127M	6 30.0	.023	.090		1.185		
TE127M	8				.256	.32	.32
TE127M	10 30.0	.750-3	.003		.310		
TE127M	16 9.	.250-3	.001		.225		
TE127M	23				.237		
TE127	1 15.	.250	1.0		.236		
TE127	3 30.	.020	.070		.235		
TE127	4 30.	.010	.050		.235		
TE127	5 30.	.250-2	.010		.240		
TE127	6 30.	.023	.090		1.175		
TE127	8				.240		
TE127	10 30.	.750-3	.003		.240		
TE127	16 9.0	.250-3	.001		.235		
TE127	23				.235		
TE129M	1 15.	.250	1.0		.665		
TE129M	3 30.0	.020	.070		.616		
TE129M	4 30.	.010	.050		.625		
TE129M	5 30.	.250-2	.010		.780		
TE129M	6 30.	.023	.090		2.985		
TE129M	8				.795	.83	.83
TE129M	10 30.	.750-3	.003		.690		
TE129M	16 9.0	.250-3	.001		.603		
TE129M	23				.610		
TE129	1 15.0	.250	1.0		.598		
TE129	3 30.	.020	.070		.552		
TE129	4 30.	.010	.050		.561		

Appendix B - Organ Data Library - ORGLIB

TE129	5	30.	.250-2	.010	.680		
TE129	6	30.	.023	.090	2.666		
TE129	8				.730	.73	.73
TE129	10	30.	.750-3	.003	.600		
TE129	16	9.0	.250-3	.001	.539		
TE129	23				.546		
I 129	1	100.	1.0	1.0	8.72 -2		
I 129	3	7.0	.040	.040	8.76 -2		
I 129	4	7.0	.120	.120	7.69 -2		
I 129	5	7.0	.005	.005	.077		
I 129	6	14.0	.070	.070	.316		
I 129	8				.082		
I 129	10	7.0	.005	.005	.068		
I 129	16	100.	.300	.300	6.52 -2		
I 129	23				.0694		
TE131M	1	15.	.250	1.0	2.316		
TE131M	3	30.	.020	.070	1.449		
TE131M	4	30.	.010	.050	1.621		
TE131M	5	30.	.250-2	.010	.800		
TE131M	6	30.	.023	.090	5.953		
TE131M	8				.763	.99	1.0
TE131M	10	30.	.750-3	.003	1.317		
TE131M	16	9.	.250-3	.001	1.317		
TE131M	23				1.181		
TE131	1	15.	.25	1.0	1.358		
TE131	3	30.	.02	.07	1.009		
TE131	4	30.	.01	.05	1.091		
TE131	6	30.	.023	.09	4.666		
TE131	8				1.13		
TE131	10	30.	.75-3	.003	1.01		
TE131	16	9.	.25-3	.001	1.010		
TE131	23				.805		
I 131	1	100.	1.0	1.0	.434		
I 131	3	7.	.04	.04	.277		
I 131	4	7.	.12	.12	.305		
I 131	5	7.	.005	.005	0.27		
I 131	6	14.	.07	.07	1.102		
I 131	8				.300		
I 131	10	7.	.005	.005	.23		
I 131	16	100.	.300	.300	.236		
I 131	23		5.0-2		.257		
TE132	1	15.	.250	1.0	2.169		
TE132	3	30.	.020	.070	1.09		
TE132	4	30.	.010	.050	1.282		
TE132	5	30.	.250-2	.010	.960		
TE132	6	30.	.023	.090	3.544		
TE132	8				1.04	1.1	1.1
TE132	10	30.	.750-3	.003	.730		
TE132	16	9.0	.250-3	.001	.814		
TE132	23				.901		

Appendix B - Organ Data Library - ORGLIB

I 132	1	100.	1.0	1.0	1.921		
I 132	3	7.0	.040	.040	.934		
I 132	4	7.0	.120	.120	1.107		
I 132	5	7.0	.005	.005	.850		
I 132	6	14.0	.070	.070	2.899		
I 132	8				.100		
I 132	10	7.0	.005	.005	.640		
I 132	16	100.	.080	.090	.677		
I 132	23		5.0-2		.810		
I 133	1	100.	1.0	1.0	.830		
I 133	8				.666	.78	.80
I 133	16	100.	.225	.240	.498		
I 133	23		5.0-2		.534		
I 134	1	100.	1.0	1.0	2.66		
I 134	8				1.10		
I 134	16	100.	.040	.040	.923		
I 134	23		5.0-2		1.107		
CS134M	1	115.	1.0	1.0	.180		
CS134M	3	42.	.010	.010	.082		
CS134M	4	90.	.070	.070	.122		
CS134M	5	98.	.005	.005	.130		
CS134M	6	140.	.040	.040	.417		
CS134M	8				.927-1	.12	.30
CS134M	14	140.	.400	.400	.260		
CS134M	23				.0548		
CS134	1	115.0	1.0	1.0	1.152		
CS134	3	42.0	.010	.010	.489		
CS134	4	90.0	.070	.070	.606		
CS134	5	98.0	.005	.005	.460		
CS134	6	140.	.040	.040	1.247		
CS134	8	140.	.003	.003	.570		
CS134	14	140.	.400	.400	1.1		
CS134	23				.405		
I 135	a 1	100.	1.0	1.0	1.483		
I 135	8				.99	1.1	1.1
I 135	16	100.	.150	.170	.503		
I 135	23		5.0-2		.802		
CS135	1	115.	1.0	1.0	6.58 -2		
CS135	3	42.	.010	.010	6.58 -2		
CS135	4	90.	.070	.070	6.58 -2		
CS135	5	98.	.005	.005	.066		
CS135	6	140.	.040	.040	.329		
CS135	8	140.	.003	.003	.066		
CS135	14	140.	.400	.400	.066		
CS136	1	115.	1.0	1.0	1.497		
CS136	3	42.	.010	.010	.583		
CS136	4	90.	.070	.070	.742		
CS136	5	98.	.005	.005	.290		
CS136	6	140.	.040	.040	1.295		
CS136	8	140.	.003	.003	.350		

Appendix B - Organ Data Library - ORGLIB

CS136	14	140.	.400	.400	.650		
CS136	23				.469		
CS137	1	115.	1.0	1.0	.594		
CS137	3	42.	.010	.010	.359		
CS137	4	90.	.070	.070	.400		
CS137	5	98.	.005	.005	.370		
CS137	6	140.	.040	.040	1.365		
CS137	8	140.	.003	.003	.410		
CS137	14	140.	.400	.400	.590		
CS137	23				.329		
BA137M	1	65.	.05	1.0	.437		
BA137M	6	65.	.035	.7	.474		
BA137M	8				.231		
BA137M	23				.154		
CS138	1	115.	1.0	1.0	2.289		
CS138	3	42.	.01	.01	1.454		
CS138	4	90.	.07	.07	1.596		
CS138	5	98.	.005	.005	1.45		
CS138	6	140.	.04	.04	5.842		
CS138	8				1.6		
CS138	14	140.	.40	.40	2.29		
CS138	23				1.352		
CS139	1	115.	1.	1.	2.711		
CS139	3	42.	.01	.01	2.557		
CS139	4	90.	.07	.07	2.584		
CS139	5	98.	.005	.005	2.56		
CS139	6	140.	.04	.04	12.5		
CS139	8				2.58		
CS139	14	140.	.4	.4	2.71		
CS139	23				2.536		
BA140	1	65.0	.050	1.0	2.364		
BA140	3	8.50	.500-5	.100-3	1.379		
BA140	4	975.	.300-4	.600-3	1.548		
BA140	5	13.0	.250-5	.500-4	1.20		
BA140	6	65.0	.035	.700	5.139		
BA140	8				.751	1.4	1.4
BA140	14	2000.	.150-3	.003	2.30		
BA140	23				.354		
LA140	1	500.	.0001	1.0	1.889		
LA140	4	400.	.150-4	.150	1.160		
LA140	6	1000.	.400-4	.400	3.536		
LA140	8				1.10		
LA140	23				.903		
BA141	1	65.	.05	1.0	2.365		
BA141	3	8.5	.500-5	.10-3	2.116		
BA141	4	975.	.300-4	.60-3	2.147		
BA141	5	13.	.250-5	.50-4	2.116		
BA141	6	65.	.035	.7	10.04		
BA141	8				2.147		
BA141	14	2000.	.150-3	.003	2.365		

Appendix B - Organ Data Library - ORGLIB

BA141	23			1.129		
LA141	1 500.	.0001	1.0	.951		
LA141	4 400.	.150-4	.15	.942		
LA141	61000.	.400-4	.40	4.680		
LA141	8			.942		
LA141	23			.938		
CE141	1 563.	.100-3	1.000	.221		
CE141	3 563.	.200-5	.020	.194		
CE141	4 293.	.250-4	.250	.199		
CE141	61500.	.300-4	.300	.928		
CE141	8			.180		
CE141	23			.191		
BA142	1 65.	.05	1.0	3.409		
BA142	3 8.5	.500-5	.100-3	2.022		
BA142	4 975.	.300-4	.600-3	2.257		
BA142	5 13.	.250-5	.500-4	2.022		
BA142	6 65.	.035	.7	7.755		
BA142	8			2.257		
BA142	14 2000.	.150-3	.003	3.409		
BA142	23			1.855		
LA142	1 500.	.0001	1.0	2.133		
LA142	4 400.	.15-4	.15	1.39		
LA142	6 1000.	.40-4	.40	4.718		
LA142	8			1.39		
LA142	23			1.135		
CE143	1 563.	.100-3	1.0	.933		
CE143	3 563.	.200-5	.020	.795		
CE143	4 293.	.250-4	.250	.818		
CE143	61500.	.300-4	.300	3.791		
CE143	8			.562	.79	.85
CE143	23			.468		
PR143	1 75.0	.100-3	1.0	.324		
PR143	3 750.	.200-5	.020	.324		
PR143	4 375.	.200-4	.200	.324		
PR143	61500.	.400-4	.400	1.618		
PR143	8			.320		
PR143	23			.324		
CE144	1 563.	.100-3	1.0	1.313		
CE144	3 563.	.200-5	.020	1.295		
CE144	4 293.	.250-4	.250	1.298		
CE144	61500.	.300-4	.300	6.443		
CE144	8			1.30	1.30	1.30
CE144	23			1.292		
PR144	1 75.	.10-3	1.	1.205		
PR144	3 750.	.20-5	.02	1.193		
PR144	4 375.	.20-4	.20	1.195		
PR144	61500.	.40-4	.40	5.944		
PR144	8			1.195		
PR144	23			1.191		
ND144	1 656.	.100-3	1.0	20.0		

Appendix B - Organ Data Library - ORGLIB

ND144	3	656.	.500-5	.050	20.0		
ND144	4	131.	.500-4	.500	20.0		
ND144	6	1500.	.350-4	.350	100.		
ND144	8				20.		
ND144	23				.19		
ND147	1	656.	.100-3	1.0	.381		
ND147	3	656.	.500-5	.050	.319		
ND147	4	131.	.500-4	.500	.330		
ND147	6	1500.	.350-4	.350	1.560		
ND147	8				.290	.290	.31
ND147	23				.282		
PM147	1	656.	.100-3	1.0	6.980-2		
PM147	3	656.	.200-5	.020	6.980-2		
PM147	4	656.	.600-5	.060	6.980-2		
PM147	6	1500.	.350-4	.350	.349		
PM147	8				.069	.069	.069
PM147	23				6.980-2		
PM148M	1	656.	.10-3	1.0	1.481		
PM148M	3	656.	.20-5	.02	.629		
PM148M	4	656.	.60-5	.06	.784		
PM148M	6	1500.	.35-4	.35	2.067		
PM148M	8				.784		
PM148M	23				.531		
PM148	1	656.	.10-3	1.0	1.065		
PM148	3	656.	.20-5	.02	.857		
PM148	4	656.	.60-5	.06	.857		
PM148	6	1500.	.35-4	.35	3.627		
PM148	8				.857		
PM148	23				.783		
PM149	1	656.	.100-3	1.0	.377		
PM149	3	656.	.200-5	.020	.374		
PM149	4	656.	.600-5	.060	.374		
PM149	6	1500.	.350-4	.350	1.863		
PM149	8				.440		
PM149	23				.373		
PM151	1	656.	.1-3	1.	.474		
PM151	3	656.	.2-5	.02	.359		
PM151	4	656.	.6-5	.06	.379		
PM151	6	1500.	.35-4	.35	1.594		
PM151	8				.379		
PM151	23				.345		
SM151	1	656.	.100-3	1.0	.042		
SM151	3	656.	.200-5	.020	.042		
SM151	4	187.	.350-4	.350	.042		
SM151	6	1500.	.350-4	.350	.130		
SM151	8				.042		
SM151	23				.041		
EU152	1	635.	.100-3	1.0	.66		
EU152	3	1480.	.300-5	.030	.33		
EU152	4	127.	.250-4	.250	.33		

Appendix B - Organ Data Library - ORGLIB

EU152	61500.	.360-4	.360	.45		
EU152	8			.330		
EU152	23			.20		
EU154	1 635.	.100-3	1.0	.965		
EU154	31480.	.300-5	.030	0.487		
EU154	4 127.	.250-4	.250	.570		
EU154	61500.	.360-4	.360	1.595		
EU154	8			.570		
EU154	23			.428		
EU155	1 635.	.100-3	1.0	.160		
EU155	31480.	.300-5	.030	.095		
EU155	4 127.	.250-4	.250	.095		
EU155	61500.	.360-4	.360	.280		
EU155	8			.095		
EU155	23			.075		
EU156	1 635.	.10-3	1.0	1.09		
EU156	3 1480.	.30-5	.03	.637		
EU156	4 127.	.25-4	.25	.715		
EU156	6 1500.	.36-4	.36	2.399		
EU156	8			.715		
EU156	23			.581		
GD153	1 550.	.100-3	1.0	.170		
GD153	4 460.	.120-4	.120	.099		
GD153	61000.	.450-4	.450	.230		
GD153	8			.099		
GD153	23			.072		
T8160	1 670.	.100-3	1.0	.850		
T8160	3 700.	.300-5	.030	.400		
T8160	61000.	.600-4	.600	1.1		
T8160	8			.480		
T8160	23			.34		
H0166M	1 750.	1.0 -4	1.0	.810		
H0166M	3 800.	2.0 -6	.02	.320		
H0166M	4 875.	6.0 -6	.06	.370		
H0166M	61000.	6.4 -5	.64	.400		
H0166M	8			.37	.37	.37
H0166M	23			.20		
W 181	1 1.0	.100	1.0	3.300-3		
W 181	4 4.0	.006	.060	3.200-3		
W 181	6 9.0	.007	.070	.016		
W 181	8			3.200-3		
W 181	23			3.200-3		
W 185	1 1.0	.100	1.0	.136		
W 185	4 4.0	.006	.060	.136		
W 185	6 9.0	.007	.070	.682		
W 185	8			.140		
W 185	23			.136		
OS185	1 20.	.1	1.0	.510		
OS185	8			.290		
OS185	23			.230		

Appendix B - Organ Data Library - ORGLIB

W 187	1	1.0	.100	1.0	.572		
W 187	4	4.0	.006	.060	.414		
W 187	6	9.0	.007	.070	1.558		
W 187	8				.440	.44	.44
W 187	23				.356		
RE187	1	7.0	.500	1.0	.012		
RE187	4	14.0	.005	.010	.012		
RE187	6	3.50	.005	.010	.062		
RE187	8				.012		
RE187	12	25.0	.130	.250	.012		
RE187	16	3.0	.350-2	.007	.012		
RE187	23				.012		
OS191	1	20.	.1	1.0	.160		
OS191	6				.618		
OS191	8				.138		
OS191	23				.130		
IR192	1	20.	.1	1.0	.81		
IR192	8				.81		
IR192	23				.81		
HG203	1	100.	.63	1.0	.25		
HG203	8				.17		
HG203	23				.14		
TH230	1	570. +2	.100-3	1.0	.480+2		
TH230	3	220. +2	.500-5	.050	.480+2		
TH230	4	570. +2	.500-5	.050	.480+2		
TH230	6	365. +2	.700-4	.700	.242+3		
TH230	8				.480+2	.480+2	.48+2
TH230	23				.47		
RA226	18100.		.300	1.0	.110+3		
RA226	6	164. +2	.030	.100	.110+3		
RA226	8				.110+3		
RA226	23				3.7		
PB210	11460.		.080	1.0	5.20		
PB210	3	531.	.010	.140	10.0		
PB210	41950.		.0064	.080	10.		
PB210	63650.		.020	.280	29.		
PB210	8				.157	14.	43.
PB210	23				.460		
BI210	1	5.0	.010	1.0	10.0		
BI210	3	6.0	.003	.300	19.		
BI210	4	15.0	.150-2	.150	13.		
8I210	5	10.0	.100-3	.010	17.		
BI210	6	13.3	.300-3	.030	40.		
BI210	8				.795	15.	43.
BI210	23				.40		
PO210	1	30.	.060	1.0	55.0		
PO210	3	70.	.004	.070	55.0		
PO210	4	41.	.010	.170	55.0		
PO210	5	60.	.002	.040	55.0		
PO210	6	24.	.006	.100	275.		

Appendix B - Organ Data Library - ORGLIB

P0210	8				55.0			
P0210	23				.53			
U 232	1	100.	.010	1.0	2.80 +2			
U 232	3	15.0	.110-2	.110	1.10 +2			
U 232	6	300.	.110-2	.110	1.20 +3			
U 232	8				.552+2	.760+2	.19+3	
U 232	23				.53			
TH232	1	570. +2	.100-3	1.0	.62 +2			
TH232	3	220. +2	.500-5	.050	.41 +2			
TH232	4	570. +2	.500-5	.050	.41 +2			
TH232	6	365. +2	.700-4	.700	.270+3			
TH232	8				.410+2	.410+2	.57+2	
TH232	23				.40			
RA228	18100.		.300	1.0	2.3 +2			
RA228	6	164. +2	.030	.100	1.9 +2			
RA228	8				.716	.22 +2	.14+3	
RA228	23				.63			
AC228	1	240. +2	.100-3	1.0	.230+3			
AC228	3	240. +2	.100-5	.010	.550+2			
AC228	4	240. +1	.500-4	.500	.560+2			
AC228	6	365. +2	.300-4	.300	.970+3			
AC228	8				.897	2.2 +1	1.4 +2	
AC228	23				.62			
TH228	1	570. +2	.100-3	1.0	.230+3			
TH228	3	220. +2	.500-5	.050	.56 +2			
TH228	4	570. +2	.500-5	.050	.56 +2			
TH228	6	365. +2	.700-4	.700	.970+3			
TH228	8				.750+2	.22 +3	.24+3	
TH228	23				4.4			
RA224	18100.		.300	1.0	2.80 +2			
RA224	6	164. +2	.150	.500	2.80 +2			
RA224	8				.249+3	.28 +3	.28+3	
RA224	23				4.2			
PB212	11460.		.080	1.0	82.0			
P8212	3	531.	.010	.140	81.0			
PB212	41950.		.640-2	.080	83.0			
PB212	63650.		.020	.280	410.0			
P8212	8				79.9	83.0	83.0	
PB212	23				.22			
BI212	1	5.0	.010	1.0	83.0			
BI212	3	6.0	.003	.300	82.0			
BI212	4	15.0	.150-2	.150	83.0			
BI212	5	10.0	.100-3	.010	82.0			
BI212	6	13.3	.300-3	.030	.411+3			
BI212	8				83.0			
BI212	23				1.7			
U 234	1	100.	.010	1.0	49.			
U 234	3	15.	.110-2	.110	49.			
U 234	6	300.	.110-2	.110	2.40 +2			
U 234	8				.490+2			

Appendix B - Organ Data Library - ORGLIB

U 234	23		1.000		.48			
U 235	1	100.	.010	1.0	46.			
U 235	3	15.	.110-2	.110	46.			
U 235	6	300.	.110-2	.110	2.30 +2			
U 235	8				.461+2	.46 +2		.46+2
U 235	23		1.0		.61			
TH231	1	570. +2	.100-3	1.0	.180			
TH231	3	220. +2	.500-5	.050	.140			
TH231	4	570. +2	.500-5	.050	.160			
TH231	6	365. +2	.700-4	.700	.560			
TH231	8				.110	.110		.110
TH231	23		1.0		.093			
PA231	1	410. +2	.100-3	1.0	1.40 +2			
PA231	3	510. +2	.400-5	.040	79.0			
PA231	4	580. +2	.500-5	.050	6.3 +1			
PA231	6	365. +2	.450-4	.450	7.50 +2			
PA231	8				.510+2	.52 +2		.70+2
PA231	23				.56			
AC227	1	240. +2	.100-3	1.0	2.0 +2			
AC227	3	240. +2	.100-5	.010	6.2 +1			
AC227	4	240. +1	.500-4	.500	6.2 +1			
AC227	6	365. +2	.300-4	.300	1.0 +3			
AC227	8				4.89	2.10 +2		3.2 +2
AC227	23				.640			
TH227	1	570. +2	.100-3	1.0	.200+3			
TH227	3	220. +2	.500-5	.050	.61 +2			
TH227	4	570. +2	.500-5	.050	.61 +2			
TH227	6	365. +2	.700-4	.700	.990+3			
TH227	8				.750+2	.20 +3		.23+3
TH227	23				4.3			
FR223	1				.149			
FR223	6				.616			
FR223	8				.135			
FR223	16				.129			
FR223	23				.129			
RA223	18	100.	.300	1.0	2.75 +2			
RA223	3	10.	6.0 -4	.002	2.75 +2			
RA223	4	10.	1.2 -4	4.0 -4	2.75 +2			
RA223	6	164. +2	.150	.500	2.75 +2			
RA223	8				28.0 +1			
RA223	23				3.7			
U 236	1	100.	.010	1.0	47.			
U 236	3	15.	.110-2	.110	47.7			
U 236	6	300.	.110-2	.110	2.30 +2			
U 236	8				47.			
U 236	23				.45			
PU236	1	650. +2	.30 -4	1.0	61.			
PU236	3	320. +2	.60 -6	.02	60.			
PU236	4	146. +2	1.35-5	.45	60.			
PU236	6	365. +2	1.35-5	.45	3.12 +2			

Appendix B - Organ Data Library - ORGLIB

PU236	8					.60	.60	.61
PU236	23	.3-4	1.0	.0		.61		
PU237	1	650. +2	.300-4	1.0		.038		
PU237	3	320. +2	.600-6	.020		.024		
PU237	4	146. +2	1.35-5	.450		.027		
PU237	6	365. +2	1.35-5	.450		.068		
PU237	8					.027		
PU237	23					.022		
NP237	1	390. +2	.100-3	1.0	49.			
NP237	3	640. +2	.300-5	.030	49.			
NP237	4	146. +3	.500-5	.050	49.			
NP237	6	365. +2	.450-4	.450	2.50 +2			
NP237	8				.490+2	.490+2	.49+2	
NP237	23				.62			
PA233	1	410. +2	.100-3	1.0	.32			
PA233	3	510. +2	.400-5	.040	.15			
PA233	4	580. +2	.500-5	.050	.18			
PA233	6	365. +2	.450-4	.450	.41			
PA233	8				.18			
PA233	23				.13			
U 233	1	100.	.010	1.0	50.			
U 233	3	15.0	.110-2	.110	50.			
U 233	6	300.	.110-2	.110	2.50 +2			
U 233	8				.500+2			
U 233	23				.49			
TH229	1	570. +2	.100-3	1.0	.330+3			
TH229	3	220. +2	.500-5	.050	.49 +2			
TH229	4	570. +2	.500-5	.050	.49 +2			
TH229	6	730. +2	.700-4	.700	.940+3			
TH229	8				.270+3	.270+3	.27+3	
TH229	23				4.0			
RA225	18	100.	.30	1.0	2.80 +2			
RA225	3	10.	6.0 -4	.002	2.50 +2			
RA225	4	10.	.12 -3	.040-2	2.50 +2			
RA225	6	164. +2	.15	.50	2.80 +2			
RA225	8				2.50 +2	2.50 +2	2.50+2	
RA225	23				3.5			
AC225	1	240. +2	.001-1	1.0	2.80 +2			
AC225	3	240. +2	1.0 -6	.01	2.80 +2			
AC225	4	240. +1	5.0 -5	.50	2.80 +2			
AC225	6	730. +2	3.0 -5	.30	1.39 +3			
AC225	8				2.70 +2	2.70 +2	2.70+2	
AC225	23				3.3			
U 238	1	100.	.01	1.0	43.0			
U 238	3	15.	1.1 -3	0.11	43.0			
U 238	6	300.	1.1 -3	0.11	220.0			
U 238	8				43.0			
U 238	23		1.0		0.43			
TH234	1	570. +2	.100-3	1.0	.91			
TH234	3	570. +2	.500-5	.050	.90			

Appendix B - Organ Data Library - ORGLIB

TH234	4	570.	+2	.500-5	.050	.90			
TH234	6	365.	+2	7.00-5	.700	4.5			
TH234	8					.900			
TH234	23			1.0		.90			
PA234M	1	410.	+2	.100-3	1.0	.277			
PA234M	6	365.	+2	.450-4	.450	1.351			
PA234M	8					.273			
PA234M	23					.271			
PA234	1	410.	+2	.100-3	1.0	1.351			
PA234	6	365.	+2	.450-4	.450	1.180			
PA234	8					.661			
PA234	23					.427			
AM242M	1	200.	+2	.100-3	1.0	61.			
AM242M	3	270.	+2	.300-5	.030	60.5			
AM242M	4	146.	+2	4.50-5	.450	57.			
AM242M	6	365.	+2	4.50-5	.450	3.02	+2		
AM242M	8					.340	.13	+2	.40+2
AM242M	23					.730			
AM242	1	200.	+2	.100-3	1.0	67.0			
AM242	3	270.	+2	.300-5	.030	66.0			
AM242	4	146.	+2	4.50-5	.450	63.0			
AM242	6	365.	+2	4.50-5	.450	3.40	+2		
AM242	8					.540	.13	+2	.40+2
AM242	23					.20			
CM242	1	240.	+2	.100-3	1.0	80.0			
CM242	3	240.	+2	.200-5	.020	78.0			
CM242	4	150.	+2	.400-4	.450	78.0			
CM242	6	365.	+2	.450-4	.450	4.0	+2		
CM242	8					63.0	63.0		64.0
CM242	23					.62			
PU242	1	650.	+2	.300-4	1.0	51.			
PU242	3	320.	+2	.600-6	.020	51.			
PU242	4	146.	+2	1.35-5	.450	51.			
PU242	6	365.	+2	1.35-5	.450	2.50	+2		
PU242	8					51.0			
PU242	23			.3-4	1.0	.0	.510		
NP238	1	390.	+2	.1-3	1.0	.459			
NP238	6	365.	+2	.45-4	.45	.761			
NP238	8					.275			
NP238	23					.208			
PU238	1	650.	+2	.300-4	1.0	57.			
PU238	3	320.	+2	.600-6	.020	57.			
PU238	4	146.	+2	1.35-5	.450	57.			
PU238	6	365.	+2	1.35-5	.450	2.80	+2		
PU238	8					57.0			
PU238	23			.3-4	1.0	0.0	.57		
CM244	1	240.	+2	.100-3	1.0	58.			
CM244	3	240.	+2	.200-5	.020	58.			
CM244	4	150.	+2	.450-4	.400	58.			
CM244	6	365.	+2	.450-4	.450	2.90	+2		

Appendix B - Organ Data Library - ORGLIB

CM244	8				60.0	60.	60.
CM244	10	1.0+8		0.5 -3	6.0 +1		
CM244	11	1.0+8		0.1 -3	6.0 +1		
CM244	23				.59		
PU244	1	650. +2	.300-4	1.0	58.4		
PU244	3	320. +2	.60 -6	.020	58.4		
PU244	4	14.6+3	1.35-5	.45	58.4		
PU244	6	365. +2	1.35-5	.45	2.92 +2		
PU244	8				58.4	58.4	58.4
PU244	23				.76		
U 240	1	100.	.01	1.0	.0847		
U 240	6	300.	1.1 -3	0.11	.398		
U 240	8				.0845		
U 240	23				.0843		
PU240	1	650. +2	.300-4	1.0	53.0		
PU240	3	320. +2	.600-6	.020	53.0		
PU240	4	146. +2	1.35-5	.450	53.0		
PU240	6	365. +2	1.35-5	.450	2.70 +2		
PU240	8				53.0		
PU240	23	.3-4	1.0	.0	.53		
CM246	1	240. +2	.100-3	1.0	56.0		
CM246	3	240. +2	.200-5	.020	56.0		
CM246	4	150. +2	.400-4	.400	56.0		
CM246	6	365. +2	.300-4	.300	2.78 +2		
CM246	8				56.0		
CM246	23				.54		
CM248	1	240. +2	.100-3	1.0	4.53 +2		
CM248	3	240. +2	2. -6	.020	4.53 +2		
CM248	4	146. +2	4.0 -5	.40	4.53 +2		
CM248	6	365. +2	.30 -4	.30	22.44 +2		
CM248	8				4.53 +2		
CM248	23				11.45		
CM247	1	240. +2	.100-3	1.0	55.		
CM247	3	240. +2	2.0 -6	.020	55.		
CM247	4	150. +2	.45 -4	.450	55.		
CM247	6	365. +2	.45 -4	.450	2.70 +2		
CM247	8				55.0	55.0	55.0
CM247	23				.71		
CM243	1	240. +2	.100-3	1.0	60.0		
CM243	3	240. +2	.200-5	.020	60.0		
CM243	4	150. +2	.450-4	.450	60.0		
CM243	6	365. +2	.450-4	.450	2.99 +2		
CM243	8				60.	60.	60.
CM243	23				.61		
PU243	1	650. +2	.300-4	1.0	.37		
PU243	3	320. +2	.600-6	.020	.37		
PU243	4	1.5+4	1.35-5	.45	.25		
PU243	6	365. +2	1.35-5	.45	2.		
PU243	8				.19		
PU243	23				.18		

Appendix B - Organ Data Library - ORGLIB

AM243	1	200.	+2	.100-3	1.0	54.0		
AM243	3	270.	+2	.300-5	.030	54.0		
AM243	4	146.	+2	.450-4	.450	54.0		
AM243	6	365.	+2	.450-4	.450	2.70	+2	
AM243	8					54.0	54.0	54.0
AM243	23					.68		
NP239	1	390.	+2	.100-3	1.0	.260		
NP239	3	640.	+2	.300-5	.030	.210		
NP239	4	1.46	+5	4.50-5	.450	.230		
NP239	6	365.	+2	.450-4	.450	1.070		
NP239	8					.160	.16	.16
NP239	23					.22		
PU239	1	650.	+2	.300-4	1.0	53.0		
PU239	3	320.	+2	.600-6	.020	53.0		
PU239	4	146.	+2	1.35-5	.450	53.0		
PU239	6	365.	+2	1.35-5	.450	2.70	+2	
PU239	8					53.0		
PU239	23		.3-4	1.0	0.0	.520		
CM245	1	240.	+2	.100-3	1.0	56.0		
CM245	3	240.	+2	.200-5	.020	56.0		
CM245	4	150.	+2	.450-4	.450	56.0		
CM245	6	365.	+2	.450-4	.450	2.80	+2	
CM245	8					55.0	55.0	55.0
CM245	23					.55		
PU241	1	650.	+2	.300-4	1.0	2.262		
PU241	3	320.	+2	.600-6	.020	2.372		
PU241	4	146.	+2	1.35-5	.450	.999		
PU241	6	365.	+2	1.35-5	.450	14.		
PU241	8					.133-1	.030	.18
PU241	23		.3-4	1.0	.0	.011		
AM241	1	200.	+2	.100-3	1.0	57.		
AM241	3	270.	+2	.300-5	.030	57.		
AM241	4	146.	+2	.450-4	.450	57.		
AM241	6	365.	+2	.450-4	.450	2.80	+2	
AM241	8					57.0		
AM241	23			1.0		.58		
CF252	1	650.	+2	.300-4	1.0	.210+3		
CF252	6	365.	+2	.240-4	.80	.110+4		
CF252	8					.210+3		

Appendix B - Food Transfer Factor Library - FTRANS

FOOD TRANSFER COEFFICIENT LIBRARY (RAP/WTF 04-APR-86 C1 Update)								
ELT	DEP. VEL.	PLANT	EGG	MILK	BEEF	PORK	POULTRY	
	M/SEC	--	DAY/KG	DAY/L	DAY/KG	DAY/KG	DAY/KG	
H	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0E-01
BE	1.0-03	4.7-04	2.0-02	2.0-06	8.0-04	1.0-02	4.0-01	5.0E-03
C	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.0E-01
N	1.0-03	7.5+00	9.9-04	1.1-02	9.9-04	9.9-04	9.9-04	
F	1.0-02	2.0-02	9.9-04	7.0-03	2.0-02	9.0-02	9.9-04	
NA	1.0-03	5.0-02	2.0-01	4.0-02	5.0-02	1.0-01	1.0-02	
P	1.0-03	5.0+01	1.0+01	1.2-02	5.0-02	5.4-01	1.9-01	
CL	1.0-03	5.0	9.9-04	2.0-02	3.0-02	3.0-02	3.0-02	8.0E-01
AR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CA	1.0-03	4.0-02	1.0+00	8.0-03	3.3-03	3.3-03	3.3-03	1.7E-02
SC	1.0-03	1.1-03	9.9-04	2.5-06	6.0-03	1.0-02	4.0-03	
CR	1.0-03	2.5-04	9.9-04	1.1-03	9.9-04	9.9-04	9.9-04	
MN	1.0-03	3.0-02	1.0-01	1.0-04	5.0-03	2.0-02	1.1-01	
FE	1.0-03	4.0-04	1.0-01	6.0-04	2.0-02	5.0-03	1.0-03	
CO	1.0-03	9.4-03	1.0-01	5.0-04	1.0-03	5.0-03	1.0-03	2.3E-04
NI	1.0-03	1.9-02	1.0-01	3.4-03	1.0-03	5.0-03	1.0-03	2.3E-03
CU	1.0-03	1.3-01	2.0-01	7.0-03	1.0-02	1.5-02	2.0-03	
ZN	1.0-03	4.0-01	4.0-03	6.0-03	5.0-02	1.4-01	2.0-03	
AS	1.0-03	1.0-02	9.9-04	3.0-03	1.47-3	2.38-2	8.33-1	
SE	1.0-03	1.3+00	2.1+00	2.3-02	1.0+00	4.5-01	3.7-01	2.2E-02
BR	1.0-02	7.6-01	1.6+00	2.5-02	2.0-02	9.0-02	4.0-03	
KR	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RB	1.0-03	1.3-01	3.0+00	1.0-02	1.5-01	2.0-01	2.0+00	
SR	1.0-03	2.0-01	4.0-01	1.5-03	3.0-04	7.3-03	9.0-04	4.5E-03
Y	1.0-03	2.5-03	5.0-04	5.0-06	5.0-03	5.0-03	5.0-04	
ZR	1.0-03	1.7-04	1.2-03	2.5-06	5.0-04	1.0-03	1.0-04	1.1E-04
NB	1.0-03	9.4-03	1.2-03	1.2-03	5.0-04	1.0-03	1.0-04	
MO	1.0-03	1.3-01	4.0-01	4.0-03	1.0-02	2.0-02	2.0-03	
TC	1.0-03	1.0	9.9-04	1.2-02	9.9-04	9.9-04	9.9-04	8.0E-01
RU	1.0-03	1.0-02	4.0-03	5.0-07	1.0-03	5.0-03	3.0-04	2.2E-02
RH	1.0-03	1.3+01	4.0-03	5.0-03	1.0-03	5.0-03	3.0-04	2.2E-02
PD	1.0-03	5.0+00	4.0-03	5.0-03	1.0-03	5.0-03	3.0-04	4.5E-03
AG	1.0-03	1.5-01	9.9-04	2.5-02	9.9-04	9.9-04	9.9-04	
CD	1.0-03	3.0-01	9.9-04	6.2-05	1.6-02	1.6-02	1.6-02	7.6E-04
SN	1.0-03	2.5-03	9.9-04	1.3-03	9.9-04	9.9-04	9.9-04	4.5E-03
SB	1.0-03	1.1-02	7.0-02	7.5-04	3.0-03	7.0-03	6.0-03	7.0E-02
TE	1.0-03	1.3+00	4.0-01	5.0-04	5.0-02	1.0-02	1.0-02	
I	1.0-02	2.0-02	1.6+00	1.0-02	2.0-02	9.0-02	4.0-03	7.0E-02
XE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CS	1.0-03	2.0-03	6.0-01	5.0-03	3.0-02	2.6-01	4.5+00	1.1E-04
BA	1.0-03	5.0-03	4.0-01	4.0-04	5.0-04	1.0-02	5.0-04	
LA	1.0-03	2.5-03	2.0-03	2.5-06	5.0-03	5.0-03	4.0-03	
CE	1.0-03	5.0-04	3.0-03	1.0-05	1.0-03	5.0-03	6.0-04	4.6E-04
PR	1.0-03	2.5-03	4.0-03	2.5-06	5.0-03	5.0-03	1.0-03	4.6E-04
ND	1.0-03	2.4-03	2.0-04	2.5-06	5.0-03	5.0-03	4.0-03	4.6E-04
PM	1.0-03	2.5-03	7.0-03	2.5-06	5.0-03	5.0-03	1.0-04	4.6E-04
SM	1.0-03	2.5-03	7.0-03	2.5-06	5.0-03	5.0-03	4.0-03	4.6E-04

Appendix B - Food Transfer Factor Library - FTRANS

EU	1.0-03	2.5-03	7.0-03	2.5-06	5.0-03	5.0-03	4.0-03	4.6E-04
TB	1.0-03	2.6-03	7.0-03	2.5-06	5.0-03	5.0-03	4.0-03	4.6E-04
HO	1.0-03	2.6-03	7.0-03	2.5-06	5.0-03	5.0-03	4.0-03	7.6E-04
W	1.0-03	1.8-02	9.9-04	2.5-04	9.9-04	9.9-04	9.9-04	
IR	1.0-03	9.9-04	9.9-04	9.9-04	9.9-04	9.9-04	9.9-04	
HG	1.0-03	3.8-01	9.9-04	1.9-02	1.0-01	3.1+00	1.1-02	
PB	1.0-03	6.8-02	9.9-04	1.0-05	9.9-04	9.9-04	9.9-04	1.1E-04
BI	1.0-03	1.5-01	9.9-04	2.5-04	9.9-04	9.9-04	9.9-04	
PO	1.0-03	9.0-03	9.9-04	1.2-04	9.9-04	9.9-04	9.9-04	
RN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
RA	1.0-03	1.4-03	2.0-05	2.0-04	9.9-04	9.9-04	9.9-04	2.3E-03
AC	1.0-03	2.5-03	2.0-03	2.5-06	5.0-03	1.0-02	4.0-03	
TH	1.0-03	4.2-03	2.0-03	2.5-06	5.0-03	1.0-02	4.0-03	2.3E-04
PA	1.0-03	2.5-03	2.0-03	2.5-06	5.0-03	1.0-02	4.0-03	4.6E-04
U	1.0-03	2.5-03	3.4-01	6.0-04	5.0-03	6.0-04	1.2-03	9.0E-03
NP	1.0-03	2.5-03	2.0-03	2.5-06	5.0-03	1.0-02	4.0-03	2.2E-02
PU	1.0-03	2.5-04	2.0-03	2.5-08	5.0-03	1.0-02	4.0-03	2.3E-04
AM	1.0-03	2.5-04	2.0-03	2.5-06	5.0-03	1.0-02	4.0-03	2.3E-04
CM	1.0-03	2.5-03	2.0-03	2.5-06	5.0-03	1.0-02	4.0-03	2.3E-04
CF	1.0-03	2.5-03	2.0-03	7.5-07	5.0-03	1.0-02	4.0-03	

Appendix B - Bioaccumulation Factor Library - BIOAC1

BIOACCUMULATION FACTOR LIBRARY FOR BA NAPIER (04-APR-86/WTF)

	FISH	CRUS.	MOLL.	ALGAE	FISH	CRUS.	MOLL.	ALGAE	FACTORS
H	1.0	1.0	1.0	1.0	.9	.9	.9	.9	1.0
BE	1000.0	10000.0	10000.0	10000.0	2.0	10.0	10.0	20.0	.2
C	1.0	1.0	1.0	1.0	4600.0	9100.0	9100.0	4600.0	1.0
N	.0	.0	.0	.0	.0	.0	.0	.0	1.0
F	4.0	4.0	4.0	1.0	10.0	100.0	100.0	2.0	.8
NA	1.0	1.0	1.0	1.0	100.0	200.0	200.0	500.0	.9
P	10000.0	10000.0	10000.0	100000.0	100000.0	20000.0	20000.0	500000.0	.4
CL	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
AR	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	.0
CA	10.0	10.0	10.0	1.0	40.0	330.0	330.0	130.0	.2
SC	100.0	300.0	300.0	1000.0	2.0	1000.0	1000.0	10000.0	.3
CR	100.0	1000.0	1000.0	1000.0	20.0	2000.0	2000.0	4000.0	.9
MN	3000.0	10000.0	50000.0	10000.0	400.0	90000.0	90000.0	10000.0	.5
FE	1000.0	4000.0	20000.0	6000.0	100.0	3200.0	3200.0	1000.0	.2
CO	100.0	10000.0	300.0	100.0	50.0	200.0	200.0	200.0	.2
NI	500.0	100.0	100.0	100.0	100.0	100.0	100.0	50.0	.2
CU	1000.0	5000.0	5000.0	1000.0	50.0	400.0	400.0	2000.0	.6
ZN	5000.0	5000.0	50000.0	1000.0	2000.0	10000.0	10000.0	20000.0	.4
AS	300.0	300.0	300.0	300.0	300.0	300.0	300.0	300.0	.7
SE	10.0	10.0	10.0	100.0	170.0	170.0	170.0	1000.0	.8
BR	3.0	10.0	10.0	100.0	420.0	330.0	330.0	50.0	.8
KR	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	.0
RB	30.0	50.0	10.0	10.0	2000.0	1000.0	1000.0	1000.0	.9
SR	1.0	1.0	1.0	20.0	30.0	100.0	100.0	500.0	.2
Y	30.0	100.0	100.0	300.0	25.0	1000.0	1000.0	5000.0	.2
ZR	30.0	100.0	100.0	1000.0	3.3	6.7	6.7	1000.0	.7
NB	100.0	200.0	200.0	100.0	30000.0	100.0	100.0	800.0	.7
MO	10.0	100.0	100.0	100.0	10.0	10.0	10.0	1000.0	.9
TC	10.0	100.0	100.0	1000.0	15.0	5.0	5.0	40.0	.7
RU	3.0	100.0	100.0	1000.0	10.0	300.0	300.0	2000.0	.5
RH	10.0	100.0	100.0	100.0	10.0	300.0	300.0	200.0	.5
PD	10.0	100.0	100.0	100.0	10.0	300.0	300.0	200.0	.5
AG	1000.0	5000.0	5000.0	1000.0	2.3	770.0	770.0	200.0	.7
CD	100.0	3000.0	10000.0	10000.0	200.0	2000.0	2000.0	1000.0	.6
SN	3.0	3.0	3.0	10.0	3000.0	1000.0	1000.0	100.0	.7
SB	1000.0	1000.0	1000.0	10000.0	1.0	10.0	10.0	1500.0	.8
TE	10.0	10.0	100.0	1000.0	400.0	75.0	75.0	100.0	.8
I	20.0	100.0	100.0	10000.0	15.0	5.0	5.0	40.0	.8
XE	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	.0
CS	30.0	50.0	10.0	10.0	2000.0	100.0	100.0	500.0	.9
BA	3.0	3.0	3.0	100.0	4.0	200.0	200.0	500.0	.4
LA	30.0	100.0	100.0	300.0	25.0	1000.0	1000.0	5000.0	.2
CE	30.0	100.0	100.0	300.0	1.0	1000.0	1000.0	4000.0	.2
PR	100.0	1000.0	1000.0	1000.0	25.0	1000.0	1000.0	5000.0	.2
ND	100.0	1000.0	1000.0	1000.0	25.0	1000.0	1000.0	5000.0	.2
PM	100.0	1000.0	1000.0	1000.0	25.0	1000.0	1000.0	5000.0	.2
SM	100.0	1000.0	1000.0	1000.0	25.0	1000.0	1000.0	5000.0	.2
EU	100.0	1000.0	1000.0	1000.0	25.0	1000.0	1000.0	5000.0	.2

Appendix B - Bioaccumulation Factor Library - BIOAC1

TB	100.0	1000.0	1000.0	1000.0	25.0	1000.0	1000.0	5000.0	.2
HO	100.0	1000.0	1000.0	1000.0	25.0	1000.0	1000.0	5000.0	.2
W	10.0	10.0	10.0	100.0	1200.0	10.0	10.0	1200.0	.9
IR	100.0	10000.0	300.0	100.0	50.0	200.0	200.0	200.0	.2
HG	1200.0	310.0	10000.0	34000.0	20000.0	20000.0	20000.0	34000.0	.5
PB	300.0	1000.0	1000.0	5000.0	100.0	100.0	100.0	200.0	.9
BI	15.0	1000.0	1000.0	10000.0	15.0	10.0	10.0	1500.0	.9
PO	300.0	5000.0	5000.0	2000.0	500.0	20000.0	20000.0	2000.0	.8
RN	1.0	1.0	1.0	1.0	57.0	1.0	1.0	1.0	.0
RA	50.0	100.0	100.0	100.0	50.0	250.0	250.0	2500.0	.7
AC	25.0	1000.0	1000.0	5000.0	25.0	1000.0	1000.0	5000.0	.7
TH	10000.0	2000.0	2000.0	3000.0	30.0	500.0	500.0	1500.0	.7
PA	10.0	10.0	10.0	6.0	11.0	110.0	110.0	1100.0	.7
U	10.0	10.0	10.0	67.0	2.0	60.0	60.0	.5	.7
NP	10.0	10.0	10.0	6.0	10.0	400.0	400.0	300.0	.7
PU	3.0	200.0	200.0	1000.0	3.5	100.0	100.0	350.0	.7
AM	25.0	1000.0	1000.0	5000.0	25.0	1000.0	1000.0	5000.0	.7
CM	25.0	1000.0	1000.0	5000.0	25.0	1000.0	1000.0	5000.0	.7
CF	25.0	1000.0	1000.0	5000.0	25.0	1000.0	1000.0	5000.0	.7

Appendix B - External Exposure Dose Rate Factors - PLANEA

OVERBURDEN: 0.0M, SOURCE: 0.15 M (DEN: CONCRETE/1.B): MR/HR 8-Jul-86 RAP

H 3	0.0E+00
C 14	6.2E-04
NA22	4.3E+02
P 32	9.2E-01
P 33	2.8E-03
S 35	0.0E+00
CL36	7.5E-02
K 40	5.7E+01
CA45	2.8E-03
SC46	7.2E+02
CR51	1.1E+01
MN54	2.9E+02
FE55	0.0E+00
FE59	4.0E+02
CO57	2.1E+01
CO60	8.6E+02
NI59	0.0E+00
NI63	1.4E-05
ZN65	2.2E+02
SE75	9.2E+01
SR85	1.8E+02
SR89	5.7E-01
Y 89M	3.7E+00
SR90	3.0E-02
Y 90	1.9E+00
MO93	1.4E+00
NB94	5.3E+02
MO99	4.8E+01
TC99M	1.9E+01
TC99	4.0E-03
RU103	1.8E+02
RH103M	5.1E-02
PD103	2.8E-01
RU106	4.0E-07
RH106	4.1E+01
CD109	7.6E+00
AG110M	1.0E+03
AG110	1.4E+01
IN111	7.6E+01
SB124	7.2E+02
SB125	1.7E+02
TE125M	5.5E-01
I 125	8.8E-01
I 129	4.3E-01
I 131	1.2E+02
XE131M	1.2E+00
CS134	6.0E+02
CS135	1.3E-03

Appendix B - External Exposure Dose Rate Factors - PLANEA

CS137	4.1E-02
BA137M	2.2E+02
CE141	1.0E+01
CE144	2.6E+00
PR144	1.4E+01
ND144	0.0E+00
EU152	4.0E+02
EU154	4.2E+02
TB160	3.8E+02
OS185	2.5E+02
OS191	7.9E+00
IR192	2.5E+02
HG203	4.7E+01
TH230	1.7E-02
RA226	8.0E-01
RN222	4.7E+02
PB210	8.1E-02
BI210	2.6E-01
TH228	2.5E-01
RA224	2.5E+00
PB212	2.9E+01
BI212	1.2E+03
TH232	7.4E-01
RA228	6.5E-06
AC228	2.9E+02
U 234	6.9E-02
U 235	2.0E+01
TH231	1.3E+00
PA231	8.6E+00
AC227	1.3E-02
TH227	2.5E+01
FR223	7.6E+00
RA223	2.6E+01
NP237	1.9E+00
PA233	6.0E+01
U 233	4.2E-03
TH229	1.8E+00
RA225	6.8E-01
AC225	1.7E+00
U 238	9.8E-03
TH234	7.5E-01
PA234M	2.9E+00
PA234	6.3E+02
PU242	8.1E-04
NP238	2.0E+02
PU238	2.9E-03
CM244	1.8E-03
PU244	6.8E-07
U 240	4.7E-02
PU240	2.7E-03

Appendix B - External Exposure Dose Rate Factors - PLANEA

CM243	2.5E+01
PU243	2.7E+00
AM243	3.6E+00
NP239	2.9E+01
PU239	2.9E-03
PU241	2.9E-12
AM241	1.1E+00

Appendix B - External Exposure Dose Rate Factors - PLANEB

OVERBURDEN: 0.0M, SOURCE: 0.15 M (DEN: WATER/1.0): MR/HR 8-Jul-86 RAP

H 3	0.0E+00
C 14	5.2E-03
NA22	6.4E+02
P 32	2.3E+00
P 33	5.1E-02
S 35	0.0E+00
CL36	1.8E-02
K 40	8.8E+01
CA45	1.8E-02
SC46	1.1E+03
CR51	2.3E+01
MN54	4.8E+02
FE55	0.0E+00
FE59	5.8E+02
CO57	6.2E+01
CO60	1.3E+03
NI59	0.0E+00
NI63	2.9E-13
ZN65	3.4E+02
SE75	2.2E+02
SR85	3.7E+02
SR89	1.6E+00
Y 89M	5.3E+00
SR90	1.3E-01
Y 90	4.6E+00
MO93	1.3E+01
NB94	9.4E+02
MO99	9.2E+01
TC99M	5.5E+01
TC99	2.4E-02
RU103	3.7E+02
RH103M	8.7E-01
PD103	4.7E+00
RU106	7.5E-06
RH106	7.9E+01
CD109	2.6E+01
AG110M	1.8E+03
AG110	2.8E+01
IN111	2.0E+02
SB124	1.2E+03
SB125	3.3E+02
TE125M	8.5E+00
I 125	1.2E+01
I 129	6.2E+00
I 131	2.6E+02
XE131M	8.4E+00
CS134	1.1E+03
CS135	9.6E-03

Appendix B - External Exposure Dose Rate Factors - PLANE B

CS137	1.6E-01
BA137M	4.1E+02
CE141	3.2E+01
CE144	9.1E+00
PR144	2.5E+01
ND144	0.0E+00
EU152	6.5E+02
EU154	6.8E+02
TB160	6.0E+02
OS185	4.7E+02
OS191	2.7E+01
IR192	5.4E+02
HG203	1.2E+02
TH230	7.7E-02
RA226	2.4E+00
RN222	7.6E+02
PB210	6.5E-01
BI210	7.8E-01
TH228	7.2E-01
RA224	6.2E+00
PB212	7.0E+01
BI212	1.8E+03
TH232	4.2E+00
RA228	1.0E-04
AC228	4.4E+02
U 234	2.6E-01
U 235	5.6E+01
TH231	5.4E+00
PA231	1.9E+01
AC227	4.0E-02
TH227	6.0E+01
FR223	2.3E+01
RA223	6.4E+01
NP237	7.8E+00
PA233	1.3E+02
U 233	3.2E-02
TH229	5.8E+00
RA225	5.4E+00
AC225	5.0E+00
U 238	5.6E-02
TH234	2.6E+00
PA234M	4.6E+00
PA234	1.0E+03
PU242	6.5E-03
NP238	2.9E+02
PU238	1.3E-02
CM244	1.5E-02
PU244	1.2E-05
U 240	2.7E-01
PU240	1.1E-02

Appendix B - External Exposure Dose Rate Factors - PLANE B

CM243	6.7E+01
PU243	8.1E+00
AM243	1.4E+01
NP239	7.6E+01
PU239	1.1E-02
PU241	5.0E-11
AM241	6.4E+00

Appendix B - External Exposure Dose Rate Factors - PLANEC

NO OVERBURDEN, 15 CM. SOURCE (DEN: H2O:CARBON/.5,.1): MR/HR 8-Jul-86

H 3	0.0E+00
C 14	8.3E-03
NA22	7.8E+02
P 32	3.1E+00
P 33	2.8E-02
S 35	0.0E+00
CL36	4.0E-01
K 40	1.1E+02
CA45	2.8E-02
SC46	1.4E+03
CR51	2.9E+01
MN54	6.0E+02
FE55	0.0E+00
FE59	7.2E+02
CO57	8.4E+01
CO60	1.6E+03
NI59	0.0E+00
NI63	3.3E-04
ZN65	4.1E+02
SE75	3.0E+02
SR85	4.8E+02
SR89	2.1E+00
Y 89M	6.6E+00
SR90	1.9E-01
Y 90	6.1E+00
MO93	2.1E+01
NB94	1.2E+03
MO99	1.1E+02
TC99M	7.6E+01
TC99	3.6E-02
RU103	4.6E+02
RH103M	1.5E+00
PD103	8.2E+00
RU106	1.3E-05
RH106	1.0E+02
CD109	3.6E+01
AG110M	2.2E+03
AG110	3.6E+01
IN111	2.7E+02
SB124	1.5E+03
SB125	4.2E+02
TE125M	1.5E+01
I 125	2.0E+01
I 129	1.0E+01
I 131	3.3E+02
XE131M	1.3E+01
CS134	1.3E+03
CS135	1.5E-02

Appendix B - External Exposure Dose Rate Factors - PLANEC

CS137	2.2E-01
BA137M	5.1E+02
CE141	4.5E+01
CE144	1.3E+01
PR144	3.1E+01
ND144	0.0E+00
EU152	8.0E+02
EU154	8.4E+02
T8160	7.5E+02
OS185	5.8E+02
OS191	3.8E+01
IR192	6.9E+02
HG203	1.5E+02
TH230	1.1E-01
RA226	3.3E+00
RN222	9.4E+02
PB210	9.8E-01
BI210	1.1E+00
TH228	9.9E-01
RA224	8.3E+00
PB212	9.3E+01
BI212	2.1E+03
TH232	6.1E+00
RA228	1.8E-04
AC228	5.5E+02
U 234	3.7E-01
U 235	7.6E+01
TH231	8.0E+00
PA231	2.6E+01
AC227	5.5E-02
TH227	7.9E+01
FR223	3.1E+01
RA223	8.6E+01
NP237	1.1E+01
PA233	1.7E+02
U 233	4.9E-02
TH229	8.1E+00
RA225	8.1E+00
AC225	6.8E+00
U 238	8.1E-02
TH234	3.6E+00
PA234M	5.8E+00
PA234	1.3E+03
PU242	9.8E-03
NP238	3.7E+02
PU238	1.8E-02
CM244	2.2E-02
PU244	2.1E-05
U 240	5.0E-01
PU240	1.6E-02

Appendix B - External Exposure Dose Rate Factors - PLANEC

CM243	9.0E+01
PU243	1.1E+01
AM243	2.1E+01
NP239	1.0E+02
PU239	1.6E-02
PU241	9.1E-11
AM241	9.5E+00

Appendix B - External Exposure Dose Rate Factors - VOLSA

OVERBURDEN: 0.0M, SOURCE: 1.0 M (DEN: CONCRETE/1.8): MR/HR 8-Jul-86 RAP

H 3	0.0E+00
C 14	6.2E-04
NA22	5.1E+02
P 32	9.8E-01
P 33	2.8E-03
S 35	0.0E+00
CL36	7.7E-02
K 40	7.0E+01
CA45	2.8E-03
SC46	8.4E+02
CR51	1.2E+01
MN54	3.3E+02
FE55	0.0E+00
FE59	4.7E+02
CO57	2.1E+01
CO60	1.0E+03
NI59	0.0E+00
NI63	1.4E-05
ZN65	2.7E+02
SE75	9.6E+01
SR85	2.0E+02
SR89	6.1E-01
Y 89M	4.4E+00
SR90	3.0E-02
Y 90	2.1E+00
MO93	1.4E+00
NB94	6.0E+02
MO99	5.4E+01
TC99M	1.9E+01
TC99	4.0E-03
RU103	2.0E+02
RH103M	5.1E-02
PD103	2.8E-01
RU106	4.0E-07
RH106	4.6E+01
CD109	7.6E+00
AG110M	1.2E+03
AG110	1.6E+01
IN111	7.8E+01
SB124	8.6E+02
SB125	1.9E+02
TE125M	5.5E-01
I 125	8.8E-01
I 129	4.3E-01
I 131	1.3E+02
XE131M	1.2E+00
CS134	6.7E+02
CS135	1.3E-03

Appendix B - External Exposure Dose Rate Factors - VOLSA

CS137	4.2E-02
BA137M	2.4E+02
CE141	1.0E+01
CE144	2.6E+00
PR144	1.7E+01
ND144	0.0E+00
EU152	4.7E+02
EU154	4.9E+02
TB160	4.4E+02
OS185	2.7E+02
OS191	8.0E+00
IR192	2.7E+02
HG203	4.9E+01
TH230	1.7E-02
RA226	8.1E-01
RN222	5.5E+02
PB210	8.1E-02
BI210	2.7E-01
TH228	2.6E-01
RA224	2.6E+00
PB212	3.0E+01
BI212	1.6E+03
TH232	7.4E-01
RA228	6.5E-06
AC228	3.4E+02
U 234	6.9E-02
U 235	2.0E+01
TH231	1.3E+00
PA231	9.3E+00
AC227	1.3E-02
TH227	2.6E+01
FR223	8.0E+00
RA223	2.7E+01
NP237	2.0E+00
PA233	6.5E+01
U 233	4.2E-03
TH229	1.9E+00
RA225	6.8E-01
AC225	1.7E+00
U 238	9.8E-03
TH234	7.6E-01
PA234M	3.4E+00
PA234	7.2E+02
PU242	8.1E-04
NP238	2.4E+02
PU238	2.9E-03
CM244	1.8E-03
PU244	6.8E-07
U 240	4.7E-02
PU240	2.7E-03

Appendix B - External Exposure Dose Rate Factors - VOLSA

CM243	2.6E+01
PU243	2.8E+00
AM243	3.6E+00
NP239	3.0E+01
PU239	2.9E-03
PU241	2.9E-12
AM241	1.1E+00

Appendix B - External Exposure Dose Rate Factors - VOLSB

OVERBURDEN: 0.0M, SOURCE: 1.0M (DEN: WATER/1.0): MR/HR 8-Jul-86 RAP

H 3	0.0E+00
C 14	5.4E-03
NA22	9.6E+02
P 32	2.8E+00
P 33	5.9E-02
S 35	0.0E+00
CL36	1.9E-02
K 40	1.5E+02
CA45	1.9E-02
SC46	1.6E+03
CR51	2.8E+01
MN54	6.8E+02
FE55	0.0E+00
FE59	8.7E+02
CO57	7.0E+01
CO60	1.9E+03
NI59	0.0E+00
NI63	2.9E-13
ZN65	5.1E+02
SE75	2.7E+02
SR85	4.8E+02
SR89	1.9E+00
Y 89M	7.8E+00
SR90	1.4E-01
Y 90	5.6E+00
MO93	1.3E+01
NB94	1.3E+03
MO99	1.3E+02
TC99M	6.3E+01
TC99	2.5E-02
RU103	4.8E+02
RH103M	8.8E-01
PD103	4.8E+00
RU106	7.5E-06
RH106	1.1E+02
CD109	2.8E+01
AG110M	2.6E+03
AG110	3.9E+01
IN111	2.3E+02
SB124	1.8E+03
SB125	4.5E+02
TE125M	8.5E+00
I 125	1.2E+01
I 129	6.2E+00
I 131	3.2E+02
XE131M	8.7E+00
CS134	1.5E+03
CS135	1.0E-02

Appendix B - External Exposure Dose Rate Factors - VOLSB

CS137	1.7E-01
BA137M	5.7E+02
CE141	3.6E+01
CE144	1.0E+01
PR144	3.7E+01
ND144	0.0E+00
EU152	9.6E+02
EU154	9.8E+02
TB160	8.6E+02
OS185	6.5E+02
OS191	3.0E+01
IR192	6.7E+02
HG203	1.4E+02
TH230	8.3E-02
RA226	2.7E+00
RN222	1.1E+03
PB210	6.8E-01
BI210	9.0E-01
TH228	8.3E-01
RA224	7.4E+00
PB212	8.3E+01
BI212	3.0E+03
TH232	4.4E+00
RA228	1.0E-04
AC228	6.5E+02
U 234	2.9E-01
U 235	6.4E+01
TH231	5.8E+00
PA231	2.4E+01
AC227	4.5E-02
TH227	7.1E+01
FR223	2.6E+01
RA223	7.6E+01
NP237	8.5E+00
PA233	1.6E+02
U 233	3.4E-02
TH229	6.5E+00
RA225	5.6E+00
AC225	5.6E+00
U 238	5.9E-02
TH234	2.8E+00
PA234M	6.5E+00
PA234	1.5E+03
PU242	6.8E-03
NP238	4.3E+02
PU238	1.4E-02
CM244	1.5E-02
PU244	1.2E-05
U 240	2.8E-01
PU240	1.2E-02

Appendix B - External Exposure Dose Rate Factors - VOLS8

CM243	7.7E+01
PU243	9.1E+00
AM243	1.5E+01
NP239	8.8E+01
PU239	1.2E-02
PU241	5.0E-11
AM241	6.8E+00

Appendix B - External Exposure Dose Rate Factors - VOLSC

NO OVERBURDEN, 1.0 M SOURCE ON SURFACE (DEN: .5,.1) MR/HR 8-Jul-86 RAP

H 3	0.0E+00
C 14	9.3E-03
NA22	1.6E+03
P 32	4.7E+00
P 33	3.2E-02
S 35	0.0E+00
CL36	5.2E-01
K 40	2.4E+02
CA45	3.2E-02
SC46	2.7E+03
CR51	4.7E+01
MN54	1.1E+03
FE55	0.0E+00
FE59	1.4E+03
CO57	1.2E+02
CO60	3.2E+03
NI59	0.0E+00
NI63	3.5E-04
ZN65	8.4E+02
SE75	4.5E+02
SR85	8.1E+02
SR89	3.1E+00
Y 89M	1.3E+01
SR90	2.4E-01
Y 90	9.4E+00
MO93	2.3E+01
NB94	2.2E+03
MO99	2.1E+02
TC99M	1.1E+02
TC99	4.2E-02
RU103	8.0E+02
RH103M	1.5E+00
PD103	8.4E+00
RU106	1.3E-05
RH106	1.8E+02
CD109	4.7E+01
AG110M	4.2E+03
AG110	6.3E+01
IN111	3.9E+02
SB124	3.0E+03
SB125	7.4E+02
TE125M	1.5E+01
I 125	2.1E+01
I 129	1.1E+01
I 131	5.4E+02
XE131M	1.5E+01
CS134	2.5E+03
CS135	1.7E-02

Appendix B - External Exposure Dose Rate Factors - VOLSC

CS137	2.9E-01
BA137M	9.3E+02
CE141	6.1E+01
CE144	1.7E+01
PR144	6.0E+01
ND144	0.0E+00
EU152	1.6E+03
EU154	1.6E+03
TB160	1.4E+03
OS185	1.1E+03
OS191	5.0E+01
IR192	1.1E+03
HG203	2.3E+02
TH230	1.4E-01
RA226	4.5E+00
RN222	1.9E+03
PB210	1.2E+00
BI210	1.5E+00
TH228	1.4E+00
RA224	1.2E+01
PB212	1.4E+02
BI212	4.9E+03
TH232	7.5E+00
RA228	1.8E-04
AC228	1.1E+03
U 234	4.8E-01
U 235	1.1E+02
TH231	9.8E+00
PA231	4.0E+01
AC227	7.5E-02
TH227	1.2E+02
FR223	4.4E+01
RA223	1.3E+02
NP237	1.4E+01
PA233	2.7E+02
U 233	5.8E-02
TH229	1.1E+01
RA225	9.6E+00
AC225	9.4E+00
U 238	1.0E-01
TH234	4.7E+00
PA234M	1.1E+01
PA234	2.5E+03
PU242	1.2E-02
NP238	7.2E+02
PU238	2.3E-02
CM244	2.6E-02
PU244	2.1E-05
U 240	6.0E-01
PU240	2.0E-02

Appendix B - External Exposure Dose Rate Factors - VOLSC

CM243	1.3E+02
PU243	1.6E+01
AM243	2.6E+01
NP239	1.5E+02
PU239	2.1E-02
PU241	9.1E-11
AM241	1.2E+01

Appendix B - External Exposure Dose Rate Factors ~ BURHFA

OVERBURDEN: 0.5M, SOURCE: 1.0M (DEN: CONCRETE/1.8) MR/HR 8-Jul-86 RAP

H 3	0.0E+00
C 14	1.2E-12
NA22	1.8E+00
P 32	4.2E-04
P 33	2.5E-06
S 35	0.0E+00
CL36	1.9E-10
K 40	3.9E-01
CA45	1.9E-10
SC46	2.3E+00
CR51	2.8E-03
MN54	4.4E-01
FE55	0.0E+00
FE59	1.6E+00
CO57	8.4E-06
CO60	3.7E+00
NI59	0.0E+00
NI63	0.0E+00
ZN65	9.3E-01
SE75	1.5E-02
SR85	1.1E-01
SR89	1.8E-04
Y 89M	1.4E-02
SR90	5.5E-07
Y 90	1.7E-03
MO93	3.5E-34
NB94	6.1E-01
MO99	4.4E-02
TC99M	7.5E-06
TC99	7.8E-10
RU103	1.1E-01
RH103M	2.7E-26
PD103	9.3E-06
RU106	0.0E+00
RH106	6.2E-02
CD109	5.5E-08
AG110M	2.6E+00
AG110	1.3E-02
IN111	1.3E-03
SB124	4.2E+00
SB125	1.1E-01
TE125M	2.5E-08
I 125	1.2E-34
I 129	6.3E-13
I 131	4.0E-02
XE131M	1.7E-07
CS134	8.0E-01
CS135	3.4E-11

Appendix B - External Exposure Dose Rate Factors - BURHFA

CS137	4.4E-06
BA137M	1.5E-01
CE141	4.3E-06
CE144	9.1E-07
PR144	1.2E-01
ND144	0.0E+00
EU152	1.6E+00
EU154	1.4E+00
TB160	1.1E+00
OS185	2.0E-01
OS191	2.2E-06
IR192	9.0E-02
HG203	1.1E-03
TH230	3.1E-14
RA226	4.4E-07
RN222	2.4E+00
PB210	1.9E-24
BI210	5.0E-05
TH228	2.9E-06
RA224	1.7E-04
PB212	7.7E-04
BI212	2.4E+01
TH232	3.9E-16
RA228	3.4E-31
AC228	1.1E+00
U 234	1.9E-08
U 235	8.7E-05
TH231	1.0E-07
PA231	1.9E-03
AC227	4.3E-09
TH227	2.4E-03
FR223	2.2E-03
RA223	3.9E-03
NP237	2.7E-08
PA233	1.6E-02
U 233	6.5E-19
TH229	7.1E-07
RA225	4.3E-09
AC225	1.4E-05
U 238	5.2E-18
TH234	4.6E-08
PA234M	9.1E-03
PA234	1.6E+00
PU242	2.7E-27
NP238	7.4E-01
PU238	8.4E-10
CM244	6.2E-27
PU244	0.0E+00
U 240	1.1E-13
PU240	8.4E-10

Appendix B – External Exposure Dose Rate Factors – BURHFA

CM243	3.5E-04
PU243	2.1E-04
AM243	8.5E-10
NP239	7.9E-04
PU239	8.4E-10
PU241	0.0E+00
AM241	2.6E-09

Appendix B - External Exposure Dose Rate Factors - BURHFB

OVERBURDEN: 0.5M, SOURCE: 1.0M (DEN: water/1.0) MR/HR 8-Jul-86 RAP

H 3	0.0E+00
C 14	4.0E-12
NA22	3.5E+00
P 32	9.5E-04
P 33	6.7E-06
S 35	0.0E+00
CL36	6.2E-10
K 40	8.2E-01
CA45	6.3E-10
SC46	4.5E+00
CR51	7.0E-03
MN54	9.8E-01
FE55	0.0E+00
FE59	3.0E+00
C057	2.8E-05
C060	7.0E+00
NI59	0.0E+00
NI63	0.0E+00
ZN65	1.8E+00
SE75	3.9E-02
SR85	2.7E-01
SR89	4.3E-04
Y 89M	2.5E-02
SR90	1.4E-06
Y 90	3.6E-03
M093	2.2E-33
NB94	1.4E+00
M099	1.0E-01
TC99M	2.5E-05
TC99	2.4E-09
RU103	2.7E-01
RH103M	1.8E-25
PD103	2.3E-05
RU106	0.0E+00
RH106	1.3E-01
CD109	2.0E-07
AG110M	5.6E+00
AG110	2.8E-02
IN111	3.8E-03
SB124	8.6E+00
SB125	2.6E-01
TE125M	8.4E-08
I 125	7.6E-34
I 129	2.2E-12
I 131	9.9E-02
XE131M	5.6E-07
CS134	1.8E+00
CS135	1.1E-10

Appendix B - External Exposure Dose Rate Factors - BURHFB

CS137	1.1E-05
BA137M	3.6E-01
CE141	1.4E-05
CE144	3.0E-06
PR144	2.2E-01
ND144	0.0E+00
EU152	3.2E+00
EU154	2.6E+00
TB160	2.2E+00
OS185	4.6E-01
OS191	7.2E-06
IR192	2.3E-01
HG203	3.1E-03
TH230	1.4E-13
RA226	1.4E-06
RN222	4.9E+00
PB210	1.0E-23
BI210	1.2E-04
TH228	8.2E-06
RA224	4.3E-04
PB212	2.2E-03
BI212	4.6E+01
TH232	2.1E-15
RA228	2.2E-30
AC228	2.1E+00
U 234	6.4E-08
U 235	2.5E-04
TH231	3.5E-07
PA231	4.8E-03
AC227	1.4E-08
TH227	6.1E-03
FR223	5.1E-03
RA223	1.0E-02
NP237	9.3E-08
PA233	4.0E-02
U 233	3.5E-18
TH229	2.4E-06
RA225	1.3E-08
AC225	4.1E-05
U 238	2.8E-17
TH234	1.5E-07
PA234M	1.7E-02
PA234	3.3E+00
PU242	1.8E-26
NP238	1.4E+00
PU238	2.8E-09
CM244	4.1E-26
PU244	0.0E+00
U 240	3.6E-13
PU240	2.8E-09

Appendix B - External Exposure Dose Rate Factors - BURHFB

CM243	1.0E-03
PU243	5.3E-04
AM243	3.4E-09
NP239	2.1E-03
PU239	2.8E-09
PU241	0.0E+00
AM241	8.7E-09

Appendix B - External Exposure Dose Rate Factors - BURHFC

1.0 M Source buried at 0.5 M (DEN: 0.5/0.1) MR/HR 8-Jul-86

H 3	0.0E+00
C 14	6.7E-12
NA22	5.8E+00
P 32	1.6E-03
P 33	1.0E-09
S 35	0.0E+00
CL36	1.9E-05
K 40	1.3E+00
CA45	1.0E-09
SC46	7.4E+00
CR51	1.2E-02
MN54	1.6E+00
FE55	0.0E+00
FE59	4.9E+00
CO57	4.7E-05
CO60	1.2E+01
NI59	0.0E+00
NI63	1.2E-21
ZN65	2.9E+00
SE75	6.6E-02
SR85	4.6E-01
SR89	7.1E-04
Y 89M	4.2E-02
SR90	2.4E-06
Y 90	5.9E-03
MO93	3.9E-33
NB94	2.3E+00
MO99	1.6E-01
TC99M	4.2E-05
TC99	4.1E-09
RU103	4.6E-01
RH103M	3.1E-25
PD103	3.9E-05
RU106	0.0E+00
RH106	2.1E-01
CD109	3.3E-07
AG110M	9.1E+00
AG110	4.6E-02
IN111	6.4E-03
SB124	1.4E+01
SB125	4.3E-01
TE125M	1.4E-07
I 125	1.3E-33
I 129	3.6E-12
I 131	1.6E-01
XE131M	9.4E-07
CS134	2.9E+00
CS135	1.9E-10

Appendix B - External Exposure Dose Rate Factors - BURHFC

CS137	1.8E-05
BA137M	5.8E-01
CE141	2.4E-05
CE144	5.1E-06
PR144	3.6E-01
ND144	0.0E+00
EU152	5.2E+00
EU154	4.3E+00
TB160	3.7E+00
OS185	7.5E-01
OS191	1.2E-05
IR192	3.8E-01
HG203	5.2E-03
TH230	2.4E-13
RA226	2.3E-06
RN222	2.1E-03
PB210	1.8E-23
BI210	2.0E-04
TH228	1.4E-05
RA224	1.2E+01
PB212	3.6E-03
BI212	6.5E-03
TH232	3.6E-15
RA228	3.8E-30
AC228	3.4E+00
U 234	1.1E-07
U 235	4.2E-04
TH231	5.8E-07
PA231	8.0E-03
AC227	2.4E-08
TH227	1.0E-02
FR223	8.4E-03
RA223	1.7E-02
NP237	1.6E-07
PA233	6.7E-02
U 233	5.9E-18
TH229	4.0E-06
RA225	2.1E-08
AC225	6.9E-05
U 238	4.7E-17
TH234	2.6E-07
PA234M	2.8E-02
PA234	5.4E+00
PU242	3.1E-26
NP238	2.3E+00
PU238	4.7E-09
CM244	7.0E-26
PU244	0.0E+00
U 240	3.0E-07
PU240	4.7E-09

Appendix B - External Exposure Dose Rate Factors - BURHFC

CM243	1.7E-03
PU243	8.9E-04
AM243	5.7E-09
NP239	3.5E-03
PU239	4.7E-09
PU241	0.0E+00
AM241	1.5E-08

Appendix B - External Exposure Dose Rate Factors - BUR1A

OVERBURDEN: 1.0m, SOURCE: 1.0M (DEN: CONCRETE/1.8): MR/HR 18-Jul-86 RAP

H 3	0.0E+00
C 14	1.3E-19
NA22	9.6E-03
P 32	9.9E-07
P 33	1.4E-16
S 35	0.0E+00
CL36	2.5E-09
K 40	3.2E-03
CA45	1.5E-16
SC46	1.0E-02
CR51	1.1E-06
MN54	9.1E-04
FE55	0.0E+00
FE59	7.7E-03
CO57	6.6E-12
CO60	1.9E-02
NI59	0.0E+00
NI63	4.5E-34
ZN65	4.8E-03
SE75	1.3E-05
SR85	9.8E-05
SR89	3.1E-07
Y 89M	6.2E-05
SR90	2.0E-10
Y 90	8.3E-06
MO93	0.0E+00
NB94	1.1E-03
MO99	7.3E-05
TC99M	6.0E-12
TC99	1.6E-14
RU103	9.9E-05
RH103M	0.0E+00
PD103	3.8E-09
RU106	0.0E+00
RH106	5.2E-04
CD109	8.6E-16
AG110M	1.5E-02
AG110	4.1E-05
IN111	5.4E-08
SB124	5.1E-02
SB125	1.0E-04
TE125M	2.0E-14
I 125	0.0E+00
I 129	5.0E-20
I 131	2.4E-05
XE131M	1.3E-13
CS134	2.3E-03
CS135	2.3E-17

Appendix B - External Exposure Dose Rate Factors - BUR1A

CS137	4.8E-09
BA137M	1.4E-04
CE141	1.2E-10
CE144	7.7E-13
PR144	2.1E-03
ND144	0.0E+00
EU152	1.0E-02
EU154	6.9E-03
TB160	5.2E-03
OS185	2.4E-04
OS191	1.7E-12
IR192	6.3E-05
HG203	4.4E-08
TH230	1.6E-25
RA226	6.0E-12
RN222	2.5E-02
PB210	0.0E+00
BI210	4.8E-08
TH228	1.2E-10
RA224	1.1E-07
PB212	6.8E-08
BI212	6.9E-01
TH232	6.7E-31
RA228	0.0E+00
AC228	6.1E-03
U 234	1.5E-14
U 235	3.3E-09
TH231	7.3E-14
PA231	7.7E-07
AC227	3.3E-15
TH227	8.3E-07
FR223	4.1E-06
RA223	2.2E-06
NP237	1.9E-15
PA233	7.3E-06
U 233	1.1E-33
TH229	5.6E-13
RA225	1.5E-13
AC225	5.8E-10
U 238	9.0E-33
TH234	1.9E-14
PA234M	3.9E-05
PA234	8.7E-03
PU242	0.0E+00
NP238	3.4E-03
PU238	6.6E-16
CM244	0.0E+00
PU244	0.0E+00
U 240	1.4E-11
PU240	6.6E-16

Appendix B - External Exposure Dose Rate Factors - BUR1A

CM243	1.4E-08
PU243	8.6E-08
AM243	5.0E-19
NP239	1.9E-07
PU239	6.6E-16
PU241	0.0E+00
AM241	2.0E-15

Appendix B - External Exposure Dose Rate Ractors - BUR1B

OVERBURDEN: 1.0m, SOURCE: 1.0M (DEN: water/1.0): MR/HR 8-Jul-86 RAP

H 3	0.0E+00
C 14	3.3E-19
NA22	1.7E-02
P 32	1.8E-06
P 33	4.4E-09
S 35	0.0E+00
CL36	3.6E-16
K 40	6.4E-03
CA45	3.7E-16
SC46	1.9E-02
CR51	2.2E-06
MN54	1.8E-03
FE55	0.0E+00
FE59	1.4E-02
CO57	1.7E-11
CO60	3.4E-02
NI59	0.0E+00
NI63	0.0E+00
ZN65	8.7E-03
SE75	2.5E-05
SR85	1.9E-04
SR89	5.7E-07
Y 89M	1.1E-04
SR90	3.8E-10
Y 90	1.5E-05
MO93	0.0E+00
NB94	2.1E-03
MO99	1.4E-04
TC99M	1.5E-11
TC99	3.5E-14
RU103	1.9E-04
RH103M	0.0E+00
PD103	7.3E-09
RU106	0.0E+00
RH106	9.3E-04
CD109	2.4E-15
AG110M	3.0E-02
AG110	7.8E-05
IN111	1.2E-07
SB124	9.4E-02
SB125	1.9E-04
TE125M	5.0E-14
I 125	0.0E+00
I 129	1.3E-19
I 131	4.7E-05
XE131M	3.3E-13
CS134	4.6E-03
CS135	5.9E-17

Appendix B - External Exposure Dose Rate Ractors - BUR1B

CS137	9.0E-09
BA137M	2.8E-04
CE141	2.3E-10
CE144	1.9E-12
PR144	3.8E-03
ND144	0.0E+00
EU152	1.9E-02
EU154	1.2E-02
TB160	9.2E-03
OS185	4.8E-04
OS191	4.3E-12
IR192	1.2E-04
HG203	9.7E-08
TH230	5.5E-25
RA226	1.3E-11
RN222	4.6E-02
PB210	0.0E+00
BI210	9.3E-08
TH228	2.5E-10
RA224	2.3E-07
PB212	1.4E-07
BI212	1.2E+00
TH232	2.7E-30
RA228	0.0E+00
AC228	1.1E-02
U 234	3.8E-14
U 235	7.2E-09
TH231	1.9E-13
PA231	1.5E-06
AC227	8.4E-15
TH227	1.6E-06
FR223	8.1E-06
RA223	4.3E-06
NP237	4.9E-15
PA233	1.4E-05
U 233	4.5E-33
TH229	1.4E-12
RA225	3.3E-13
AC225	1.3E-09
U 238	3.6E-32
TH234	4.8E-14
PA234M	6.7E-05
PA234	1.6E-02
PU242	0.0E+00
NP236	5.8E-03
PU236	1.7E-15
CM244	0.0E+00
PU244	0.0E+00
U 240	2.0E-20
PU240	1.7E-15

Appendix B - External Exposure Dose Rate Ractors - BUR1B

CM243	3.0E-08
PU243	1.6E-07
AM243	1.5E-18
NP239	3.7E-07
PU239	1.7E-15
PU241	0.0E+00
AM241	5.0E-15

Appendix B - External Exposure Dose Rate Factors - BUR1C

ONSITE/MAXI 1.0 M THICK BURIED AT 1.0 M (DEN: WATER/CARBON 0.5/0.1) :MR/HR

	100
H 3	0.0E+00
C 14	5.5E-19
NA22	2.8E-02
P 32	3.0E-06
P 33	5.8E-16
S 35	0.0E+00
CL36	8.2E-09
K 40	1.0E-02
CA45	6.2E-16
SC46	3.1E-02
CR51	3.6E-06
MN54	3.0E-03
FE55	0.0E+00
FE59	2.2E-02
CO57	2.8E-11
CO60	5.7E-02
NI59	0.0E+00
NI63	2.7E-33
ZN65	1.4E-02
SE75	4.2E-05
SR85	3.2E-04
SR89	9.5E-07
Y 89M	1.8E-04
SR90	6.4E-10
Y 90	2.5E-05
MO93	0.0E+00
NB94	3.5E-03
MO99	2.3E-04
TC99M	2.5E-11
TC99	5.9E-14
RU103	3.2E-04
RH103M	0.0E+00
PD103	1.2E-08
RU106	0.0E+00
RH106	1.5E-03
CD109	4.0E-15
AG110M	4.8E-02
AG110	1.3E-04
IN111	2.0E-07
SB124	1.5E-01
SB125	3.2E-04
TE125M	8.4E-14
I 125	0.0E+00
I 129	2.2E-19
I 131	7.7E-05
XE131M	5.6E-13
CS134	7.5E-03

Appendix B - External Exposure Dose Rate Factors - BUR1C

CS135	1.0E-16
CS137	1.5E-08
BA137M	4.6E-04
CE141	3.9E-10
CE144	3.2E-12
PR144	6.0E-03
ND144	0.0E+00
EU152	3.1E-02
EU154	2.1E-02
TB160	1.5E-02
OS185	7.9E-04
OS191	7.3E-12
IR192	2.0E-04
HG203	1.6E-07
TH230	9.3E-25
RA226	2.2E-11
RN222	6.3E-07
PB210	0.0E+00
BI210	1.5E-07
TH228	4.2E-10
RA224	9.3E-02
PB212	2.3E-07
BI212	1.6E-05
TH232	4.6E-30
RA228	0.0E+00
AC228	1.8E-02
U 234	6.5E-14
U 235	1.2E-08
TH231	3.1E-13
PA231	2.5E-06
AC227	1.4E-14
TH227	2.7E-06
FR223	1.3E-05
RA223	7.1E-06
NP237	8.3E-15
PA233	2.3E-05
U 233	7.7E-33
TH229	2.4E-12
RA225	5.5E-13
AC225	2.1E-09
U 238	6.2E-32
TH234	8.1E-14
PA234M	1.1E-04
PA234	2.6E-02
PU242	0.0E+00
NP238	9.6E-03
PU238	2.8E-15
CM244	0.0E+00
PU244	0.0E+00
U 240	4.5E-11

Appendix B - External Exposure Dose Rate Factors - BUR1C

PU240	2.8E-15
CM243	5.1E-08
PU243	2.8E-07
AM243	2.6E-18
NP239	6.2E-07
PU239	2.8E-15
PU241	0.0E+00
AM241	8.5E-15

Appendix B - External Exposure Dose Rate Factors - STOREDA

ROOM: 1.0 M THICK FINITE SLAB (DEN: soil 1.8): MR/HR 8-Jul-86 RAP

H 3	7.6E-15
C 14	1.0E-04
NA22	1.7E+02
P 32	3.4E-01
P 33	6.3E-04
S 35	0.0E+00
CL36	2.5E-02
K 40	2.2E+01
CA45	6.4E-04
SC46	2.8E+02
CR51	4.1E+00
MN54	1.1E+02
FE55	0.0E+00
FE59	1.5E+02
CO57	8.2E+00
CO60	3.3E+02
NI59	0.0E+00
NI63	1.2E-06
ZN65	8.7E+01
SE75	3.6E+01
SR85	7.0E+01
SR89	2.1E-01
Y 89M	1.4E+00
SR90	9.5E-03
Y 90	7.2E-01
MO93	1.3E-01
NB94	2.0E+02
MO99	1.8E+01
TC99M	7.4E+00
TC99	1.0E-03
RU103	6.9E+01
RH103M	4.0E-03
PD103	3.2E-02
RU106	3.0E-08
RH106	1.6E+01
CD109	2.2E+00
AG110M	4.0E+02
AG110	5.4E+00
IN111	2.9E+01
SB124	2.8E+02
SB125	6.4E+01
TE125M	6.3E-02
I 125	7.4E-02
I 129	3.8E-02
I 131	4.7E+01
XE131M	2.3E-01
CS134	2.3E+02
CS135	2.6E-04

Appendix B - External Exposure Dose Rate Factors - STOREDA

CS137	1.4E-02
BA137M	8.2E+01
CE141	4.0E+00
CE144	9.5E-01
PR144	5.5E+00
ND144	0.0E+00
EU152	1.6E+02
EU154	1.6E+02
TB160	1.5E+02
OS185	9.3E+01
OS191	2.8E+00
IR192	9.8E+01
HG203	1.8E+01
TH230	4.7E-03
RA226	3.1E-01
RN222	1.8E+02
P8210	8.6E-03
BI210	9.3E-02
TH228	9.0E-02
RA224	9.4E-01
PB212	1.1E+01
BI212	4.8E+02
TH232	2.0E-01
RA228	4.0E-07
AC228	1.1E+02
U 234	2.4E-02
U 235	7.6E+00
TH231	3.9E-01
PA231	3.3E+00
AC227	5.0E-03
TH227	9.5E+00
FR223	2.7E+00
RA223	9.7E+00
NP237	5.6E-01
PA233	2.3E+01
U 233	6.4E-04
TH229	7.0E-01
RA225	7.3E-02
AC225	5.7E-01
U 238	2.6E-03
TH234	2.3E-01
PA234M	1.1E+00
PA234	2.4E+02
PU242	8.6E-05
NP238	7.9E+01
PU238	9.1E-04
CM244	1.9E-04
PU244	7.9E-09
U 240	7.6E-03
PU240	8.9E-04

Appendix B - External Exposure Dose Rate Factors - STOREDA

CM243	9.8E+00
PU243	8.8E-01
AM243	1.0E+00
NP239	1.1E+01
PU239	1.0E-03
PU241	2.9E-14
AM241	3.0E-01

Appendix B - External Exposure Dose Rate Factors - STOREDB

ROOM: 1.0 M THICK FINITE SLAB (DEN: H2O 1.0): MR/HR 8-Jul-86 RAP

H 3	7.3E-12
C 14	3.4E-03
NA22	3.0E+02
P 32	1.1E+00
P 33	1.1E-02
S 35	0.0E+00
CL36	1.5E-01
K 40	4.5E+01
CA45	1.1E-02
SC46	5.3E+02
CR51	9.8E+00
MN54	2.2E+02
FE55	0.0E+00
FE59	2.8E+02
CO57	2.7E+01
CO60	6.1E+02
NI59	0.0E+00
NI63	1.4E-04
ZN65	1.6E+02
SE75	9.7E+01
SR85	1.7E+02
SR89	7.8E-01
Y 89M	2.5E+00
SR90	7.3E-02
Y 90	2.2E+00
MO93	7.9E+00
NB94	4.3E+02
MO99	4.2E+01
TC99M	2.4E+01
TC99	1.5E-02
RU103	1.6E+02
RH103M	6.2E-01
PD103	3.4E+00
RU106	5.4E-06
RH106	3.6E+01
CD109	1.7E+01
AG110M	8.3E+02
AG110	1.3E+01
IN111	8.8E+01
SB124	5.7E+02
SB125	1.5E+02
TE125M	6.0E+00
I 125	8.2E+00
I 129	4.3E+00
I 131	1.1E+02
XE131M	4.8E+00
CS134	4.9E+02
CS135	6.2E-03

Appendix B - External Exposure Dose Rate Factors - STOREDB

CS137	8.5E-02
BA137M	1.9E+02
CE141	1.4E+01
CE144	4.4E+00
PR144	1.2E+01
ND144	0.0E+00
EU152	3.1E+02
EU154	3.2E+02
TB160	2.8E+02
OS185	2.2E+02
OS191	1.4E+01
IR192	2.3E+02
HG203	5.1E+01
TH230	5.1E-02
RA226	1.1E+00
RN222	3.7E+02
PB210	3.7E-01
BI210	4.0E-01
TH228	3.8E-01
RA224	2.8E+00
PB212	3.0E+01
BI212	8.9E+02
TH232	2.8E+00
RA228	6.8E-05
AC228	2.1E+02
U 234	1.4E-01
U 235	2.5E+01
TH231	3.5E+00
PA231	8.8E+00
AC227	1.9E-02
TH227	2.7E+01
FR223	1.2E+01
RA223	3.1E+01
NP237	5.2E+00
PA233	5.9E+01
U 233	2.0E-02
TH229	2.6E+00
RA225	3.1E+00
AC225	2.8E+00
U 238	3.7E-02
TH234	1.6E+00
PA234M	2.2E+00
PA234	4.9E+02
PU242	3.7E-03
NP238	1.4E+02
PU238	6.4E-03
CM244	8.3E-03
PU244	6.6E-06
U 240	1.9E-01
PU240	5.4E-03

Appendix B - External Exposure Dose Rate Factors - STOREDB

CM243	2.9E+01
PU243	4.9E+00
AM243	9.3E+00
NP239	3.3E+01
PU239	5.9E-03
PU241	2.8E-11
AM241	4.3E+00

Appendix B - External Exposure Dose Rate Factors - STOREDC

ROOM: 1.0 M THICK FINITE SLAB (DEN: .5,.1): MR/HR 8-Jul-86 RAP

H 3	5.6E-14
C 14	9.1E-04
NA22	4.8E+02
P 32	1.5E+00
P 33	4.3E-03
S 35	0.0E+00
CL36	1.3E-01
K 40	6.7E+01
CA45	4.3E-03
SC46	8.3E+02
CR51	1.6E+01
MN54	3.6E+02
FE55	0.0E+00
FE59	4.4E+02
CO57	4.4E+01
CO60	9.5E+02
NI59	0.0E+00
NI63	2.3E-05
ZN65	2.5E+02
SE75	1.6E+02
SR85	2.7E+02
SR89	9.3E-01
Y 89M	3.9E+00
SR90	5.2E-02
Y 90	3.0E+00
MO93	1.6E+00
NB94	6.9E+02
MO99	6.6E+01
TC99M	3.9E+01
TC99	6.3E-03
RU103	2.6E+02
RH103M	1.0E-01
PD103	5.8E-01
RU106	8.5E-07
RH106	5.7E+01
CD109	9.3E+00
AG110M	1.3E+03
AG110	2.0E+01
IN111	1.4E+02
SB124	8.9E+02
SB125	2.4E+02
TE125M	1.1E+00
I 125	1.4E+00
I 129	7.2E-01
I 131	1.8E+02
XE131M	1.7E+00
CS134	7.7E+02
CS135	2.0E-03

Appendix B - External Exposure Dose Rate Factors - STOREDC

CS137	7.0E-02
BA137M	3.0E+02
CE141	2.1E+01
CE144	5.2E+00
PR144	1.8E+01
ND144	0.0E+00
EU152	4.8E+02
EU154	5.0E+02
TB160	4.4E+02
OS185	3.3E+02
OS191	1.5E+01
IR192	3.8E+02
HG203	8.1E+01
TH230	2.8E-02
RA226	1.6E+00
RN222	5.6E+02
PB210	8.2E-02
BI210	4.3E-01
TH228	4.1E-01
RA224	4.2E+00
PB212	4.9E+01
BI212	1.3E+03
TH232	1.6E+00
RA228	8.6E-06
AC228	3.3E+02
U 234	1.5E-01
U 235	3.9E+01
TH231	1.9E+00
PA231	1.3E+01
AC227	2.5E-02
TH227	4.1E+01
FR223	1.3E+01
RA223	4.1E+01
NP237	2.7E+00
PA233	9.0E+01
U 233	5.8E-03
TH229	3.8E+00
RA225	6.8E-01
AC225	2.5E+00
U 238	2.1E-02
TH234	9.8E-01
PA234M	3.3E+00
PA234	7.7E+02
PU242	8.2E-04
NP238	2.2E+02
PU238	5.2E-03
CM244	1.8E-03
PU244	8.4E-08
U 240	5.7E-02
PU240	5.0E-03

Appendix B - External Exposure Dose Rate Factors - STOREDC

CM243	4.7E+01
PU243	3.6E+00
AM243	5.0E+00
NP239	5.4E+01
PU239	5.9E-03
PU241	2.1E-13
AM241	2.4E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

DACRIN (DIFDOS) DOSE INCREMENT FILE ONSITE/MAXI 26-Aug-86 RAP
121

	1	6	8	16	23			
H 3			0	0	0			
C 14			4	0	0			
C 14 1 1			2.39E-06	1.05E-05	2.39E-06	2.39E-06	2.06E-06	
C 14 1 2			1.01E-07	1.97E-06	1.01E-07	1.01E-07	1.23E-10	
C 14 1 3			.00	3.51E-09	.00	.00	.00	
C 14 1 4			.00	6.37E-12	.00	.00	.00	
NA22			2	0	0			
NA22 1 1			7.25E-05	0.00E+00	5.01E-05	0.00E+00	1.15E-05	
NA22 1 2			3.33E-06	0.00E+00	9.90E-08	0.00E+00	6.88E-10	
P 32			2	0	0			
P 32 1 1			3.79E-05	9.79E-04	4.18E-05	0.00E+00	2.58E-05	
P 32 1 2			2.18E-06	5.89E-05	7.98E-08	0.00E+00	1.53E-09	
P 33			3	0	0			
P 33 1 1			7.41E-06	7.88E-05	5.23E-06	0.00E+00	3.20E-06	
P 33 1 2			7.24E-07	8.31E-06	1.01E-08	0.00E+00	1.90E-10	
P 33 1 3			8.19E-12	2.04E-10	0.00E+00	0.00E+00	0.00E+00	
S 35			0	6	0			
S 35 2 1			8.32E-06	1.84E-05	1.20E-04	0.00E+00	0.00E+00	
S 35 2 2			2.03E-06	7.99E-06	1.68E-05	0.00E+00	0.00E+00	
S 35 2 3			8.52E-09	3.03E-07	5.81E-09	0.00E+00	0.00E+00	
S 35 2 4			2.91E-11	1.09E-08	1.46E-11	0.00E+00	0.00E+00	
S 35 2 5			0.00E+00	3.91E-10	0.00E+00	0.00E+00	0.00E+00	
S 35 2 6			0.00E+00	1.46E-11	0.00E+00	0.00E+00	0.00E+00	
CL36			3	0	0			
CL36 1 1			3.07E-05	0.00E+00	1.63E-05	0.00E+00	1.98E-06	
CL36 1 2			4.01E-06	0.00E+00	3.22E-08	0.00E+00	1.19E-10	
CL36 1 3			6.51E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
K 40			5	0	0			
K 40 1 1			5.18E-05	0.00E+00	1.25E-05	0.00E+00	1.39E-06	
K 40 1 2			1.50E-05	0.00E+00	2.48E-08	0.00E+00	8.30E-11	
K 40 1 3			1.91E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
K 40 1 4			2.43E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
K 40 1 5			2.91E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
CA45			0	3	0			
CA45 2 1			5.36E-06	2.41E-04	0.00E+00	0.00E+00	1.46E-05	
CA45 2 2			7.18E-07	3.23E-05	0.00E+00	0.00E+00	1.09E-07	
CA45 2 3			8.59E-11	3.84E-09	0.00E+00	0.00E+00	0.00E+00	
SC46			0	0	6			
SC46 3 1			1.04E-06	1.83E-06	2.54E-03	0.00E+00	1.95E-04	
SC46 3 2			2.48E-07	4.52E-07	9.24E-04	0.00E+00	1.87E-06	
SC46 3 3			9.21E-09	1.68E-08	2.71E-05	0.00E+00	4.43E-08	
SC46 3 4			4.10E-10	7.47E-10	7.97E-07	0.00E+00	1.30E-09	
SC46 3 5			1.74E-11	3.14E-11	2.35E-08	0.00E+00	4.37E-11	
SC46 3 6			6.82E-13	1.36E-12	6.98E-10	0.00E+00	0.00E+00	
CR51			0	0	3			
CR 51 3 1			2.97E-08	.00	2.56E-05	3.14E-08	4.59E-06	
CR 51 3 2			3.95E-09	.00	2.90E-06	4.18E-09	1.37E-08	

Appendix B - Inhalation Dose Rate Factors - FILE23

CR	51	3	3	6.33E-13	.00	1.94E-10	6.70E-13	3.41E-13
MN54				0	5	0		
MN	54	2	1	8.51E-06	.00	6.28E-04	.00	5.52E-05
MN	54	2	2	1.20E-06	.00	1.25E-04	.00	1.73E-06
MN	54	2	3	4.63E-09	.00	3.39E-07	.00	4.42E-09
MN	54	2	4	1.89E-11	.00	9.24E-10	.00	1.18E-11
MN	54	2	5	1.14E-13	.00	.00	.00	.00
FE55				0	50	0		
FE	55	2	1	7.57E-07	7.96E-07	2.05E-05	.00	2.80E-06
FE	55	2	2	1.23E-06	1.41E-06	6.49E-06	.00	1.06E-07
FE	55	2	3	7.30E-07	9.90E-07	1.60E-06	.00	5.07E-10
FE	55	2	4	4.23E-07	6.76E-07	1.16E-06	.00	2.53E-12
FE	55	2	5	2.45E-07	4.62E-07	8.52E-07	.00	2.84E-14
FE	55	2	6	1.42E-07	3.16E-07	6.27E-07	.00	.00
FE	55	2	7	8.19E-08	2.15E-07	4.59E-07	.00	.00
FE	55	2	8	4.76E-08	1.48E-07	3.38E-07	.00	.00
FE	55	2	9	2.75E-08	1.01E-07	2.48E-07	.00	.00
FE	55	210		1.59E-08	6.87E-08	1.81E-07	.00	.00
FE	55	211		9.23E-09	4.71E-08	1.34E-07	.00	.00
FE	55	212		5.33E-09	3.21E-08	9.77E-08	.00	.00
FE	55	213		3.09E-09	2.20E-08	7.20E-08	.00	.00
FE	55	214		1.79E-09	1.50E-08	5.27E-08	.00	.00
FE	55	215		1.04E-09	1.03E-08	3.88E-08	.00	.00
FE	55	216		6.00E-10	7.02E-09	2.84E-08	.00	.00
FE	55	217		3.46E-10	4.78E-09	2.08E-08	.00	.00
FE	55	218		2.01E-10	3.28E-09	1.53E-08	.00	.00
FE	55	219		1.16E-10	2.23E-09	1.12E-08	.00	.00
FE	55	220		6.74E-11	1.53E-09	8.26E-09	.00	.00
FE	55	221		3.91E-11	1.04E-09	6.06E-09	.00	.00
FE	55	222		2.25E-11	7.12E-10	4.43E-09	.00	.00
FE	55	223		1.30E-11	4.88E-10	3.27E-09	.00	.00
FE	55	224		7.56E-12	3.32E-10	2.39E-09	.00	.00
FE	55	225		4.38E-12	2.28E-10	1.76E-09	.00	.00
FE	55	226		2.53E-12	1.55E-10	1.29E-09	.00	.00
FE	55	227		1.48E-12	1.06E-10	9.48E-10	.00	.00
FE	55	228		8.81E-13	7.26E-11	6.95E-10	.00	.00
FE	55	229		4.55E-13	4.94E-11	5.09E-10	.00	.00
FE	55	230		3.13E-13	3.40E-11	3.75E-10	.00	.00
FE	55	231		1.42E-13	2.31E-11	2.74E-10	.00	.00
FE	55	232		8.53E-14	1.59E-11	2.02E-10	.00	.00
FE	55	233		5.68E-14	1.07E-11	1.49E-10	.00	.00
FE	55	234		2.84E-14	7.33E-12	1.06E-10	.00	.00
FE	55	235		2.84E-14	5.12E-12	8.14E-11	.00	.00
FE	55	236		.00	3.47E-12	5.91E-11	.00	.00
FE	55	237		.00	2.27E-12	4.23E-11	.00	.00
FE	55	238		.00	1.65E-12	3.18E-11	.00	.00
FE	55	239		.00	1.08E-12	2.27E-11	.00	.00
FE	55	240		.00	7.96E-13	1.73E-11	.00	.00
FE	55	241		.00	5.12E-13	1.18E-11	.00	.00
FE	55	242		.00	3.41E-13	9.55E-12	.00	.00

Appendix B - Inhalation Dose Rate Factors - FILE23

FE	55	243	.00	1.71E-13	6.37E-12	.00	.00
FE	55	244	.00	2.27E-13	5.46E-12	.00	.00
FE	55	245	.00	1.14E-13	3.64E-12	.00	.00
FE	55	246	.00	5.68E-14	2.27E-12	.00	.00
FE	55	247	.00	5.68E-14	1.82E-12	.00	.00
FE	55	248	.00	.00	1.36E-12	.00	.00
FE	55	249	.00	.00	1.36E-12	.00	.00
FE	55	250	.00	.00	4.55E-13	.00	.00
FE59		0	4	0			
FE	59	2 1	2.82E-05	.00	7.22E-04	.00	1.14E-04
FE	59	2 2	6.50E-06	.00	7.54E-05	.00	1.32E-06
FE	59	2 3	1.99E-08	.00	2.10E-08	.00	2.55E-11
FE	59	2 4	5.28E-11	.00	6.55E-11	.00	.00
C057		0	0	14			
CO	57	3 1	8.97E-07	.00	3.32E-04	.00	1.36E-05
CO	57	3 2	7.77E-08	.00	2.83E-04	.00	4.09E-07
CO	57	3 3	1.28E-08	.00	6.67E-05	.00	9.04E-08
CO	57	3 4	3.77E-09	.00	1.57E-05	.00	2.13E-08
CO	57	3 5	1.12E-09	.00	3.71E-06	.00	5.03E-09
CO	57	3 6	3.33E-10	.00	8.78E-07	.00	1.19E-09
CO	57	3 7	9.93E-11	.00	2.07E-07	.00	2.80E-10
CO	57	3 8	2.99E-11	.00	4.89E-08	.00	6.63E-11
CO	57	3 9	8.98E-12	.00	1.15E-08	.00	1.56E-11
CO	57	310	2.71E-12	.00	2.71E-09	.00	3.75E-12
CO	57	311	8.10E-13	.00	6.40E-10	.00	7.96E-13
CO	57	312	2.56E-13	.00	1.53E-10	.00	2.27E-13
CO	57	313	7.11E-14	.00	3.64E-11	.00	1.14E-13
CO	57	314	2.84E-14	.00	7.28E-12	.00	.00
C060		0	0	40			
CO	60	3 1	1.56E-05	.00	5.64E-03	.00	1.51E-04
CO	60	3 2	2.06E-06	.00	7.49E-03	.00	8.51E-06
CO	60	3 3	9.57E-07	.00	3.95E-03	.00	4.34E-06
CO	60	3 4	6.30E-07	.00	2.08E-03	.00	2.29E-06
CO	60	3 5	4.17E-07	.00	1.10E-03	.00	1.21E-06
CO	60	3 6	2.79E-07	.00	5.81E-04	.00	6.38E-07
CO	60	3 7	1.86E-07	.00	3.05E-04	.00	3.35E-07
CO	60	3 8	1.25E-07	.00	1.62E-04	.00	1.77E-07
CO	60	3 9	8.41E-08	.00	8.51E-05	.00	9.35E-08
CO	60	310	5.65E-08	.00	4.48E-05	.00	4.92E-08
CO	60	311	3.83E-08	.00	2.37E-05	.00	2.60E-08
CO	60	312	2.58E-08	.00	1.25E-05	.00	1.37E-08
CO	60	313	1.75E-08	.00	6.59E-06	.00	7.24E-09
CO	60	314	1.18E-08	.00	3.47E-06	.00	3.81E-09
CO	60	315	8.06E-09	.00	1.83E-06	.00	2.02E-09
CO	60	316	5.46E-09	.00	9.67E-07	.00	1.06E-09
CO	60	317	3.70E-09	.00	5.09E-07	.00	5.57E-10
CO	60	318	2.52E-09	.00	2.69E-07	.00	2.96E-10
CO	60	319	1.70E-09	.00	1.41E-07	.00	1.55E-10
CO	60	320	1.16E-09	.00	7.50E-08	.00	8.19E-11
CO	60	321	7.88E-10	.00	3.96E-08	.00	4.37E-11

Appendix B - Inhalation Dose Rate Factors - FILE23

CO	60	322	5.33E-10	.00	2.07E-08	.00	2.36E-11
CO	60	323	3.63E-10	.00	1.09E-08	.00	1.27E-11
CO	60	324	2.46E-10	.00	5.59E-09	.00	5.46E-12
CO	60	325	1.68E-10	.00	3.26E-09	.00	3.64E-12
CO	60	326	1.14E-10	.00	1.63E-09	.00	1.82E-12
CO	60	327	7.73E-11	.00	6.98E-10	.00	.00
CO	60	328	5.30E-11	.00	2.33E-10	.00	1.82E-12
CO	60	329	3.55E-11	.00	4.66E-10	.00	.00
CO	60	330	2.41E-11	.00	.00	.00	.00
CO	60	331	1.64E-11	.00	.00	.00	.00
CO	60	332	1.14E-11	.00	.00	.00	.00
CO	60	333	7.50E-12	.00	.00	.00	.00
CO	60	334	5.23E-12	.00	.00	.00	.00
CO	60	335	3.64E-12	.00	.00	.00	.00
CO	60	336	2.50E-12	.00	.00	.00	.00
CO	60	337	1.59E-12	.00	.00	.00	.00
CO	60	338	1.14E-12	.00	.00	.00	.00
CO	60	339	6.82E-13	.00	.00	.00	.00
CO	60	340	4.55E-13	.00	.00	.00	.00
NI59			0	50	0		
NI59	2	1	1.55E-06	7.92E-06	2.37E-05	0.00E+00	2.60E-06
NI59	2	2	2.72E-06	1.44E-05	5.65E-06	0.00E+00	1.06E-07
NI59	2	3	1.90E-06	1.07E-05	3.57E-08	0.00E+00	6.41E-10
NI59	2	4	1.30E-06	7.78E-06	2.24E-10	0.00E+00	3.87E-12
NI59	2	5	8.89E-07	5.67E-06	1.82E-12	0.00E+00	0.00E+00
NI59	2	6	6.09E-07	4.14E-06	0.00E+00	0.00E+00	0.00E+00
NI59	2	7	4.15E-07	3.01E-06	0.00E+00	0.00E+00	0.00E+00
NI59	2	8	2.85E-07	2.20E-06	0.00E+00	0.00E+00	0.00E+00
NI59	2	9	1.95E-07	1.60E-06	0.00E+00	0.00E+00	0.00E+00
NI59	2	10	1.33E-07	1.16E-06	0.00E+00	0.00E+00	0.00E+00
NI59	2	11	9.13E-08	8.51E-07	0.00E+00	0.00E+00	0.00E+00
NI59	2	12	6.23E-08	6.18E-07	0.00E+00	0.00E+00	0.00E+00
NI59	2	13	4.27E-08	4.52E-07	0.00E+00	0.00E+00	0.00E+00
NI59	2	14	2.92E-08	3.28E-07	0.00E+00	0.00E+00	0.00E+00
NI59	2	15	2.00E-08	2.40E-07	0.00E+00	0.00E+00	0.00E+00
NI59	2	16	1.37E-08	1.75E-07	0.00E+00	0.00E+00	0.00E+00
NI59	2	17	9.33E-09	1.27E-07	0.00E+00	0.00E+00	0.00E+00
NI59	2	18	6.40E-09	9.28E-08	0.00E+00	0.00E+00	0.00E+00
NI59	2	19	4.37E-09	6.74E-08	0.00E+00	0.00E+00	0.00E+00
NI59	2	20	3.00E-09	4.93E-08	0.00E+00	0.00E+00	0.00E+00
NI59	2	21	2.05E-09	3.59E-08	0.00E+00	0.00E+00	0.00E+00
NI59	2	22	1.40E-09	2.61E-08	0.00E+00	0.00E+00	0.00E+00
NI59	2	23	9.60E-10	1.91E-08	0.00E+00	0.00E+00	0.00E+00
NI59	2	24	6.55E-10	1.39E-08	0.00E+00	0.00E+00	0.00E+00
NI59	2	25	4.50E-10	1.01E-08	0.00E+00	0.00E+00	0.00E+00
NI59	2	26	3.06E-10	7.36E-09	0.00E+00	0.00E+00	0.00E+00
NI59	2	27	2.10E-10	5.38E-09	0.00E+00	0.00E+00	0.00E+00
NI59	2	28	1.44E-10	3.93E-09	0.00E+00	0.00E+00	0.00E+00
NI59	2	29	9.82E-11	2.84E-09	0.00E+00	0.00E+00	0.00E+00
NI59	2	30	6.73E-11	2.08E-09	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

NI59	231	4.55E-11	1.51E-09	0.00E+00	0.00E+00	0.00E+00
NI59	232	3.18E-11	1.11E-09	0.00E+00	0.00E+00	0.00E+00
NI59	233	2.18E-11	8.15E-10	0.00E+00	0.00E+00	0.00E+00
NI59	234	1.46E-11	5.68E-10	0.00E+00	0.00E+00	0.00E+00
NI59	235	1.00E-11	4.29E-10	0.00E+00	0.00E+00	0.00E+00
NI59	236	7.28E-12	3.20E-10	0.00E+00	0.00E+00	0.00E+00
NI59	237	4.55E-12	2.26E-10	0.00E+00	0.00E+00	0.00E+00
NI59	238	3.64E-12	1.67E-10	0.00E+00	0.00E+00	0.00E+00
NI59	239	1.82E-12	1.09E-10	0.00E+00	0.00E+00	0.00E+00
NI59	240	9.09E-13	9.46E-11	0.00E+00	0.00E+00	0.00E+00
NI59	241	9.09E-13	6.55E-11	0.00E+00	0.00E+00	0.00E+00
NI59	242	9.09E-13	4.37E-11	0.00E+00	0.00E+00	0.00E+00
NI59	243	9.09E-13	3.64E-11	0.00E+00	0.00E+00	0.00E+00
NI59	244	0.00E+00	2.91E-11	0.00E+00	0.00E+00	0.00E+00
NI59	245	0.00E+00	1.46E-11	0.00E+00	0.00E+00	0.00E+00
NI59	246	9.09E-13	1.46E-11	0.00E+00	0.00E+00	0.00E+00
NI59	247	0.00E+00	7.28E-12	0.00E+00	0.00E+00	0.00E+00
NI59	248	0.00E+00	7.28E-12	0.00E+00	0.00E+00	0.00E+00
NI59	249	0.00E+00	7.28E-12	0.00E+00	0.00E+00	0.00E+00
NI59	250	0.00E+00	7.28E-12	0.00E+00	0.00E+00	0.00E+00
NI63		0	50	0		
NI63	2 1	4.22E-06	1.08E-04	6.45E-05	0.00E+00	7.08E-06
NI63	2 2	7.36E-06	1.94E-04	1.54E-05	0.00E+00	2.89E-07
NI63	2 3	5.11E-06	1.44E-04	9.63E-08	0.00E+00	1.73E-09
NI63	2 4	3.47E-06	1.04E-04	6.04E-10	0.00E+00	1.09E-11
NI63	2 5	2.36E-06	7.51E-05	0.00E+00	0.00E+00	0.00E+00
NI63	2 6	1.60E-06	5.45E-05	0.00E+00	0.00E+00	0.00E+00
NI63	2 7	1.09E-06	3.93E-05	0.00E+00	0.00E+00	0.00E+00
NI63	2 8	7.40E-07	2.85E-05	0.00E+00	0.00E+00	0.00E+00
NI63	2 9	5.02E-07	2.06E-05	0.00E+00	0.00E+00	0.00E+00
NI63	210	3.40E-07	1.49E-05	0.00E+00	0.00E+00	0.00E+00
NI63	211	2.32E-07	1.08E-05	0.00E+00	0.00E+00	0.00E+00
NI63	212	1.57E-07	7.79E-06	0.00E+00	0.00E+00	0.00E+00
NI63	213	1.07E-07	5.65E-06	0.00E+00	0.00E+00	0.00E+00
NI63	214	7.24E-08	4.08E-06	0.00E+00	0.00E+00	0.00E+00
NI63	215	4.94E-08	2.96E-06	0.00E+00	0.00E+00	0.00E+00
NI63	216	3.35E-08	2.14E-06	0.00E+00	0.00E+00	0.00E+00
NI63	217	2.27E-08	1.54E-06	0.00E+00	0.00E+00	0.00E+00
NI63	218	1.55E-08	1.12E-06	0.00E+00	0.00E+00	0.00E+00
NI63	219	1.05E-08	8.08E-07	0.00E+00	0.00E+00	0.00E+00
NI63	220	7.14E-09	5.87E-07	0.00E+00	0.00E+00	0.00E+00
NI63	221	4.85E-09	4.24E-07	0.00E+00	0.00E+00	0.00E+00
NI63	222	3.28E-09	3.06E-07	0.00E+00	0.00E+00	0.00E+00
NI63	223	2.24E-09	2.22E-07	0.00E+00	0.00E+00	0.00E+00
NI63	224	1.51E-09	1.60E-07	0.00E+00	0.00E+00	0.00E+00
NI63	225	1.03E-09	1.16E-07	0.00E+00	0.00E+00	0.00E+00
NI63	226	6.98E-10	8.38E-08	0.00E+00	0.00E+00	0.00E+00
NI63	227	4.75E-10	6.09E-08	0.00E+00	0.00E+00	0.00E+00
NI63	228	3.24E-10	4.39E-08	0.00E+00	0.00E+00	0.00E+00
NI63	229	2.18E-10	3.18E-08	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

NI63	230	1.47E-10	2.30E-08	0.00E+00	0.00E+00	0.00E+00
NI63	231	1.04E-10	1.67E-08	0.00E+00	0.00E+00	0.00E+00
NI63	232	6.91E-11	1.20E-08	0.00E+00	0.00E+00	0.00E+00
NI63	233	4.55E-11	8.67E-09	0.00E+00	0.00E+00	0.00E+00
NI63	234	3.27E-11	6.17E-09	0.00E+00	0.00E+00	0.00E+00
NI63	235	2.00E-11	4.66E-09	0.00E+00	0.00E+00	0.00E+00
NI63	236	1.46E-11	3.38E-09	0.00E+00	0.00E+00	0.00E+00
NI63	237	1.09E-11	2.33E-09	0.00E+00	0.00E+00	0.00E+00
NI63	238	7.28E-12	1.75E-09	0.00E+00	0.00E+00	0.00E+00
NI63	239	3.64E-12	1.28E-09	0.00E+00	0.00E+00	0.00E+00
NI63	240	3.64E-12	8.73E-10	0.00E+00	0.00E+00	0.00E+00
NI63	241	1.82E-12	6.40E-10	0.00E+00	0.00E+00	0.00E+00
NI63	242	0.00E+00	4.66E-10	0.00E+00	0.00E+00	0.00E+00
NI63	243	3.64E-12	3.49E-10	0.00E+00	0.00E+00	0.00E+00
NI63	244	0.00E+00	2.91E-10	0.00E+00	0.00E+00	0.00E+00
NI63	245	0.00E+00	1.16E-10	0.00E+00	0.00E+00	0.00E+00
NI63	246	0.00E+00	1.75E-10	0.00E+00	0.00E+00	0.00E+00
NI63	247	0.00E+00	1.16E-10	0.00E+00	0.00E+00	0.00E+00
NI63	248	0.00E+00	5.82E-11	0.00E+00	0.00E+00	0.00E+00
NI63	249	0.00E+00	1.16E-10	0.00E+00	0.00E+00	0.00E+00
NI63	250	0.00E+00	5.82E-11	0.00E+00	0.00E+00	0.00E+00
ZN65		0	0	16		
ZN65	3 1	1.16E-05	7.79E-06	9.16E-04	0.00E+00	3.67E-05
ZN65	3 2	1.20E-05	8.33E-06	7.42E-04	0.00E+00	1.03E-06
ZN65	3 3	3.93E-06	2.90E-06	1.58E-04	0.00E+00	2.05E-07
ZN65	3 4	1.27E-06	9.84E-07	3.38E-05	0.00E+00	4.37E-08
ZN65	3 5	4.01E-07	3.27E-07	7.22E-06	0.00E+00	9.33E-09
ZN65	3 6	1.25E-07	1.07E-07	1.55E-06	0.00E+00	2.00E-09
ZN65	3 7	3.85E-08	3.43E-08	3.29E-07	0.00E+00	4.22E-10
ZN65	3 8	1.18E-08	1.10E-08	7.05E-08	0.00E+00	9.09E-11
ZN65	3 9	3.55E-09	3.45E-09	1.50E-08	0.00E+00	2.18E-11
ZN65	310	1.06E-09	1.07E-09	3.14E-09	0.00E+00	3.64E-12
ZN65	311	3.13E-10	3.33E-10	6.98E-10	0.00E+00	0.00E+00
ZN65	312	9.46E-11	1.02E-10	1.16E-10	0.00E+00	0.00E+00
ZN65	313	2.73E-11	3.27E-11	0.00E+00	0.00E+00	0.00E+00
ZN65	314	9.09E-12	9.09E-12	0.00E+00	0.00E+00	0.00E+00
ZN65	315	1.82E-12	1.82E-12	0.00E+00	0.00E+00	0.00E+00
ZN65	316	0.00E+00	1.82E-12	0.00E+00	0.00E+00	0.00E+00
SE75		4				
SE75	2 1	7.35E-06	0.00E+00	2.20E-02	0.00E+00	0.00E+00
SE75	2 2	5.31E-07	0.00E+00	3.48E-03	0.00E+00	0.00E+00
SE75	2 3	3.11E-10	0.00E+00	2.66E-06	0.00E+00	0.00E+00
SE75	2 4	0.00E+00	0.00E+00	1.86E-09	0.00E+00	0.00E+00
SR85		5	0	0		
SR85	1 1	6.07E-05	2.93E-05	9.94E-06	0.00E+00	0.00E+00
SR85	1 2	2.00E-05	9.67E-06	1.95E-08	0.00E+00	0.00E+00
SR85	1 3	3.99E-07	1.94E-07	0.00E+00	0.00E+00	0.00E+00
SR85	1 4	7.95E-09	3.89E-09	0.00E+00	0.00E+00	0.00E+00
SR85	1 5	1.60E-10	8.00E-11	0.00E+00	0.00E+00	0.00E+00
MO93		2	0	0		

Appendix B - Inhalation Dose Rate Factors - FILE23

M093	1 1	1.03E-06	0.00E+00	3.01E-06	0.00E+00	1.46E-06
M093	1 2	2.18E-08	0.00E+00	5.95E-09	0.00E+00	8.70E-11
NB94	0 0	50				
NB94	3 1	5.14E-06	1.21E-05	3.88E-03	0.00E+00	1.37E-04
NB94	3 2	1.55E-05	3.85E-05	5.59E-03	0.00E+00	8.66E-06
NB94	3 3	2.14E-05	5.51E-05	3.37E-03	0.00E+00	5.07E-06
NB94	3 4	2.47E-05	6.57E-05	2.03E-03	0.00E+00	3.05E-06
NB94	3 5	2.59E-05	7.09E-05	1.22E-03	0.00E+00	1.84E-06
NB94	3 6	2.54E-05	7.18E-05	7.38E-04	0.00E+00	1.11E-06
NB94	3 7	2.37E-05	6.93E-05	4.43E-04	0.00E+00	6.67E-07
NB94	3 8	2.16E-05	6.50E-05	2.68E-04	0.00E+00	4.03E-07
NB94	3 9	1.91E-05	5.94E-05	1.61E-04	0.00E+00	2.43E-07
NB94	310	1.65E-05	5.30E-05	9.69E-05	0.00E+00	1.46E-07
NB94	311	1.42E-05	4.69E-05	5.86E-05	0.00E+00	8.82E-08
NB94	312	1.19E-05	4.06E-05	3.52E-05	0.00E+00	5.30E-08
NB94	313	9.98E-06	3.51E-05	2.13E-05	0.00E+00	3.20E-08
NB94	314	8.23E-06	2.98E-05	1.28E-05	0.00E+00	1.93E-08
NB94	315	6.78E-06	2.54E-05	7.73E-06	0.00E+00	1.16E-08
NB94	316	5.53E-06	2.13E-05	4.65E-06	0.00E+00	7.01E-09
NB94	317	4.47E-06	1.78E-05	2.80E-06	0.00E+00	4.21E-09
NB94	318	3.62E-06	1.48E-05	1.69E-06	0.00E+00	2.53E-09
NB94	319	2.90E-06	1.23E-05	1.02E-06	0.00E+00	1.54E-09
NB94	320	2.33E-06	1.02E-05	6.15E-07	0.00E+00	9.17E-10
NB94	321	1.86E-06	8.35E-06	3.69E-07	0.00E+00	5.68E-10
NB94	322	1.48E-06	6.82E-06	2.24E-07	0.00E+00	3.35E-10
NB94	323	1.18E-06	5.60E-06	1.34E-07	0.00E+00	1.89E-10
NB94	324	9.32E-07	4.55E-06	8.20E-08	0.00E+00	1.16E-10
NB94	325	7.40E-07	3.71E-06	4.66E-08	0.00E+00	7.28E-11
NB94	326	5.83E-07	3.01E-06	2.98E-08	0.00E+00	4.37E-11
NB94	327	4.61E-07	2.44E-06	1.86E-08	0.00E+00	2.91E-11
NB94	328	3.63E-07	1.98E-06	9.31E-09	0.00E+00	1.46E-11
NB94	329	2.85E-07	1.59E-06	7.45E-09	0.00E+00	1.46E-11
NB94	330	2.24E-07	1.29E-06	3.73E-09	0.00E+00	1.46E-11
NB94	331	1.76E-07	1.03E-06	1.86E-09	0.00E+00	0.00E+00
NB94	332	1.38E-07	8.35E-07	1.86E-09	0.00E+00	0.00E+00
NB94	333	1.08E-07	6.72E-07	1.86E-09	0.00E+00	0.00E+00
NB94	334	8.32E-08	5.28E-07	0.00E+00	0.00E+00	0.00E+00
NB94	335	6.72E-08	4.37E-07	0.00E+00	0.00E+00	0.00E+00
NB94	336	5.23E-08	3.49E-07	0.00E+00	0.00E+00	0.00E+00
NB94	337	3.96E-08	2.71E-07	0.00E+00	0.00E+00	0.00E+00
NB94	338	3.20E-08	2.23E-07	0.00E+00	0.00E+00	0.00E+00
NB94	339	2.42E-08	1.73E-07	0.00E+00	0.00E+00	0.00E+00
NB94	340	1.95E-08	1.43E-07	0.00E+00	0.00E+00	0.00E+00
NB94	341	1.47E-08	1.10E-07	0.00E+00	0.00E+00	0.00E+00
NB94	342	1.18E-08	9.06E-08	0.00E+00	0.00E+00	0.00E+00
NB94	343	8.96E-09	6.98E-08	0.00E+00	0.00E+00	0.00E+00
NB94	344	7.25E-09	5.75E-08	0.00E+00	0.00E+00	0.00E+00
NB94	345	5.56E-09	4.56E-08	0.00E+00	0.00E+00	0.00E+00
NB94	346	4.22E-09	3.51E-08	0.00E+00	0.00E+00	0.00E+00
NB94	347	3.38E-09	2.88E-08	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

NB94	348	2.56E-09	2.21E-08	0.00E+00	0.00E+00	0.00E+00
NB94	349	2.07E-09	1.82E-08	0.00E+00	0.00E+00	0.00E+00
NB94	350	1.57E-09	1.40E-08	0.00E+00	0.00E+00	0.00E+00
IN111		2 0	0			
IN111	1 1	2.36E-06	4.27E-06	8.24E-06	9.56E-07	1.38E-05
IN111	1 2	2.72E-08	4.96E-08	1.38E-08	8.91E-09	7.86E-10
SB124		0 4	0			
SB 124	2 1	2.63E-05	5.70E-05	1.78E-03	1.72E-07	2.94E-04
SB 124	2 2	3.61E-06	1.22E-05	2.15E-04	7.85E-09	4.27E-06
SB 124	2 3	8.24E-10	2.23E-08	3.79E-08	1.21E-12	3.49E-10
SB 124	2 4	2.27E-13	2.73E-11	2.91E-11	.00	.00
I 125		5 0	0			
I 125	1 1	1.47E-05	6.85E-06	4.08E-06	1.20E-02	4.27E-07
I 125	1 2	4.20E-06	3.28E-07	8.00E-09	3.44E-03	2.54E-11
I 125	1 3	5.03E-08	0.00E+00	0.00E+00	4.12E-05	0.00E+00
I 125	1 4	6.00E-10	0.00E+00	0.00E+00	4.94E-07	0.00E+00
I 125	1 5	7.28E-12	0.00E+00	0.00E+00	5.59E-09	0.00E+00
CS136		2 0	0			
CS 136	1 1	3.08E-05	1.48E-05	2.49E-05	.00	1.78E-06
CS 136	1 2	1.43E-06	7.42E-07	2.30E-07	.00	1.05E-10
EU152		0 50	0			
EU152	2 1	5.44E-05	1.43E-04	1.01E-03	0.00E+00	9.63E-05
EU152	2 2	9.65E-05	2.89E-04	2.38E-04	0.00E+00	3.86E-06
EU152	2 3	6.39E-05	2.39E-04	1.42E-06	0.00E+00	2.22E-08
EU152	2 4	4.08E-05	1.92E-04	8.50E-09	0.00E+00	1.31E-10
EU152	2 5	2.60E-05	1.54E-04	0.00E+00	0.00E+00	7.28E-12
EU152	2 6	1.66E-05	1.24E-04	0.00E+00	0.00E+00	0.00E+00
EU152	2 7	1.06E-05	9.91E-05	0.00E+00	0.00E+00	0.00E+00
EU152	2 8	6.76E-06	7.98E-05	0.00E+00	0.00E+00	0.00E+00
EU152	2 9	4.31E-06	6.41E-05	0.00E+00	0.00E+00	0.00E+00
EU152	210	2.74E-06	5.13E-05	0.00E+00	0.00E+00	0.00E+00
EU152	211	1.75E-06	4.13E-05	0.00E+00	0.00E+00	0.00E+00
EU152	212	1.12E-06	3.30E-05	0.00E+00	0.00E+00	0.00E+00
EU152	213	7.14E-07	2.66E-05	0.00E+00	0.00E+00	0.00E+00
EU152	214	4.54E-07	2.13E-05	0.00E+00	0.00E+00	0.00E+00
EU152	215	2.90E-07	1.71E-05	0.00E+00	0.00E+00	0.00E+00
EU152	216	1.85E-07	1.38E-05	0.00E+00	0.00E+00	0.00E+00
EU152	217	1.18E-07	1.10E-05	0.00E+00	0.00E+00	0.00E+00
EU152	218	7.54E-08	8.87E-06	0.00E+00	0.00E+00	0.00E+00
EU152	219	4.79E-08	7.10E-06	0.00E+00	0.00E+00	0.00E+00
EU152	220	3.06E-08	5.71E-06	0.00E+00	0.00E+00	0.00E+00
EU152	221	1.95E-08	4.59E-06	0.00E+00	0.00E+00	0.00E+00
EU152	222	1.25E-08	3.67E-06	0.00E+00	0.00E+00	0.00E+00
EU152	223	7.95E-09	2.96E-06	0.00E+00	0.00E+00	0.00E+00
EU152	224	5.06E-09	2.37E-06	0.00E+00	0.00E+00	0.00E+00
EU152	225	3.23E-09	1.90E-06	0.00E+00	0.00E+00	0.00E+00
EU152	226	2.07E-09	1.52E-06	0.00E+00	0.00E+00	0.00E+00
EU152	227	1.31E-09	1.23E-06	0.00E+00	0.00E+00	0.00E+00
EU152	228	8.44E-10	9.85E-07	0.00E+00	0.00E+00	0.00E+00
EU152	229	5.53E-10	7.89E-07	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

EU152	230	2.91E-10	6.35E-07	0.00E+00	0.00E+00	0.00E+00
EU152	231	2.33E-10	5.08E-07	0.00E+00	0.00E+00	0.00E+00
EU152	232	1.46E-10	4.09E-07	0.00E+00	0.00E+00	0.00E+00
EU152	233	8.73E-11	3.29E-07	0.00E+00	0.00E+00	0.00E+00
EU152	234	5.82E-11	2.59E-07	0.00E+00	0.00E+00	0.00E+00
EU152	235	2.91E-11	2.15E-07	0.00E+00	0.00E+00	0.00E+00
EU152	236	2.91E-11	1.72E-07	0.00E+00	0.00E+00	0.00E+00
EU152	237	2.91E-11	1.34E-07	0.00E+00	0.00E+00	0.00E+00
EU152	238	0.00E+00	1.11E-07	0.00E+00	0.00E+00	0.00E+00
EU152	239	0.00E+00	8.61E-08	0.00E+00	0.00E+00	0.00E+00
EU152	240	0.00E+00	7.16E-08	0.00E+00	0.00E+00	0.00E+00
EU152	241	2.91E-11	5.55E-08	0.00E+00	0.00E+00	0.00E+00
EU152	242	0.00E+00	4.61E-08	0.00E+00	0.00E+00	0.00E+00
EU152	243	0.00E+00	3.57E-08	0.00E+00	0.00E+00	0.00E+00
EU152	244	0.00E+00	2.96E-08	0.00E+00	0.00E+00	0.00E+00
EU152	245	0.00E+00	2.39E-08	0.00E+00	0.00E+00	0.00E+00
EU152	246	0.00E+00	1.85E-08	0.00E+00	0.00E+00	0.00E+00
EU152	247	0.00E+00	1.54E-08	0.00E+00	0.00E+00	0.00E+00
EU152	248	0.00E+00	1.19E-08	0.00E+00	0.00E+00	0.00E+00
EU152	249	0.00E+00	9.90E-09	0.00E+00	0.00E+00	0.00E+00
EU152	250	0.00E+00	7.57E-09	0.00E+00	0.00E+00	0.00E+00
EU154	0	50	0			
EU 154	2 1	1.08E-04	8.62E-04	2.63E-03	.00	3.32E-04
EU 154	2 2	1.91E-04	1.75E-03	6.21E-04	.00	1.34E-05
EU 154	2 3	1.28E-04	1.46E-03	3.75E-06	.00	7.73E-08
EU 154	2 4	8.21E-05	1.18E-03	2.27E-08	.00	4.66E-10
EU 154	2 5	5.27E-05	9.52E-04	1.46E-10	.00	3.64E-12
EU 154	2 6	3.40E-05	7.72E-04	.00	.00	.00
EU 154	2 7	2.18E-05	6.22E-04	.00	.00	.00
EU 154	2 8	1.40E-05	5.05E-04	.00	.00	.00
EU 154	2 9	9.01E-06	4.08E-04	.00	.00	.00
EU 154	210	5.78E-06	3.29E-04	.00	.00	.00
EU 154	211	3.72E-06	2.67E-04	.00	.00	.00
EU 154	212	2.39E-06	2.15E-04	.00	.00	.00
EU 154	213	1.54E-06	1.75E-04	.00	.00	.00
EU 154	214	9.86E-07	1.41E-04	.00	.00	.00
EU 154	215	6.36E-07	1.14E-04	.00	.00	.00
EU 154	216	4.08E-07	9.25E-05	.00	.00	.00
EU 154	217	2.62E-07	7.46E-05	.00	.00	.00
EU 154	218	1.69E-07	6.05E-05	.00	.00	.00
EU 154	219	1.08E-07	4.88E-05	.00	.00	.00
EU 154	220	6.97E-08	3.96E-05	.00	.00	.00
EU 154	221	4.48E-08	3.20E-05	.00	.00	.00
EU 154	222	2.87E-08	2.58E-05	.00	.00	.00
EU 154	223	1.85E-08	2.09E-05	.00	.00	.00
EU 154	224	1.19E-08	1.69E-05	.00	.00	.00
EU 154	225	7.65E-09	1.37E-05	.00	.00	.00
EU 154	226	4.90E-09	1.11E-05	.00	.00	.00
EU 154	227	3.16E-09	8.97E-06	.00	.00	.00
EU 154	228	2.03E-09	7.25E-06	.00	.00	.00

Appendix B - Inhalation Dose Rate Factors - FILE23

EU 154 229	1.30E-09	5.85E-06	.00	.00	.00
EU 154 230	8.44E-10	4.75E-06	.00	.00	.00
EU 154 231	5.38E-10	3.83E-06	.00	.00	.00
EU 154 232	3.49E-10	3.11E-06	.00	.00	.00
EU 154 233	2.11E-10	2.52E-06	.00	.00	.00
EU 154 234	1.46E-10	1.99E-06	.00	.00	.00
EU 154 235	9.46E-11	1.67E-06	.00	.00	.00
EU 154 236	5.82E-11	1.34E-06	.00	.00	.00
EU 154 237	3.64E-11	1.05E-06	.00	.00	.00
EU 154 238	2.91E-11	8.80E-07	.00	.00	.00
EU 154 239	1.46E-11	6.90E-07	.00	.00	.00
EU 154 240	7.28E-12	5.76E-07	.00	.00	.00
EU 154 241	1.46E-11	4.51E-07	.00	.00	.00
EU 154 242	.00	3.77E-07	.00	.00	.00
EU 154 243	.00	2.96E-07	.00	.00	.00
EU 154 244	.00	2.47E-07	.00	.00	.00
EU 154 245	.00	1.99E-07	.00	.00	.00
EU 154 246	.00	1.56E-07	.00	.00	.00
EU 154 247	.00	1.30E-07	.00	.00	.00
EU 154 248	.00	1.02E-07	.00	.00	.00
EU 154 249	.00	8.53E-08	.00	.00	.00
EU 154 250	.00	6.71E-08	.00	.00	.00
T8160	0 6	0			
TB160 2 1	2.84E-05	2.25E-04	9.67E-04	0.00E+00	1.53E-04
TB160 2 2	1.11E-05	9.15E-05	1.25E-04	0.00E+00	2.53E-06
TB160 2 3	2.61E-07	2.40E-06	2.36E-08	0.00E+00	4.37E-10
TB160 2 4	5.40E-09	5.63E-08	0.00E+00	0.00E+00	0.00E+00
TB160 2 5	1.06E-10	1.34E-09	0.00E+00	0.00E+00	0.00E+00
TB160 2 6	3.64E-12	2.91E-11	0.00E+00	0.00E+00	0.00E+00
OS185	2 0	0			
OS185 1 1	2.81E-05	0.00E+00	1.81E-05	0.00E+00	3.14E-05
OS185 1 2	2.00E-06	0.00E+00	3.55E-08	0.00E+00	1.88E-09
OS191	2 0	0			
OS191 1 1	4.66E-06	0.00E+00	8.36E-06	0.00E+00	1.74E-05
OS191 1 2	1.69E-07	0.00E+00	1.60E-08	0.00E+00	1.03E-09
IR192	0 0	5			
IR192 3 1	4.67E-06	0.00E+00	2.97E-03	0.00E+00	3.46E-04
IR192 3 2	3.97E-07	0.00E+00	9.41E-04	0.00E+00	2.81E-06
IR192 3 3	2.58E-09	0.00E+00	1.77E-05	0.00E+00	4.07E-08
IR192 3 4	6.64E-11	0.00E+00	3.32E-07	0.00E+00	7.57E-10
IR192 3 5	1.82E-12	0.00E+00	6.52E-09	0.00E+00	2.91E-11
HG203	3 0	0			
HG203 1 1	2.89E-05	0.00E+00	1.05E-05	0.00E+00	7.84E-06
HG203 1 2	4.19E-06	0.00E+00	2.06E-08	0.00E+00	4.67E-10
HG203 1 3	1.46E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U 234	0 0	50			
U 234 3 1	2.58E-04	2.08E-03	7.01E-01	.00	2.34E-04
U 234 3 2	3.19E-04	4.10E-03	1.01E+00	.00	1.48E-05
U 234 3 3	2.43E-04	3.97E-03	6.08E-01	.00	8.63E-06
U 234 3 4	2.14E-04	3.68E-03	3.66E-01	.00	5.20E-06

Appendix B - Inhalation Dose Rate Factors - FILE23

U	234	3	5	1.83E-04	3.28E-03	2.21E-01	.00	3.13E-06
U	234	3	6	1.53E-04	2.83E-03	1.33E-01	.00	1.89E-06
U	234	3	7	1.25E-04	2.37E-03	8.00E-02	.00	1.14E-06
U	234	3	8	1.01E-04	1.96E-03	4.84E-02	.00	6.87E-07
U	234	3	9	8.06E-05	1.59E-03	2.91E-02	.00	4.14E-07
U	234	3	10	6.38E-05	1.27E-03	1.75E-02	.00	2.49E-07
U	234	3	11	5.05E-05	1.02E-03	1.06E-02	.00	1.50E-07
U	234	3	12	3.96E-05	8.03E-04	6.36E-03	.00	9.03E-08
U	234	3	13	3.11E-05	6.35E-04	3.84E-03	.00	5.46E-08
U	234	3	14	2.43E-05	4.97E-04	2.31E-03	.00	3.28E-08
U	234	3	15	1.90E-05	3.91E-04	1.40E-03	.00	1.98E-08
U	234	3	16	1.48E-05	3.06E-04	8.41E-04	.00	1.19E-08
U	234	3	17	1.15E-05	2.38E-04	5.05E-04	.00	7.17E-09
U	234	3	18	8.99E-06	1.86E-04	3.05E-04	.00	4.33E-09
U	234	3	19	6.97E-06	1.44E-04	1.83E-04	.00	2.60E-09
U	234	3	20	5.44E-06	1.13E-04	1.11E-04	.00	1.58E-09
U	234	3	21	4.23E-06	8.76E-05	6.68E-05	.00	9.50E-10
U	234	3	22	3.27E-06	6.79E-05	4.01E-05	.00	5.71E-10
U	234	3	23	2.55E-06	5.30E-05	2.43E-05	.00	3.46E-10
U	234	3	24	1.98E-06	4.10E-05	1.46E-05	.00	2.04E-10
U	234	3	25	1.54E-06	3.20E-05	8.79E-06	.00	1.24E-10
U	234	3	26	1.19E-06	2.48E-05	5.30E-06	.00	7.64E-11
U	234	3	27	9.29E-07	1.93E-05	3.22E-06	.00	4.73E-11
U	234	3	28	7.21E-07	1.50E-05	1.91E-06	.00	2.55E-11
U	234	3	29	5.58E-07	1.16E-05	1.19E-06	.00	1.82E-11
U	234	3	30	4.35E-07	9.03E-06	6.56E-07	.00	1.09E-11
U	234	3	31	3.36E-07	6.99E-06	4.47E-07	.00	3.64E-12
U	234	3	32	2.62E-07	5.45E-06	2.38E-07	.00	3.64E-12
U	234	3	33	2.04E-07	4.24E-06	1.79E-07	.00	3.64E-12
U	234	3	34	1.55E-07	3.22E-06	5.96E-08	.00	.00
U	234	3	35	1.24E-07	2.58E-06	5.96E-08	.00	.00
U	234	3	36	9.62E-08	2.00E-06	5.96E-08	.00	.00
U	234	3	37	7.24E-08	1.50E-06	.00	.00	.00
U	234	3	38	5.80E-08	1.21E-06	.00	.00	.00
U	234	3	39	4.37E-08	9.07E-07	.00	.00	.00
U	234	3	40	3.50E-08	7.28E-07	.00	.00	.00
U	234	3	41	2.64E-08	5.48E-07	.00	.00	.00
U	234	3	42	2.11E-08	4.39E-07	.00	.00	.00
U	234	3	43	1.59E-08	3.30E-07	.00	.00	.00
U	234	3	44	1.27E-08	2.65E-07	.00	.00	.00
U	234	3	45	9.84E-09	2.05E-07	.00	.00	.00
U	234	3	46	7.42E-09	1.54E-07	.00	.00	.00
U	234	3	47	5.94E-09	1.24E-07	.00	.00	.00
U	234	3	48	4.48E-09	9.27E-08	.00	.00	.00
U	234	3	49	3.58E-09	7.45E-08	.00	.00	.00
U	234	3	50	2.68E-09	5.63E-08	.00	.00	.00
SR89				5	0	0		
SR89	1	1		8.50E-05	2.96E-03	3.41E-05	0.00E+00	5.88E-05
SR89	1	2		2.10E-05	7.31E-04	6.68E-08	0.00E+00	3.51E-09
SR89	1	3		1.38E-07	4.84E-06	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

SR89	1 4	9.09E-10	3.21E-08	0.00E+00	0.00E+00	0.00E+00
SR89	1 5	7.28E-12	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Y 89M		0 0	0			
SR90		50 0	0			
SR90	1 1	5.32E-04	7.94E-03	8.17E-05	0.00E+00	8.30E-05
SR90	1 2	1.01E-03	1.50E-02	1.62E-07	0.00E+00	4.95E-09
SR90	1 3	9.23E-04	1.38E-02	0.00E+00	0.00E+00	0.00E+00
SR90	1 4	8.45E-04	1.26E-02	0.00E+00	0.00E+00	0.00E+00
SR90	1 5	7.74E-04	1.15E-02	0.00E+00	0.00E+00	0.00E+00
SR90	1 6	7.10E-04	1.06E-02	0.00E+00	0.00E+00	0.00E+00
SR90	1 7	6.49E-04	9.67E-03	0.00E+00	0.00E+00	0.00E+00
SR90	1 8	5.96E-04	8.89E-03	0.00E+00	0.00E+00	0.00E+00
SR90	1 9	5.46E-04	8.14E-03	0.00E+00	0.00E+00	0.00E+00
SR90	110	4.99E-04	7.43E-03	0.00E+00	0.00E+00	0.00E+00
SR90	111	4.58E-04	6.83E-03	0.00E+00	0.00E+00	0.00E+00
SR90	112	4.18E-04	6.24E-03	0.00E+00	0.00E+00	0.00E+00
SR90	113	3.85E-04	5.73E-03	0.00E+00	0.00E+00	0.00E+00
SR90	114	3.51E-04	5.24E-03	0.00E+00	0.00E+00	0.00E+00
SR90	115	3.23E-04	4.81E-03	0.00E+00	0.00E+00	0.00E+00
SR90	116	2.96E-04	4.41E-03	0.00E+00	0.00E+00	0.00E+00
SR90	117	2.70E-04	4.02E-03	0.00E+00	0.00E+00	0.00E+00
SR90	118	2.48E-04	3.70E-03	0.00E+00	0.00E+00	0.00E+00
SR90	119	2.27E-04	3.38E-03	0.00E+00	0.00E+00	0.00E+00
SR90	120	2.08E-04	3.10E-03	0.00E+00	0.00E+00	0.00E+00
SR90	121	1.91E-04	2.84E-03	0.00E+00	0.00E+00	0.00E+00
SR90	122	1.74E-04	2.60E-03	0.00E+00	0.00E+00	0.00E+00
SR90	123	1.60E-04	2.39E-03	0.00E+00	0.00E+00	0.00E+00
SR90	124	1.46E-04	2.18E-03	0.00E+00	0.00E+00	0.00E+00
SR90	125	1.34E-04	2.00E-03	0.00E+00	0.00E+00	0.00E+00
SR90	126	1.23E-04	1.83E-03	0.00E+00	0.00E+00	0.00E+00
SR90	127	1.13E-04	1.68E-03	0.00E+00	0.00E+00	0.00E+00
SR90	128	1.03E-04	1.54E-03	0.00E+00	0.00E+00	0.00E+00
SR90	129	9.43E-05	1.41E-03	0.00E+00	0.00E+00	0.00E+00
SR90	130	8.67E-05	1.29E-03	0.00E+00	0.00E+00	0.00E+00
SR90	131	7.92E-05	1.18E-03	0.00E+00	0.00E+00	0.00E+00
SR90	132	7.27E-05	1.08E-03	0.00E+00	0.00E+00	0.00E+00
SR90	133	6.68E-05	9.96E-04	0.00E+00	0.00E+00	0.00E+00
SR90	134	5.99E-05	8.93E-04	0.00E+00	0.00E+00	0.00E+00
SR90	135	5.67E-05	8.45E-04	0.00E+00	0.00E+00	0.00E+00
SR90	136	5.18E-05	7.73E-04	0.00E+00	0.00E+00	0.00E+00
SR90	137	4.60E-05	6.86E-04	0.00E+00	0.00E+00	0.00E+00
SR90	138	4.35E-05	6.49E-04	0.00E+00	0.00E+00	0.00E+00
SR90	139	3.86E-05	5.76E-04	0.00E+00	0.00E+00	0.00E+00
SR90	140	3.65E-05	5.45E-04	0.00E+00	0.00E+00	0.00E+00
SR90	141	3.24E-05	4.83E-04	0.00E+00	0.00E+00	0.00E+00
SR90	142	3.07E-05	4.57E-04	0.00E+00	0.00E+00	0.00E+00
SR90	143	2.72E-05	4.06E-04	0.00E+00	0.00E+00	0.00E+00
SR90	144	2.58E-05	3.84E-04	0.00E+00	0.00E+00	0.00E+00
SR90	145	2.36E-05	3.51E-04	0.00E+00	0.00E+00	0.00E+00
SR90	146	2.09E-05	3.12E-04	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

SR90	147	1.98E-05	2.95E-04	0.00E+00	0.00E+00	0.00E+00
SR90	148	1.76E-05	2.62E-04	0.00E+00	0.00E+00	0.00E+00
SR90	149	1.66E-05	2.48E-04	0.00E+00	0.00E+00	0.00E+00
SR90	150	1.47E-05	2.20E-04	0.00E+00	0.00E+00	0.00E+00
Y 90		0 0	2			
Y 90	3 1	6.79E-08	2.52E-06	2.09E-04	.00	3.11E-04
Y 90	3 2	7.40E-10	2.75E-08	1.97E-06	.00	4.76E-07
M099		2 0	0			
M099	1 1	3.90E-06	0.00E+00	2.49E-05	0.00E+00	1.18E-05
M099	1 2	3.04E-08	0.00E+00	4.17E-08	0.00E+00	6.75E-10
TC99M		0 2	0			
TC99M	2 1	1.77E-08	4.89E-10	0.00E+00	0.00E+00	4.74E-07
TC99M	2 2	1.99E-11	6.44E-13	0.00E+00	0.00E+00	2.88E-10
TC99		0 4	0			
TC99	2 1	2.45E-07	5.50E-07	2.89E-04	0.00E+00	2.29E-05
TC99	2 2	1.62E-08	1.02E-07	6.90E-05	0.00E+00	9.35E-07
TC99	2 3	1.50E-10	6.83E-10	4.35E-07	0.00E+00	5.65E-09
TC99	2 4	1.28E-12	6.03E-12	2.76E-09	0.00E+00	3.64E-11
RU103		0 0	4			
RU103	3 1	3.69E-07	7.54E-07	6.32E-04	.00	6.35E-05
RU103	3 2	1.37E-08	4.51E-08	1.06E-04	.00	2.59E-07
RU103	3 3	7.68E-12	1.90E-11	1.14E-07	.00	1.51E-10
RU103	3 4	1.42E-14	2.13E-14	1.24E-10	.00	.00
PD103		0 0	2			
PD103	3 1	1.74E-07	0.00E+00	7.71E-05	0.00E+00	6.86E-06
PD103	3 2	3.15E-09	0.00E+00	5.16E-06	0.00E+00	1.57E-08
RH103M		0 0	0			
RU106		0 0	19			
RU106	3 1	1.66E-06	1.26E-05	9.38E-03	0.00E+00	6.79E-04
RU106	3 2	3.67E-07	3.32E-06	9.09E-03	0.00E+00	2.45E-05
RU106	3 3	1.49E-07	1.21E-06	2.75E-03	0.00E+00	7.03E-06
RU106	3 4	6.48E-08	5.27E-07	8.34E-04	0.00E+00	2.13E-06
RU106	3 5	2.73E-08	2.23E-07	2.53E-04	0.00E+00	6.45E-07
RU106	3 6	1.13E-08	9.22E-08	7.67E-05	0.00E+00	1.96E-07
RU106	3 7	4.59E-09	3.74E-08	2.31E-05	0.00E+00	5.91E-08
RU106	3 8	1.85E-09	1.51E-08	7.04E-06	0.00E+00	1.79E-08
RU106	3 9	7.40E-10	6.03E-09	2.13E-06	0.00E+00	5.41E-09
RU106	310	2.93E-10	2.39E-09	6.43E-07	0.00E+00	1.69E-09
RU106	311	1.16E-10	9.50E-10	1.96E-07	0.00E+00	4.07E-10
RU106	312	4.57E-11	3.71E-10	5.96E-08	0.00E+00	1.75E-10
RU106	313	1.82E-11	1.47E-10	1.86E-08	0.00E+00	5.82E-11
RU106	314	7.05E-12	5.82E-11	3.73E-09	0.00E+00	0.00E+00
RU106	315	2.73E-12	2.36E-11	0.00E+00	0.00E+00	0.00E+00
RU106	316	9.09E-13	9.09E-12	1.86E-09	0.00E+00	0.00E+00
RU106	317	4.55E-13	3.64E-12	0.00E+00	0.00E+00	0.00E+00
RU106	318	2.27E-13	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RU106	319	0.00E+00	1.82E-12	0.00E+00	0.00E+00	0.00E+00
AG110M		3 0	0			
AG*110	1 1	2.85E-05	4.60E-05	5.25E-05	.00	7.69E-05
AG*110	1 2	5.99E-07	5.54E-06	1.04E-07	.00	4.59E-09

Appendix B - Inhalation Dose Rate Factors - FILE23

AG*110	1 3	.00	4.52E-10	.00	.00	.00
AG110		0 0	0			
SB125		0 35	0			
SB125	2 1	2.93E-05	5.85E-05	6.82E-04	5.50E-08	7.43E-05
SB125	2 2	3.95E-05	9.83E-05	1.53E-04	6.04E-09	2.79E-06
SB125	2 3	1.65E-05	6.10E-05	7.49E-07	5.35E-11	1.30E-08
SB125	2 4	6.56E-06	3.66E-05	3.65E-09	3.93E-13	6.37E-11
SB125	2 5	2.61E-06	2.20E-05	1.46E-11	1.78E-15	.00
SB125	2 6	1.04E-06	1.32E-05	.00	.00	.00
SB125	2 7	4.11E-07	7.92E-06	.00	.00	.00
SB125	2 8	1.64E-07	4.77E-06	.00	.00	.00
SB125	2 9	6.50E-08	2.86E-06	.00	.00	.00
SB125	210	2.57E-08	1.71E-06	.00	.00	.00
SB125	211	1.03E-08	1.03E-06	.00	.00	.00
SB125	212	4.06E-09	6.18E-07	.00	.00	.00
SB125	213	1.62E-09	3.72E-07	.00	.00	.00
SB125	214	6.41E-10	2.23E-07	.00	.00	.00
SB125	215	2.56E-10	1.34E-07	.00	.00	.00
SB125	216	1.01E-10	8.05E-08	.00	.00	.00
SB125	217	4.09E-11	4.82E-08	.00	.00	.00
SB125	218	1.55E-11	2.90E-08	.00	.00	.00
SB125	219	6.37E-12	1.74E-08	.00	.00	.00
SB125	220	2.73E-12	1.05E-08	.00	.00	.00
SB125	221	9.09E-13	6.29E-09	.00	.00	.00
SB125	222	.00	3.76E-09	.00	.00	.00
SB125	223	.00	2.27E-09	.00	.00	.00
SB125	224	.00	1.36E-09	.00	.00	.00
SB125	225	.00	8.19E-10	.00	.00	.00
SB125	226	.00	4.87E-10	.00	.00	.00
SB125	227	.00	2.98E-10	.00	.00	.00
SB125	228	.00	1.78E-10	.00	.00	.00
SB125	229	.00	1.02E-10	.00	.00	.00
SB125	230	.00	6.55E-11	.00	.00	.00
SB125	231	.00	3.64E-11	.00	.00	.00
SB125	232	.00	2.18E-11	.00	.00	.00
SB125	233	.00	1.82E-11	.00	.00	.00
SB125	234	.00	7.28E-12	.00	.00	.00
SB125	235	.00	3.64E-12	.00	.00	.00
TE125M		0 4	0			
TE*125	2 1	2.56E-06	1.26E-05	2.60E-04	1.31E-03	4.33E-05
TE*125	2 2	1.88E-07	1.39E-06	3.00E-05	7.19E-05	6.13E-07
TE*125	2 3	1.41E-11	1.38E-10	2.41E-09	5.69E-09	4.27E-11
TE*125	2 4	.00	.00	3.64E-12	.00	.00
TE127M		0 4	0			
TE*127	2 1	6.22E-06	4.46E-05	7.23E-04	3.95E-03	2.61E-05
TE*127	2 2	5.75E-07	6.37E-06	1.09E-04	2.77E-04	5.44E-07
TE*127	2 3	3.46E-10	4.66E-09	6.17E-08	1.78E-07	2.81E-10
TE*127	2 4	2.84E-13	3.64E-12	3.64E-11	1.16E-10	2.27E-13
TE127		0 2	0			
TE127	2 1	7.79E-08	3.55E-07	1.03E-05	8.05E-05	1.27E-05

Appendix B - Inhalation Dose Rate Factors - FILE23

TE127	2 2	1.43E-10	6.60E-10	1.43E-08	1.46E-07	1.01E-08
TE129M		0 3	0			
TE*129	2 1	1.58E-05	6.21E-05	1.20E-03	7.13E-03	3.00E-05
TE*129	2 2	8.99E-07	5.07E-06	1.01E-04	3.02E-04	2.71E-07
TE*129	2 3	2.73E-12	2.09E-11	3.49E-10	9.31E-10	9.09E-13
TE129		0 2	0			
TE129	2 1	2.31E-08	5.94E-08	4.19E-06	1.48E-05	6.01E-09
TE129	2 2	5.42E-12	1.40E-11	7.56E-10	3.47E-09	9.79E-13
I 129		12 0	0			
I 129	1 1	3.06E-05	1.28E-06	5.14E-06	2.46E-02	5.57E-07
I 129	1 2	2.18E-05	7.62E-08	1.02E-08	1.75E-02	3.33E-11
I 129	1 3	3.48E-06	.00	.00	2.80E-03	.00
I 129	1 4	5.56E-07	.00	.00	4.46E-04	.00
I 129	1 5	8.88E-08	.00	.00	7.13E-05	.00
I 129	1 6	1.42E-08	.00	.00	1.14E-05	.00
I 129	1 7	2.26E-09	.00	.00	1.82E-06	.00
I 129	1 8	3.62E-10	.00	.00	2.91E-07	.00
I 129	1 9	5.87E-11	.00	.00	4.66E-08	.00
I 129	110	8.64E-12	.00	.00	7.45E-09	.00
I 129	111	1.36E-12	.00	.00	9.31E-10	.00
I 129	112	4.55E-13	.00	.00	.00	.00
I 131		2 0	0			
I 131	1 1	1.40E-05	1.73E-05	1.77E-05	8.01E-03	1.87E-06
I 131	1 2	4.38E-07	3.71E-07	3.29E-08	2.50E-04	1.10E-10
XE131M		0 0	0			
I 133		2 0	0			
I 133	1 1	2.79E-06	.00	2.66E-05	1.88E-03	2.79E-06
I 133	1 2	1.08E-08	.00	3.34E-08	7.30E-06	1.46E-10
CS134		10 0	0			
CS134	1 1	2.44E-04	1.27E-04	7.40E-05	.00	2.90E-06
CS134	1 2	7.95E-05	7.87E-05	2.39E-05	.00	1.73E-10
CS134	1 3	1.53E-06	9.28E-06	2.80E-06	.00	.00
CS134	1 4	2.96E-08	1.09E-06	3.30E-07	.00	.00
CS134	1 5	5.71E-10	1.29E-07	3.89E-08	.00	.00
CS134	1 6	1.09E-11	1.52E-08	4.60E-09	.00	.00
CS134	1 7	3.64E-12	1.79E-09	5.40E-10	.00	.00
CS134	1 8	.00	2.11E-10	6.37E-11	.00	.00
CS134	1 9	.00	2.55E-11	7.28E-12	.00	.00
CS134	110	.00	1.82E-12	9.09E-13	.00	.00
CS135		12 0	0			
CS135	1 1	1.55E-05	4.57E-05	8.93E-06	.00	5.03E-07
CS135	1 2	5.59E-06	3.30E-05	3.47E-06	.00	3.01E-11
CS135	1 3	1.50E-07	5.40E-06	5.67E-07	.00	.00
CS135	1 4	4.04E-09	8.86E-07	9.30E-08	.00	.00
CS135	1 5	1.09E-10	1.45E-07	1.52E-08	.00	.00
CS135	1 6	2.96E-12	2.39E-08	2.51E-09	.00	.00
CS135	1 7	.00	3.90E-09	4.09E-10	.00	.00
CS135	1 8	.00	6.41E-10	6.73E-11	.00	.00
CS135	1 9	.00	1.06E-10	1.11E-11	.00	.00
CS135	110	.00	1.64E-11	1.71E-12	.00	.00

Appendix B - Inhalation Dose Rate Factors - FILE23

CS135	111	.00	3.64E-12	3.41E-13	.00	.00
CS135	112	.00	.00	1.14E-13	.00	.00
CS137	12	0	0			
CS137	1 1	1.38E-04	1.93E-04	5.53E-05	.00	2.59E-06
CS137	1 2	4.94E-05	1.38E-04	2.12E-05	.00	1.55E-10
CS137	1 3	1.30E-06	2.20E-05	3.39E-06	.00	.00
CS137	1 4	3.41E-08	3.53E-06	5.43E-07	.00	.00
CS137	1 5	8.95E-10	5.65E-07	8.69E-08	.00	.00
CS137	1 6	2.18E-11	9.08E-08	1.40E-08	.00	.00
CS137	1 7	.00	1.45E-08	2.23E-09	.00	.00
CS137	1 8	.00	2.34E-09	3.58E-10	.00	.00
CS137	1 9	.00	3.71E-10	5.82E-11	.00	.00
CS137	110	.00	6.18E-11	9.09E-12	.00	.00
CS137	111	.00	7.28E-12	1.82E-12	.00	.00
CS137	112	.00	3.64E-12	.00	.00	.00
BA137M	2	0	0			
BA137M	1 1	1.97E-10	1.50E-09	4.89E-08	0.00E+00	0.00E+00
BA137M	1 2	2.55E-15	1.94E-14	3.41E-13	0.00E+00	0.00E+00
BA140	2	0	0			
BA140	1 1	8.12E-05	1.04E-03	4.53E-05	.00	4.50E-05
BA140	1 2	3.68E-06	4.71E-05	8.62E-08	.00	2.66E-09
LA140	2	0	0			
LA140	1 1	4.51E-10	2.57E-09	2.54E-09	.00	4.63E-09
LA140	1 2	3.36E-12	1.92E-11	3.87E-12	.00	2.57E-13
CE141	0	0	4			
CE141	3 1	1.90E-07	2.27E-06	3.73E-04	.00	7.89E-05
CE141	3 2	3.19E-08	3.94E-07	4.99E-05	.00	2.67E-07
CE141	3 3	2.25E-11	3.24E-10	1.24E-08	.00	3.00E-11
CE141	3 4	1.07E-14	1.71E-13	3.64E-12	.00	.00
PR143	0	0	3			
PR143	3 1	1.09E-07	2.53E-06	3.19E-04	.00	1.43E-04
PR143	3 2	5.76E-09	1.56E-07	1.70E-05	.00	3.01E-07
PR143	3 3	8.88E-16	.00	.00	.00	.00
CE144	0	0	19			
CE144	3 1	4.71E-06	7.45E-05	8.25E-03	0.00E+00	6.28E-04
CE144	3 2	7.63E-06	1.33E-04	7.19E-03	0.00E+00	1.95E-05
CE144	3 3	4.28E-06	8.46E-05	1.78E-03	0.00E+00	4.53E-06
CE144	3 4	1.98E-06	4.38E-05	4.39E-04	0.00E+00	1.12E-06
CE144	3 5	8.26E-07	2.04E-05	1.08E-04	0.00E+00	2.76E-07
CE144	3 6	3.23E-07	8.87E-06	2.69E-05	0.00E+00	6.85E-08
CE144	3 7	1.20E-07	3.67E-06	6.62E-06	0.00E+00	1.69E-08
CE144	3 8	4.34E-08	1.48E-06	1.64E-06	0.00E+00	4.13E-09
CE144	3 9	1.53E-08	5.77E-07	4.04E-07	0.00E+00	1.05E-09
CE144	310	5.25E-09	2.21E-07	1.01E-07	0.00E+00	2.91E-10
CE144	311	1.79E-09	8.38E-08	2.42E-08	0.00E+00	5.82E-11
CE144	312	6.00E-10	3.12E-08	5.59E-09	0.00E+00	0.00E+00
CE144	313	2.02E-10	1.16E-08	0.00E+00	0.00E+00	0.00E+00
CE144	314	6.55E-11	4.22E-09	1.86E-09	0.00E+00	0.00E+00
CE144	315	2.18E-11	1.57E-09	0.00E+00	0.00E+00	0.00E+00
CE144	316	7.28E-12	5.53E-10	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

CE144	317	1.82E-12	1.75E-10	0.00E+00	0.00E+00	0.00E+00
CE144	318	0.00E+00	5.82E-11	0.00E+00	0.00E+00	0.00E+00
CE144	319	0.00E+00	2.91E-11	0.00E+00	0.00E+00	0.00E+00
PR144		0	0	2		
PR144	3 1	2.22E-10	4.38E-09	1.79E-06	0.00E+00	4.41E-19
PR144	3 2	1.53E-14	3.02E-13	8.45E-11	0.00E+00	2.01E-23
ND144		0	0	50		
ND144	3 1	9.98E-05	1.86E-03	2.86E-01	0.00E+00	9.35E-05
ND144	3 2	2.95E-04	5.98E-03	4.12E-01	0.00E+00	5.90E-06
ND144	3 3	3.99E-04	8.91E-03	2.48E-01	0.00E+00	3.45E-06
ND144	3 4	4.52E-04	1.10E-02	1.49E-01	0.00E+00	2.08E-06
ND144	3 5	4.63E-04	1.24E-02	9.01E-02	0.00E+00	1.25E-06
ND144	3 6	4.47E-04	1.30E-02	5.44E-02	0.00E+00	7.56E-07
ND144	3 7	4.10E-04	1.31E-02	3.27E-02	0.00E+00	4.54E-07
ND144	3 8	3.67E-04	1.28E-02	1.98E-02	0.00E+00	2.75E-07
ND144	3 9	3.19E-04	1.21E-02	1.19E-02	0.00E+00	1.65E-07
ND144	310	2.72E-04	1.13E-02	7.15E-03	0.00E+00	9.94E-08
ND144	311	2.29E-04	1.04E-02	4.32E-03	0.00E+00	6.01E-08
ND144	312	1.90E-04	9.45E-03	2.60E-03	0.00E+00	3.61E-08
ND144	313	1.56E-04	8.54E-03	1.57E-03	0.00E+00	2.18E-08
ND144	314	1.27E-04	7.60E-03	9.43E-04	0.00E+00	1.31E-08
ND144	315	1.03E-04	6.76E-03	5.70E-04	0.00E+00	7.92E-09
ND144	316	8.31E-05	5.96E-03	3.43E-04	0.00E+00	4.78E-09
ND144	317	6.63E-05	5.22E-03	2.06E-04	0.00E+00	2.87E-09
ND144	318	5.31E-05	4.57E-03	1.25E-04	0.00E+00	1.74E-09
ND144	319	4.20E-05	3.97E-03	7.49E-05	0.00E+00	1.04E-09
ND144	320	3.34E-05	3.46E-03	4.53E-05	0.00E+00	6.26E-10
ND144	321	2.64E-05	2.99E-03	2.73E-05	0.00E+00	3.78E-10
ND144	322	2.07E-05	2.57E-03	1.63E-05	0.00E+00	2.33E-10
ND144	323	1.64E-05	2.22E-03	9.89E-06	0.00E+00	1.31E-10
ND144	324	1.28E-05	1.91E-03	5.96E-06	0.00E+00	8.73E-11
ND144	325	1.01E-05	1.64E-03	3.58E-06	0.00E+00	4.37E-11
ND144	326	7.87E-06	1.40E-03	2.26E-06	0.00E+00	3.64E-11
ND144	327	6.17E-06	1.20E-03	1.31E-06	0.00E+00	1.46E-11
ND144	328	4.83E-06	1.03E-03	7.15E-07	0.00E+00	1.46E-11
ND144	329	3.76E-06	8.76E-04	4.77E-07	0.00E+00	7.28E-12
ND144	330	2.94E-06	7.50E-04	2.38E-07	0.00E+00	0.00E+00
ND144	331	2.29E-06	6.37E-04	1.19E-07	0.00E+00	7.28E-12
ND144	332	1.79E-06	5.44E-04	1.19E-07	0.00E+00	0.00E+00
ND144	333	1.40E-06	4.65E-04	0.00E+00	0.00E+00	0.00E+00
ND144	334	1.06E-06	3.87E-04	1.19E-07	0.00E+00	0.00E+00
ND144	335	8.56E-07	3.39E-04	0.00E+00	0.00E+00	0.00E+00
ND144	336	6.63E-07	2.88E-04	0.00E+00	0.00E+00	0.00E+00
ND144	337	5.00E-07	2.37E-04	1.19E-07	0.00E+00	0.00E+00
ND144	338	4.01E-07	2.07E-04	0.00E+00	0.00E+00	0.00E+00
ND144	339	3.03E-07	1.71E-04	0.00E+00	0.00E+00	0.00E+00
ND144	340	2.43E-07	1.49E-04	0.00E+00	0.00E+00	0.00E+00
ND144	341	1.83E-07	1.23E-04	0.00E+00	0.00E+00	0.00E+00
ND144	342	1.47E-07	1.07E-04	0.00E+00	0.00E+00	0.00E+00
ND144	343	1.10E-07	8.82E-05	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

ND144	344	8.85E-08	7.71E-05	0.00E+00	0.00E+00	0.00E+00
ND144	345	6.94E-08	6.52E-05	0.00E+00	0.00E+00	0.00E+00
ND144	346	5.22E-08	5.35E-05	0.00E+00	0.00E+00	0.00E+00
ND144	347	4.14E-08	4.67E-05	0.00E+00	0.00E+00	0.00E+00
ND144	348	3.12E-08	3.83E-05	0.00E+00	0.00E+00	0.00E+00
ND144	349	2.47E-08	3.35E-05	0.00E+00	0.00E+00	0.00E+00
ND144	350	1.96E-08	2.74E-05	0.00E+00	0.00E+00	0.00E+00
PM147		0	0	46		
PM147	3 1	3.12E-07	5.88E-06	5.20E-04	.00	3.38E-05
PM147	3 2	7.68E-07	1.57E-05	6.38E-04	.00	1.70E-06
PM147	3 3	8.04E-07	1.82E-05	2.94E-04	.00	7.56E-07
PM147	3 4	7.02E-07	1.73E-05	1.36E-04	.00	3.49E-07
PM147	3 5	5.53E-07	1.49E-05	6.27E-05	.00	1.61E-07
PM147	3 6	4.10E-07	1.21E-05	2.90E-05	.00	7.44E-08
PM147	3 7	2.88E-07	9.28E-06	1.33E-05	.00	3.42E-08
PM147	3 8	1.98E-07	6.95E-06	6.18E-06	.00	1.59E-08
PM147	3 9	1.32E-07	5.07E-06	2.85E-06	.00	7.31E-09
PM147	310	8.60E-08	3.62E-06	1.31E-06	.00	3.36E-09
PM147	311	5.56E-08	2.56E-06	6.07E-07	.00	1.56E-09
PM147	312	3.53E-08	1.78E-06	2.79E-07	.00	7.16E-10
PM147	313	2.23E-08	1.23E-06	1.29E-07	.00	3.32E-10
PM147	314	1.39E-08	8.39E-07	5.95E-08	.00	1.53E-10
PM147	315	8.64E-09	5.72E-07	2.75E-08	.00	7.05E-11
PM147	316	5.32E-09	3.86E-07	1.27E-08	.00	3.27E-11
PM147	317	3.25E-09	2.59E-07	5.85E-09	.00	1.50E-11
PM147	318	1.99E-09	1.74E-07	2.69E-09	.00	6.82E-12
PM147	319	1.21E-09	1.16E-07	1.24E-09	.00	3.64E-12
PM147	320	7.37E-10	7.70E-08	5.82E-10	.00	1.36E-12
PM147	321	4.46E-10	5.10E-08	2.76E-10	.00	4.55E-13
PM147	322	2.68E-10	3.36E-08	1.31E-10	.00	4.55E-13
PM147	323	1.62E-10	2.23E-08	5.82E-11	.00	.00
PM147	324	9.72E-11	1.46E-08	1.46E-11	.00	.00
PM147	325	5.85E-11	9.65E-09	1.46E-11	.00	.00
PM147	326	3.51E-11	6.31E-09	.00	.00	.00
PM147	327	2.10E-11	4.15E-09	.00	.00	.00
PM147	328	1.27E-11	2.72E-09	.00	.00	.00
PM147	329	7.45E-12	1.77E-09	.00	.00	.00
PM147	330	4.49E-12	1.16E-09	.00	.00	.00
PM147	331	2.73E-12	7.55E-10	.00	.00	.00
PM147	332	1.59E-12	4.95E-10	.00	.00	.00
PM147	333	9.66E-13	3.23E-10	.00	.00	.00
PM147	334	5.68E-13	2.06E-10	.00	.00	.00
PM147	335	3.41E-13	1.38E-10	.00	.00	.00
PM147	336	2.27E-13	9.00E-11	.00	.00	.00
PM147	337	1.14E-13	5.73E-11	.00	.00	.00
PM147	338	5.68E-14	3.64E-11	.00	.00	.00
PM147	339	5.68E-14	2.55E-11	.00	.00	.00
PM147	340	.00	1.55E-11	.00	.00	.00
PM147	341	.00	1.00E-11	.00	.00	.00
PM147	342	.00	6.37E-12	.00	.00	.00

Appendix B - Inhalation Dose Rate Factors - FILE23

PM147	343	.00	4.55E-12	.00	.00	.00
PM147	344	.00	3.64E-12	.00	.00	.00
PM147	345	.00	1.82E-12	.00	.00	.00
PM147	346	.00	9.09E-13	.00	.00	.00
SM151	0	50	0			
SM151	2 1	3.53E-06	4.08E-05	1.29E-04	0.00E+00	1.98E-05
SM151	2 2	6.47E-06	8.48E-05	3.07E-05	0.00E+00	8.05E-07
SM151	2 3	4.52E-06	7.31E-05	1.92E-07	0.00E+00	4.82E-09
SM151	2 4	3.05E-06	6.13E-05	1.21E-09	0.00E+00	3.09E-11
SM151	2 5	2.06E-06	5.13E-05	1.46E-11	0.00E+00	0.00E+00
SM151	2 6	1.39E-06	4.31E-05	0.00E+00	0.00E+00	0.00E+00
SM151	2 7	9.36E-07	3.60E-05	0.00E+00	0.00E+00	0.00E+00
SM151	2 8	6.33E-07	3.03E-05	0.00E+00	0.00E+00	0.00E+00
SM151	2 9	4.27E-07	2.54E-05	0.00E+00	0.00E+00	0.00E+00
SM151	210	2.87E-07	2.12E-05	0.00E+00	0.00E+00	0.00E+00
SM151	211	1.94E-07	1.78E-05	0.00E+00	0.00E+00	0.00E+00
SM151	212	1.31E-07	1.49E-05	0.00E+00	0.00E+00	0.00E+00
SM151	213	8.85E-08	1.25E-05	0.00E+00	0.00E+00	0.00E+00
SM151	214	5.95E-08	1.05E-05	0.00E+00	0.00E+00	0.00E+00
SM151	215	4.03E-08	8.81E-06	0.00E+00	0.00E+00	0.00E+00
SM151	216	2.71E-08	7.38E-06	0.00E+00	0.00E+00	0.00E+00
SM151	217	1.83E-08	6.17E-06	0.00E+00	0.00E+00	0.00E+00
SM151	218	1.24E-08	5.19E-06	0.00E+00	0.00E+00	0.00E+00
SM151	219	8.31E-09	4.33E-06	0.00E+00	0.00E+00	0.00E+00
SM151	220	5.63E-09	3.64E-06	0.00E+00	0.00E+00	0.00E+00
SM151	221	3.79E-09	3.05E-06	0.00E+00	0.00E+00	0.00E+00
SM151	222	2.55E-09	2.55E-06	0.00E+00	0.00E+00	0.00E+00
SM151	223	1.73E-09	2.15E-06	0.00E+00	0.00E+00	0.00E+00
SM151	224	1.16E-09	1.79E-06	0.00E+00	0.00E+00	0.00E+00
SM151	225	7.86E-10	1.51E-06	0.00E+00	0.00E+00	0.00E+00
SM151	226	5.29E-10	1.26E-06	0.00E+00	0.00E+00	0.00E+00
SM151	227	3.58E-10	1.06E-06	0.00E+00	0.00E+00	0.00E+00
SM151	228	2.38E-10	8.88E-07	0.00E+00	0.00E+00	0.00E+00
SM151	229	1.64E-10	7.42E-07	0.00E+00	0.00E+00	0.00E+00
SM151	230	1.11E-10	6.24E-07	0.00E+00	0.00E+00	0.00E+00
SM151	231	7.28E-11	5.21E-07	0.00E+00	0.00E+00	0.00E+00
SM151	232	5.09E-11	4.38E-07	0.00E+00	0.00E+00	0.00E+00
SM151	233	3.27E-11	3.69E-07	0.00E+00	0.00E+00	0.00E+00
SM151	234	2.36E-11	3.02E-07	0.00E+00	0.00E+00	0.00E+00
SM151	235	1.46E-11	2.62E-07	0.00E+00	0.00E+00	0.00E+00
SM151	236	1.09E-11	2.19E-07	0.00E+00	0.00E+00	0.00E+00
SM151	237	5.46E-12	1.78E-07	0.00E+00	0.00E+00	0.00E+00
SM151	238	7.28E-12	1.54E-07	0.00E+00	0.00E+00	0.00E+00
SM151	239	0.00E+00	1.25E-07	0.00E+00	0.00E+00	0.00E+00
SM151	240	5.46E-12	1.08E-07	0.00E+00	0.00E+00	0.00E+00
SM151	241	0.00E+00	8.79E-08	0.00E+00	0.00E+00	0.00E+00
SM151	242	0.00E+00	7.61E-08	0.00E+00	0.00E+00	0.00E+00
SM151	243	1.82E-12	6.18E-08	0.00E+00	0.00E+00	0.00E+00
SM151	244	0.00E+00	5.35E-08	0.00E+00	0.00E+00	0.00E+00
SM151	245	0.00E+00	4.47E-08	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

SM151	246	0.00E+00	3.63E-08	0.00E+00	0.00E+00	0.00E+00
SM151	247	1.82E-12	3.14E-08	0.00E+00	0.00E+00	0.00E+00
SM151	248	0.00E+00	2.56E-08	0.00E+00	0.00E+00	0.00E+00
SM151	249	0.00E+00	2.21E-08	0.00E+00	0.00E+00	0.00E+00
SM151	250	0.00E+00	1.80E-08	0.00E+00	0.00E+00	0.00E+00
TH230		0	0	50		
TH230	3 1	2.68E-04	9.37E-03	6.87E-01	7.90E-31	2.31E-04
TH230	3 2	9.24E-04	3.23E-02	9.88E-01	.00	1.46E-05
TH230	3 3	1.49E-03	5.21E-02	5.96E-01	.00	8.54E-06
TH230	3 4	2.01E-03	7.00E-02	3.59E-01	.00	5.14E-06
TH230	3 5	2.45E-03	8.53E-02	2.16E-01	.00	3.10E-06
TH230	3 6	2.83E-03	9.82E-02	1.31E-01	.00	1.87E-06
TH230	3 7	3.12E-03	1.08E-01	7.84E-02	.00	1.12E-06
TH230	3 8	3.37E-03	1.17E-01	4.74E-02	.00	6.80E-07
TH230	3 9	3.56E-03	1.23E-01	2.85E-02	.00	4.09E-07
TH230	310	3.69E-03	1.27E-01	1.71E-02	.00	2.46E-07
TH230	311	3.81E-03	1.31E-01	1.04E-02	.00	1.49E-07
TH230	312	3.88E-03	1.33E-01	6.23E-03	.00	8.93E-08
TH230	313	3.96E-03	1.36E-01	3.77E-03	.00	5.40E-08
TH230	314	3.99E-03	1.36E-01	2.26E-03	.00	3.24E-08
TH230	315	4.03E-03	1.38E-01	1.37E-03	.00	1.96E-08
TH230	316	4.05E-03	1.38E-01	8.24E-04	.00	1.18E-08
TH230	317	4.05E-03	1.38E-01	4.95E-04	.00	7.09E-09
TH230	318	4.07E-03	1.38E-01	2.99E-04	.00	4.29E-09
TH230	319	4.05E-03	1.37E-01	1.80E-04	.00	2.58E-09
TH230	320	4.06E-03	1.37E-01	1.09E-04	.00	1.56E-09
TH230	321	4.05E-03	1.36E-01	6.54E-05	.00	9.39E-10
TH230	322	4.03E-03	1.35E-01	3.93E-05	.00	5.60E-10
TH230	323	4.03E-03	1.35E-01	2.38E-05	.00	3.42E-10
TH230	324	4.01E-03	1.34E-01	1.42E-05	.00	2.04E-10
TH230	325	4.01E-03	1.34E-01	8.67E-06	.00	1.27E-10
TH230	326	3.98E-03	1.32E-01	5.19E-06	.00	6.91E-11
TH230	327	3.98E-03	1.32E-01	3.10E-06	.00	4.73E-11
TH230	328	3.96E-03	1.31E-01	1.91E-06	.00	2.55E-11
TH230	329	3.93E-03	1.30E-01	1.13E-06	.00	1.82E-11
TH230	330	3.93E-03	1.29E-01	6.85E-07	.00	1.09E-11
TH230	331	3.90E-03	1.28E-01	4.17E-07	.00	3.64E-12
TH230	332	3.89E-03	1.28E-01	2.68E-07	.00	3.64E-12
TH230	333	3.89E-03	1.27E-01	1.49E-07	.00	3.64E-12
TH230	334	3.79E-03	1.24E-01	8.94E-08	.00	.00
TH230	335	3.89E-03	1.27E-01	5.96E-08	.00	.00
TH230	336	3.88E-03	1.26E-01	2.98E-08	.00	.00
TH230	337	3.74E-03	1.21E-01	.00	.00	.00
TH230	338	3.84E-03	1.24E-01	.00	.00	.00
TH230	339	3.71E-03	1.19E-01	.00	.00	.00
TH230	340	3.81E-03	1.22E-01	.00	.00	.00
TH230	341	3.67E-03	1.18E-01	.00	.00	.00
TH230	342	3.77E-03	1.21E-01	.00	.00	.00
TH230	343	3.64E-03	1.16E-01	.00	.00	.00
TH230	344	3.74E-03	1.19E-01	.00	.00	.00

Appendix B - Inhalation Dose Rate Factors - FILE23

TH230	345	3.72E-03	1.18E-01	.00	.00	.00
TH230	346	3.59E-03	1.14E-01	.00	.00	.00
TH230	347	3.69E-03	1.17E-01	.00	.00	.00
TH230	348	3.56E-03	1.12E-01	.00	.00	.00
TH230	349	3.66E-03	1.15E-01	.00	.00	.00
TH230	350	3.53E-03	1.11E-01	.00	.00	.00
RA226	0	50	0			
RA226	2 1	2.47E-02	2.49E-02	5.94E-01	7.90E-31	1.62E-04
RA226	2 2	5.33E-02	5.41E-02	1.42E-01	.00	6.61E-06
RA226	2 3	5.24E-02	5.41E-02	8.93E-04	.00	3.99E-08
RA226	2 4	5.08E-02	5.32E-02	5.63E-06	.00	2.51E-10
RA226	2 5	4.92E-02	5.23E-02	3.73E-08	.00	1.82E-12
RA226	2 6	4.78E-02	5.16E-02	.00	.00	.00
RA226	2 7	4.61E-02	5.07E-02	.00	.00	.00
RA226	2 8	4.48E-02	5.00E-02	.00	.00	.00
RA226	2 9	4.34E-02	4.92E-02	.00	.00	.00
RA226	210	4.19E-02	4.83E-02	.00	.00	.00
RA226	211	4.08E-02	4.77E-02	.00	.00	.00
RA226	212	3.94E-02	4.68E-02	.00	.00	.00
RA226	213	3.83E-02	4.62E-02	.00	.00	.00
RA226	214	3.69E-02	4.53E-02	.00	.00	.00
RA226	215	3.59E-02	4.48E-02	.00	.00	.00
RA226	216	3.48E-02	4.40E-02	.00	.00	.00
RA226	217	3.36E-02	4.32E-02	.00	.00	.00
RA226	218	3.26E-02	4.27E-02	.00	.00	.00
RA226	219	3.15E-02	4.19E-02	.00	.00	.00
RA226	220	3.06E-02	4.13E-02	.00	.00	.00
RA226	221	2.97E-02	4.07E-02	.00	.00	.00
RA226	222	2.87E-02	3.99E-02	.00	.00	.00
RA226	223	2.79E-02	3.94E-02	.00	.00	.00
RA226	224	2.69E-02	3.87E-02	.00	.00	.00
RA226	225	2.62E-02	3.82E-02	.00	.00	.00
RA226	226	2.53E-02	3.75E-02	.00	.00	.00
RA226	227	2.45E-02	3.70E-02	.00	.00	.00
RA226	228	2.38E-02	3.64E-02	.00	.00	.00
RA226	229	2.30E-02	3.57E-02	.00	.00	.00
RA226	230	2.23E-02	3.53E-02	.00	.00	.00
RA226	231	2.16E-02	3.46E-02	.00	.00	.00
RA226	232	2.10E-02	3.42E-02	.00	.00	.00
RA226	233	2.04E-02	3.37E-02	.00	.00	.00
RA226	234	1.93E-02	3.25E-02	.00	.00	.00
RA226	235	1.93E-02	3.30E-02	.00	.00	.00
RA226	236	1.87E-02	3.25E-02	.00	.00	.00
RA226	237	1.75E-02	3.10E-02	.00	.00	.00
RA226	238	1.75E-02	3.15E-02	.00	.00	.00
RA226	239	1.65E-02	3.00E-02	.00	.00	.00
RA226	240	1.65E-02	3.05E-02	.00	.00	.00
RA226	241	1.55E-02	2.91E-02	.00	.00	.00
RA226	242	1.55E-02	2.95E-02	.00	.00	.00
RA226	243	1.45E-02	2.82E-02	.00	.00	.00

Appendix B - Inhalation Dose Rate Factors - FILE23

RA226	244	1.45E-02	2.86E-02	.00	.00	.00
RA226	245	1.41E-02	2.82E-02	.00	.00	.00
RA226	246	1.32E-02	2.68E-02	.00	.00	.00
RA226	247	1.32E-02	2.73E-02	.00	.00	.00
RA226	248	1.24E-02	2.60E-02	.00	.00	.00
RA226	249	1.24E-02	2.64E-02	.00	.00	.00
RA226	250	1.16E-02	2.52E-02	.00	.00	.00
RN222	0	0	0			
PB210	50	0	0			
PB210	1 1	2.19E-03	3.53E-02	9.83E-06	7.90E-31	2.67E-06
PB210	1 2	3.82E-03	6.61E-02	1.94E-08	.00	1.59E-10
PB210	1 3	3.10E-03	5.95E-02	.00	.00	.00
PB210	1 4	2.52E-03	5.35E-02	.00	.00	.00
PB210	1 5	2.04E-03	4.82E-02	.00	.00	.00
PB210	1 6	1.66E-03	4.35E-02	.00	.00	.00
PB210	1 7	1.34E-03	3.90E-02	.00	.00	.00
PB210	1 8	1.09E-03	3.52E-02	.00	.00	.00
PB210	1 9	8.86E-04	3.17E-02	.00	.00	.00
PB210	110	7.17E-04	2.85E-02	.00	.00	.00
PB210	111	5.83E-04	2.57E-02	.00	.00	.00
PB210	112	4.72E-04	2.31E-02	.00	.00	.00
PB210	113	3.84E-04	2.08E-02	.00	.00	.00
PB210	114	3.11E-04	1.87E-02	.00	.00	.00
PB210	115	2.53E-04	1.69E-02	.00	.00	.00
PB210	116	2.05E-04	1.52E-02	.00	.00	.00
PB210	117	1.66E-04	1.36E-02	.00	.00	.00
PB210	118	1.35E-04	1.23E-02	.00	.00	.00
PB210	119	1.09E-04	1.11E-02	.00	.00	.00
PB210	120	8.89E-05	9.99E-03	.00	.00	.00
PB210	121	7.21E-05	9.00E-03	.00	.00	.00
PB210	122	5.83E-05	8.07E-03	.00	.00	.00
PB210	123	4.75E-05	7.29E-03	.00	.00	.00
PB210	124	3.84E-05	6.54E-03	.00	.00	.00
PB210	125	3.13E-05	5.91E-03	.00	.00	.00
PB210	126	2.53E-05	5.30E-03	.00	.00	.00
PB210	127	2.06E-05	4.79E-03	.00	.00	.00
PB210	128	1.67E-05	4.31E-03	.00	.00	.00
PB210	129	1.35E-05	3.87E-03	.00	.00	.00
PB210	130	1.10E-05	3.50E-03	.00	.00	.00
PB210	131	8.89E-06	3.14E-03	.00	.00	.00
PB210	132	7.23E-06	2.83E-03	.00	.00	.00
PB210	133	5.88E-06	2.56E-03	.00	.00	.00
PB210	134	4.67E-06	2.25E-03	.00	.00	.00
PB210	135	3.92E-06	2.10E-03	.00	.00	.00
PB210	136	3.17E-06	1.88E-03	.00	.00	.00
PB210	137	2.49E-06	1.64E-03	.00	.00	.00
PB210	138	2.09E-06	1.53E-03	.00	.00	.00
PB210	139	1.64E-06	1.33E-03	.00	.00	.00
PB210	140	1.38E-06	1.24E-03	.00	.00	.00
PB210	141	1.08E-06	1.08E-03	.00	.00	.00

Appendix B - Inhalation Dose Rate Factors - FILE23

PB210	142	9.06E-07	1.00E-03	.00	.00	.00
PB210	143	7.12E-07	8.76E-04	.00	.00	.00
PB210	144	5.97E-07	8.14E-04	.00	.00	.00
PB210	145	4.83E-07	7.32E-04	.00	.00	.00
PB210	146	3.79E-07	6.39E-04	.00	.00	.00
PB210	147	3.18E-07	5.94E-04	.00	.00	.00
PB210	148	2.50E-07	5.18E-04	.00	.00	.00
PB210	149	2.10E-07	4.81E-04	.00	.00	.00
PB210	150	1.65E-07	4.20E-04	.00	.00	.00
BI210	0 2	0	0			
BI210	2 1	1.43E-05	2.48E-05	9.94E-03	7.90E-31	1.38E-04
BI210	2 2	1.56E-07	3.86E-07	1.65E-04	.00	2.99E-07
PO210	0 4	0	0			
PO210	2 1	1.14E-03	4.91E-03	2.33E-01	7.90E-31	2.30E-04
PO210	2 2	1.94E-04	7.26E-04	3.86E-02	.00	5.52E-06
PO210	2 3	3.41E-07	1.13E-06	3.91E-05	.00	5.18E-09
PO210	2 4	5.53E-10	1.86E-09	4.10E-08	.00	5.46E-12
TH232	0 0 50	0	0			
TH232	3 1	3.46E-04	1.05E-02	8.16E-01	0.00E+00	1.97E-04
TH232	3 2	1.19E-03	3.63E-02	1.17E+00	0.00E+00	1.24E-05
TH232	3 3	1.93E-03	5.86E-02	7.07E-01	0.00E+00	7.27E-06
TH232	3 4	2.59E-03	7.87E-02	4.26E-01	0.00E+00	4.38E-06
TH232	3 5	3.17E-03	9.60E-02	2.57E-01	0.00E+00	2.64E-06
TH232	3 6	3.65E-03	1.10E-01	1.55E-01	0.00E+00	1.59E-06
TH232	3 7	4.03E-03	1.22E-01	9.31E-02	0.00E+00	9.57E-07
TH232	3 8	4.35E-03	1.31E-01	5.63E-02	0.00E+00	5.78E-07
TH232	3 9	4.59E-03	1.38E-01	3.39E-02	0.00E+00	3.48E-07
TH232	310	4.77E-03	1.43E-01	2.04E-02	0.00E+00	2.09E-07
TH232	311	4.92E-03	1.48E-01	1.23E-02	0.00E+00	1.26E-07
TH232	312	5.02E-03	1.50E-01	7.40E-03	0.00E+00	7.60E-08
TH232	313	5.11E-03	1.53E-01	4.47E-03	0.00E+00	4.60E-08
TH232	314	5.15E-03	1.54E-01	2.69E-03	0.00E+00	2.76E-08
TH232	315	5.21E-03	1.55E-01	1.62E-03	0.00E+00	1.67E-08
TH232	316	5.23E-03	1.55E-01	9.78E-04	0.00E+00	1.01E-08
TH232	317	5.23E-03	1.55E-01	5.88E-04	0.00E+00	6.02E-09
TH232	318	5.25E-03	1.55E-01	3.55E-04	0.00E+00	3.65E-09
TH232	319	5.24E-03	1.54E-01	2.14E-04	0.00E+00	2.20E-09
TH232	320	5.25E-03	1.54E-01	1.29E-04	0.00E+00	1.32E-09
TH232	321	5.24E-03	1.54E-01	7.75E-05	0.00E+00	8.00E-10
TH232	322	5.21E-03	1.52E-01	4.70E-05	0.00E+00	4.66E-10
TH232	323	5.21E-03	1.52E-01	2.81E-05	0.00E+00	3.06E-10
TH232	324	5.18E-03	1.51E-01	1.69E-05	0.00E+00	1.75E-10
TH232	325	5.18E-03	1.50E-01	1.00E-05	0.00E+00	1.02E-10
TH232	326	5.14E-03	1.49E-01	6.20E-06	0.00E+00	5.82E-11
TH232	327	5.14E-03	1.48E-01	3.81E-06	0.00E+00	4.37E-11
TH232	328	5.12E-03	1.47E-01	2.15E-06	0.00E+00	2.91E-11
TH232	329	5.08E-03	1.46E-01	1.43E-06	0.00E+00	1.46E-11
TH232	330	5.08E-03	1.46E-01	9.54E-07	0.00E+00	0.00E+00
TH232	331	5.04E-03	1.44E-01	2.38E-07	0.00E+00	1.46E-11
TH232	332	5.03E-03	1.44E-01	2.38E-07	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

TH232	333	5.03E-03	1.43E-01	4.77E-07	0.00E+00	0.00E+00
TH232	334	4.89E-03	1.39E-01	0.00E+00	0.00E+00	0.00E+00
TH232	335	5.03E-03	1.42E-01	2.38E-07	0.00E+00	0.00E+00
TH232	336	5.01E-03	1.42E-01	0.00E+00	0.00E+00	0.00E+00
TH232	337	4.83E-03	1.36E-01	0.00E+00	0.00E+00	0.00E+00
TH232	338	4.96E-03	1.40E-01	0.00E+00	0.00E+00	0.00E+00
TH232	339	4.79E-03	1.34E-01	0.00E+00	0.00E+00	0.00E+00
TH232	340	4.92E-03	1.38E-01	0.00E+00	0.00E+00	0.00E+00
TH232	341	4.75E-03	1.32E-01	0.00E+00	0.00E+00	0.00E+00
TH232	342	4.88E-03	1.36E-01	0.00E+00	0.00E+00	0.00E+00
TH232	343	4.70E-03	1.31E-01	0.00E+00	0.00E+00	0.00E+00
TH232	344	4.83E-03	1.34E-01	0.00E+00	0.00E+00	0.00E+00
TH232	345	4.81E-03	1.33E-01	0.00E+00	0.00E+00	0.00E+00
TH232	346	4.64E-03	1.28E-01	0.00E+00	0.00E+00	0.00E+00
TH232	347	4.77E-03	1.31E-01	0.00E+00	0.00E+00	0.00E+00
TH232	348	4.60E-03	1.26E-01	0.00E+00	0.00E+00	0.00E+00
TH232	349	4.73E-03	1.29E-01	0.00E+00	0.00E+00	0.00E+00
TH232	350	4.56E-03	1.24E-01	0.00E+00	0.00E+00	0.00E+00
RA228	0	50	0			
RA228	2 1	4.96E-02	4.12E-02	1.17E-01	0.00E+00	2.12E-04
RA228	2 2	9.90E-02	8.30E-02	2.71E-02	0.00E+00	8.31E-06
RA228	2 3	8.64E-02	7.35E-02	1.51E-04	0.00E+00	4.44E-08
RA228	2 4	7.42E-02	6.42E-02	8.49E-07	0.00E+00	2.47E-10
RA228	2 5	6.37E-02	5.60E-02	0.00E+00	0.00E+00	0.00E+00
RA228	2 6	5.49E-02	4.90E-02	0.00E+00	0.00E+00	0.00E+00
RA228	2 7	4.70E-02	4.26E-02	0.00E+00	0.00E+00	0.00E+00
RA228	2 8	4.05E-02	3.73E-02	0.00E+00	0.00E+00	0.00E+00
RA228	2 9	3.48E-02	3.26E-02	0.00E+00	0.00E+00	0.00E+00
RA228	210	2.98E-02	2.83E-02	0.00E+00	0.00E+00	0.00E+00
RA228	211	2.57E-02	2.48E-02	0.00E+00	0.00E+00	0.00E+00
RA228	212	2.20E-02	2.16E-02	0.00E+00	0.00E+00	0.00E+00
RA228	213	1.90E-02	1.89E-02	0.00E+00	0.00E+00	0.00E+00
RA228	214	1.62E-02	1.65E-02	0.00E+00	0.00E+00	0.00E+00
RA228	215	1.40E-02	1.44E-02	0.00E+00	0.00E+00	0.00E+00
RA228	216	1.20E-02	1.26E-02	0.00E+00	0.00E+00	0.00E+00
RA228	217	1.03E-02	1.09E-02	0.00E+00	0.00E+00	0.00E+00
RA228	218	8.87E-03	9.58E-03	0.00E+00	0.00E+00	0.00E+00
RA228	219	7.60E-03	8.33E-03	0.00E+00	0.00E+00	0.00E+00
RA228	220	6.55E-03	7.30E-03	0.00E+00	0.00E+00	0.00E+00
RA228	221	5.63E-03	6.37E-03	0.00E+00	0.00E+00	0.00E+00
RA228	222	4.82E-03	5.54E-03	0.00E+00	0.00E+00	0.00E+00
RA228	223	4.15E-03	4.85E-03	0.00E+00	0.00E+00	0.00E+00
RA228	224	3.56E-03	4.22E-03	0.00E+00	0.00E+00	0.00E+00
RA228	225	3.07E-03	3.70E-03	0.00E+00	0.00E+00	0.00E+00
RA228	226	2.63E-03	3.22E-03	0.00E+00	0.00E+00	0.00E+00
RA228	227	2.26E-03	2.82E-03	0.00E+00	0.00E+00	0.00E+00
RA228	228	1.94E-03	2.46E-03	0.00E+00	0.00E+00	0.00E+00
RA228	229	1.66E-03	2.14E-03	0.00E+00	0.00E+00	0.00E+00
RA228	230	1.44E-03	1.87E-03	0.00E+00	0.00E+00	0.00E+00
RA228	231	1.23E-03	1.63E-03	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

RA228	232	1.06E-03	1.43E-03	0.00E+00	0.00E+00	0.00E+00
RA228	233	9.13E-04	1.25E-03	0.00E+00	0.00E+00	0.00E+00
RA228	234	7.67E-04	1.07E-03	0.00E+00	0.00E+00	0.00E+00
RA228	235	6.81E-04	9.62E-04	0.00E+00	0.00E+00	0.00E+00
RA228	236	5.84E-04	8.38E-04	0.00E+00	0.00E+00	0.00E+00
RA228	237	4.86E-04	7.09E-04	0.00E+00	0.00E+00	0.00E+00
RA228	238	4.31E-04	6.39E-04	0.00E+00	0.00E+00	0.00E+00
RA228	239	3.59E-04	5.40E-04	0.00E+00	0.00E+00	0.00E+00
RA228	240	3.18E-04	4.87E-04	0.00E+00	0.00E+00	0.00E+00
RA228	241	2.65E-04	4.12E-04	0.00E+00	0.00E+00	0.00E+00
RA228	242	2.35E-04	3.71E-04	0.00E+00	0.00E+00	0.00E+00
RA228	243	1.96E-04	3.14E-04	0.00E+00	0.00E+00	0.00E+00
RA228	244	1.74E-04	2.83E-04	0.00E+00	0.00E+00	0.00E+00
RA228	245	1.49E-04	2.46E-04	0.00E+00	0.00E+00	0.00E+00
RA228	246	1.24E-04	2.08E-04	0.00E+00	0.00E+00	0.00E+00
RA228	247	1.10E-04	1.88E-04	0.00E+00	0.00E+00	0.00E+00
RA228	248	9.16E-05	1.59E-04	0.00E+00	0.00E+00	0.00E+00
RA228	249	8.12E-05	1.43E-04	0.00E+00	0.00E+00	0.00E+00
RA228	250	6.76E-05	1.21E-04	0.00E+00	0.00E+00	0.00E+00
TH228		0	0	46		
TH228	3 1	1.12E-03	3.30E-02	3.09E+00	0.00E+00	2.15E-03
TH228	3 2	3.00E-03	8.83E-02	3.58E+00	0.00E+00	1.00E-04
TH228	3 3	3.43E-03	1.01E-01	1.50E+00	0.00E+00	4.03E-05
TH228	3 4	3.24E-03	9.51E-02	6.31E-01	0.00E+00	1.69E-05
TH228	3 5	2.76E-03	8.11E-02	2.65E-01	0.00E+00	7.10E-06
TH228	3 6	2.22E-03	6.52E-02	1.11E-01	0.00E+00	2.98E-06
TH228	3 7	1.71E-03	5.00E-02	4.65E-02	0.00E+00	1.25E-06
TH228	3 8	1.29E-03	3.76E-02	1.96E-02	0.00E+00	5.25E-07
TH228	3 9	9.47E-04	2.76E-02	8.20E-03	0.00E+00	2.20E-07
TH228	310	6.85E-04	1.99E-02	3.43E-03	0.00E+00	9.20E-08
TH228	311	4.93E-04	1.43E-02	1.44E-03	0.00E+00	3.89E-08
TH228	312	3.50E-04	1.01E-02	6.04E-04	0.00E+00	1.61E-08
TH228	313	2.48E-04	7.18E-03	2.55E-04	0.00E+00	6.98E-09
TH228	314	1.74E-04	5.03E-03	1.06E-04	0.00E+00	2.79E-09
TH228	315	1.23E-04	3.53E-03	4.48E-05	0.00E+00	1.40E-09
TH228	316	8.57E-05	2.46E-03	1.91E-05	0.00E+00	2.33E-10
TH228	317	5.97E-05	1.71E-03	6.68E-06	0.00E+00	2.33E-10
TH228	318	4.17E-05	1.19E-03	3.81E-06	0.00E+00	0.00E+00
TH228	319	2.90E-05	8.26E-04	1.91E-06	0.00E+00	0.00E+00
TH228	320	2.02E-05	5.75E-04	0.00E+00	0.00E+00	0.00E+00
TH228	321	1.40E-05	3.99E-04	0.00E+00	0.00E+00	0.00E+00
TH228	322	9.72E-06	2.75E-04	0.00E+00	0.00E+00	0.00E+00
TH228	323	6.77E-06	1.91E-04	0.00E+00	0.00E+00	0.00E+00
TH228	324	4.68E-06	1.32E-04	0.00E+00	0.00E+00	0.00E+00
TH228	325	3.26E-06	9.17E-05	0.00E+00	0.00E+00	0.00E+00
TH228	326	2.26E-06	6.32E-05	0.00E+00	0.00E+00	0.00E+00
TH228	327	1.57E-06	4.39E-05	0.00E+00	0.00E+00	0.00E+00
TH228	328	1.08E-06	3.03E-05	0.00E+00	0.00E+00	0.00E+00
TH228	329	7.51E-07	2.09E-05	0.00E+00	0.00E+00	0.00E+00
TH228	330	5.23E-07	1.45E-05	9.54E-07	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

TH228	331	3.61E-07	9.95E-06	0.00E+00	0.00E+00	0.00E+00
TH228	332	2.50E-07	6.97E-06	0.00E+00	0.00E+00	0.00E+00
TH228	333	1.77E-07	4.83E-06	0.00E+00	0.00E+00	0.00E+00
TH228	334	1.15E-07	3.22E-06	0.00E+00	0.00E+00	0.00E+00
TH228	335	8.57E-08	2.38E-06	0.00E+00	0.00E+00	0.00E+00
TH228	336	5.96E-08	1.61E-06	0.00E+00	0.00E+00	0.00E+00
TH228	337	3.91E-08	1.01E-06	0.00E+00	0.00E+00	0.00E+00
TH228	338	2.79E-08	8.34E-07	0.00E+00	0.00E+00	0.00E+00
TH228	339	1.86E-08	4.77E-07	0.00E+00	0.00E+00	0.00E+00
TH228	340	1.30E-08	3.58E-07	0.00E+00	0.00E+00	0.00E+00
TH228	341	9.31E-09	2.98E-07	0.00E+00	0.00E+00	0.00E+00
TH228	342	5.59E-09	1.19E-07	0.00E+00	0.00E+00	0.00E+00
TH228	343	5.59E-09	1.19E-07	0.00E+00	0.00E+00	0.00E+00
TH228	344	1.86E-09	5.96E-08	0.00E+00	0.00E+00	0.00E+00
TH228	345	3.73E-09	1.19E-07	0.00E+00	0.00E+00	0.00E+00
TH228	346	1.86E-09	5.96E-08	0.00E+00	0.00E+00	0.00E+00
AC228		0	0	2		
AC228	3 1	1.60E-06	2.02E-05	7.21E-03	0.00E+00	2.56E-05
AC228	3 2	1.68E-09	2.12E-08	6.76E-06	0.00E+00	1.51E-08
RA224		0	2	0		
RA224	2 1	1.36E-03	6.81E-03	1.44E-01	0.00E+00	9.60E-04
RA224	2 2	2.19E-05	1.09E-04	1.76E-03	0.00E+00	1.85E-06
PB212		2	0	0		
PB212	1 1	9.01E-05	1.26E-03	4.13E-03	0.00E+00	1.28E-05
PB212	1 2	1.88E-07	2.64E-06	3.83E-06	0.00E+00	6.19E-10
BI212		0	2	0		
BI212	2 1	1.48E-06	2.21E-06	7.55E-04	0.00E+00	8.06E-09
BI212	2 2	2.92E-10	4.38E-10	1.23E-07	0.00E+00	1.20E-12
U 235		0	0	50		
U 235	3 1	2.42E-04	1.99E-03	6.58E-01	.00	2.53E-04
U 235	3 2	2.99E-04	3.93E-03	9.47E-01	.00	1.60E-05
U 235	3 3	2.28E-04	3.80E-03	5.71E-01	.00	9.35E-06
U 235	3 4	2.01E-04	3.53E-03	3.44E-01	.00	5.63E-06
U 235	3 5	1.72E-04	3.14E-03	2.07E-01	.00	3.39E-06
U 235	3 6	1.43E-04	2.71E-03	1.25E-01	.00	2.05E-06
U 235	3 7	1.17E-04	2.27E-03	7.51E-02	.00	1.23E-06
U 235	3 8	9.47E-05	1.88E-03	4.54E-02	.00	7.44E-07
U 235	3 9	7.57E-05	1.52E-03	2.74E-02	.00	4.48E-07
U 235	310	5.99E-05	1.22E-03	1.64E-02	.00	2.69E-07
U 235	311	4.74E-05	9.75E-04	9.94E-03	.00	1.63E-07
U 235	312	3.72E-05	7.70E-04	5.97E-03	.00	9.78E-08
U 235	313	2.92E-05	6.09E-04	3.61E-03	.00	5.91E-08
U 235	314	2.28E-05	4.77E-04	2.17E-03	.00	3.55E-08
U 235	315	1.79E-05	3.75E-04	1.31E-03	.00	2.15E-08
U 235	316	1.39E-05	2.93E-04	7.89E-04	.00	1.29E-08
U 235	317	1.08E-05	2.28E-04	4.74E-04	.00	7.77E-09
U 235	318	8.44E-06	1.78E-04	2.87E-04	.00	4.70E-09
U 235	319	6.55E-06	1.38E-04	1.72E-04	.00	2.82E-09
U 235	320	5.11E-06	1.08E-04	1.04E-04	.00	1.71E-09
U 235	321	3.97E-06	8.40E-05	6.27E-05	.00	1.03E-09

Appendix B - Inhalation Dose Rate Factors - FILE23

U 235	322	3.07E-06	6.51E-05	3.77E-05	.00	6.18E-10
U 235	323	2.40E-06	5.08E-05	2.28E-05	.00	3.75E-10
U 235	324	1.86E-06	3.93E-05	1.37E-05	.00	2.22E-10
U 235	325	1.45E-06	3.06E-05	8.29E-06	.00	1.38E-10
U 235	326	1.12E-06	2.37E-05	4.95E-06	.00	8.00E-11
U 235	327	8.72E-07	1.85E-05	3.01E-06	.00	5.09E-11
U 235	328	6.77E-07	1.44E-05	1.82E-06	.00	2.91E-11
U 235	329	5.24E-07	1.11E-05	1.07E-06	.00	1.82E-11
U 235	330	4.08E-07	8.66E-06	6.85E-07	.00	1.09E-11
U 235	331	3.16E-07	6.70E-06	3.87E-07	.00	7.28E-12
U 235	332	2.46E-07	5.22E-06	2.38E-07	.00	3.64E-12
U 235	333	1.91E-07	4.06E-06	1.49E-07	.00	.00
U 235	334	1.46E-07	3.09E-06	8.94E-08	.00	.00
U 235	335	1.17E-07	2.48E-06	.00	.00	.00
U 235	336	9.03E-08	1.92E-06	.00	.00	.00
U 235	337	6.80E-08	1.44E-06	.00	.00	.00
U 235	338	5.45E-08	1.16E-06	.00	.00	.00
U 235	339	4.10E-08	8.69E-07	2.98E-08	.00	.00
U 235	340	3.29E-08	6.98E-07	.00	.00	.00
U 235	341	2.47E-08	5.25E-07	.00	.00	.00
U 235	342	1.98E-08	4.21E-07	.00	.00	.00
U 235	343	1.49E-08	3.16E-07	.00	.00	.00
U 235	344	1.19E-08	2.54E-07	.00	.00	.00
U 235	345	9.27E-09	1.96E-07	.00	.00	.00
U 235	346	6.96E-09	1.48E-07	.00	.00	.00
U 235	347	5.59E-09	1.19E-07	.00	.00	.00
U 235	348	4.21E-09	8.89E-08	.00	.00	.00
U 235	349	3.38E-09	7.12E-08	.00	.00	.00
U 235	350	2.53E-09	5.36E-08	.00	.00	.00
TH231		0	0	2		
TH231	3 1	5.43E-09	1.18E-07	1.17E-05	.00	2.18E-05
TH231	3 2	2.35E-11	5.11E-10	4.31E-08	.00	2.58E-08
PA231		0	0	50		
PA231	3 1	7.81E-04	1.88E-02	1.00E+00	7.90E-31	2.76E-04
PA231	3 2	2.69E-03	6.48E-02	1.44E+00	.00	1.74E-05
PA231	3 3	4.34E-03	1.05E-01	8.69E-01	.00	1.02E-05
PA231	3 4	5.84E-03	1.41E-01	5.23E-01	.00	6.13E-06
PA231	3 5	7.12E-03	1.71E-01	3.15E-01	.00	3.69E-06
PA231	3 6	8.20E-03	1.97E-01	1.90E-01	.00	2.23E-06
PA231	3 7	9.04E-03	2.17E-01	1.14E-01	.00	1.34E-06
PA231	3 8	9.75E-03	2.34E-01	6.91E-02	.00	8.10E-07
PA231	3 9	1.03E-02	2.47E-01	4.16E-02	.00	4.88E-07
PA231	310	1.07E-02	2.56E-01	2.50E-02	.00	2.93E-07
PA231	311	1.10E-02	2.64E-01	1.51E-02	.00	1.77E-07
PA231	312	1.12E-02	2.68E-01	9.08E-03	.00	1.06E-07
PA231	313	1.14E-02	2.72E-01	5.49E-03	.00	6.43E-08
PA231	314	1.14E-02	2.74E-01	3.30E-03	.00	3.86E-08
PA231	315	1.16E-02	2.76E-01	1.99E-03	.00	2.34E-08
PA231	316	1.16E-02	2.77E-01	1.20E-03	.00	1.41E-08
PA231	317	1.16E-02	2.76E-01	7.21E-04	.00	8.45E-09

Appendix B - Inhalation Dose Rate Factors - FILE23

PA231	318	1.16E-02	2.77E-01	4.36E-04	.00	5.11E-09
PA231	319	1.15E-02	2.75E-01	2.62E-04	.00	3.07E-09
PA231	320	1.15E-02	2.75E-01	1.58E-04	.00	1.85E-09
PA231	321	1.15E-02	2.74E-01	9.54E-05	.00	1.12E-09
PA231	322	1.14E-02	2.72E-01	5.73E-05	.00	6.69E-10
PA231	323	1.14E-02	2.71E-01	3.47E-05	.00	4.07E-10
PA231	324	1.13E-02	2.69E-01	2.09E-05	.00	2.44E-10
PA231	325	1.13E-02	2.68E-01	1.25E-05	.00	1.46E-10
PA231	326	1.12E-02	2.66E-01	7.63E-06	.00	9.09E-11
PA231	327	1.12E-02	2.65E-01	4.53E-06	.00	5.46E-11
PA231	328	1.11E-02	2.63E-01	2.74E-06	.00	3.27E-11
PA231	329	1.10E-02	2.61E-01	1.67E-06	.00	1.82E-11
PA231	330	1.10E-02	2.60E-01	1.01E-06	.00	1.09E-11
PA231	331	1.09E-02	2.57E-01	5.96E-07	.00	7.28E-12
PA231	332	1.08E-02	2.56E-01	2.98E-07	.00	7.28E-12
PA231	333	1.08E-02	2.55E-01	2.38E-07	.00	.00
PA231	334	1.05E-02	2.48E-01	1.19E-07	.00	.00
PA231	335	1.08E-02	2.54E-01	1.19E-07	.00	.00
PA231	336	1.07E-02	2.53E-01	5.96E-08	.00	.00
PA231	337	1.03E-02	2.43E-01	.00	.00	.00
PA231	338	1.06E-02	2.49E-01	.00	.00	.00
PA231	339	1.02E-02	2.40E-01	.00	.00	.00
PA231	340	1.05E-02	2.46E-01	.00	.00	.00
PA231	341	1.01E-02	2.36E-01	.00	.00	.00
PA231	342	1.03E-02	2.42E-01	.00	.00	.00
PA231	343	9.95E-03	2.33E-01	.00	.00	.00
PA231	344	1.02E-02	2.39E-01	.00	.00	.00
PA231	345	1.01E-02	2.37E-01	.00	.00	.00
PA231	346	9.76E-03	2.28E-01	.00	.00	.00
PA231	347	1.00E-02	2.34E-01	.00	.00	.00
PA231	348	9.64E-03	2.25E-01	.00	.00	.00
PA231	349	9.89E-03	2.31E-01	.00	.00	.00
PA231	350	9.52E-03	2.22E-01	.00	.00	.00
AC227		0	0	50		
AC227	3 1	1.10E-03	1.65E-02	4.54E+00	7.90E-31	9.35E-06
AC227	3 2	3.70E-03	5.56E-02	6.40E+00	.00	5.74E-07
AC227	3 3	5.78E-03	8.71E-02	3.74E+00	.00	3.25E-07
AC227	3 4	7.52E-03	1.14E-01	2.18E+00	.00	1.90E-07
AC227	3 5	8.86E-03	1.34E-01	1.27E+00	.00	1.11E-07
AC227	3 6	9.87E-03	1.50E-01	7.45E-01	.00	6.47E-08
AC227	3 7	1.05E-02	1.60E-01	4.34E-01	.00	3.77E-08
AC227	3 8	1.09E-02	1.67E-01	2.54E-01	.00	2.21E-08
AC227	3 9	1.12E-02	1.70E-01	1.48E-01	.00	1.29E-08
AC227	310	1.12E-02	1.71E-01	8.62E-02	.00	7.49E-09
AC227	311	1.11E-02	1.71E-01	5.05E-02	.00	4.39E-09
AC227	312	1.09E-02	1.68E-01	2.94E-02	.00	2.56E-09
AC227	313	1.07E-02	1.66E-01	1.72E-02	.00	1.50E-09
AC227	314	1.04E-02	1.61E-01	1.00E-02	.00	8.71E-10
AC227	315	1.01E-02	1.58E-01	5.87E-03	.00	5.10E-10
AC227	316	9.83E-03	1.53E-01	3.43E-03	.00	2.98E-10

Appendix B - Inhalation Dose Rate Factors - FILE23

AC227	317	9.46E-03	1.48E-01	1.99E-03	.00	1.73E-10
AC227	318	9.16E-03	1.44E-01	1.17E-03	.00	1.02E-10
AC227	319	8.79E-03	1.39E-01	6.80E-04	.00	5.90E-11
AC227	320	8.49E-03	1.34E-01	3.98E-04	.00	3.47E-11
AC227	321	8.16E-03	1.29E-01	2.32E-04	.00	2.01E-11
AC227	322	7.82E-03	1.24E-01	1.35E-04	.00	1.18E-11
AC227	323	7.53E-03	1.20E-01	7.92E-05	.00	6.82E-12
AC227	324	7.21E-03	1.16E-01	4.60E-05	.00	4.09E-12
AC227	325	6.94E-03	1.12E-01	2.72E-05	.00	2.39E-12
AC227	326	6.64E-03	1.07E-01	1.57E-05	.00	1.36E-12
AC227	327	6.39E-03	1.04E-01	9.06E-06	.00	6.82E-13
AC227	328	6.13E-03	9.96E-02	5.48E-06	.00	4.55E-13
AC227	329	5.86E-03	9.56E-02	3.10E-06	.00	2.27E-13
AC227	330	5.63E-03	9.23E-02	1.91E-06	.00	2.27E-13
AC227	331	5.39E-03	8.85E-02	1.19E-06	.00	1.14E-13
AC227	332	5.18E-03	8.55E-02	4.77E-07	.00	.00
AC227	333	4.98E-03	8.25E-02	4.77E-07	.00	.00
AC227	334	4.67E-03	7.77E-02	.00	.00	.00
AC227	335	4.63E-03	7.71E-02	.00	.00	.00
AC227	336	4.43E-03	7.42E-02	.00	.00	.00
AC227	337	4.12E-03	6.92E-02	.00	.00	.00
AC227	338	4.07E-03	6.87E-02	.00	.00	.00
AC227	339	3.78E-03	6.40E-02	.00	.00	.00
AC227	340	3.75E-03	6.36E-02	.00	.00	.00
AC227	341	3.48E-03	5.93E-02	.00	.00	.00
AC227	342	3.44E-03	5.89E-02	.00	.00	.00
AC227	343	3.20E-03	5.49E-02	.00	.00	.00
AC227	344	3.16E-03	5.45E-02	.00	.00	.00
AC227	345	3.03E-03	5.24E-02	.00	.00	.00
AC227	346	2.82E-03	4.89E-02	.00	.00	.00
AC227	347	2.79E-03	4.85E-02	.00	.00	.00
AC227	348	2.59E-03	4.53E-02	.00	.00	.00
AC227	349	2.56E-03	4.49E-02	.00	.00	.00
AC227	350	2.38E-03	4.19E-02	.00	.00	.00
TH227		0 0	3			
TH227	3 1	1.08E-04	3.73E-03	7.47E-01	7.90E-31	2.81E-04
TH227	3 2	9.41E-06	3.26E-04	5.43E-02	.00	6.63E-07
TH227	3 3	2.27E-11	8.15E-10	3.73E-08	.00	.00
FR223		2 0	0			
FR223	1 1	0.00E+00	0.00E+00	2.47E-07	0.00E+00	0.00E+00
FR223	1 2	0.00E+00	0.00E+00	1.43E-11	0.00E+00	4.36E-21
RA223		0 2	0			
RA223	2 1	4.61E-03	2.31E-02	3.60E-01	7.90E-31	1.02E-03
RA223	2 2	2.42E-04	1.21E-03	1.32E-02	.00	3.60E-06
NP237		0 50	0			
NP237	2 1	4.64E-03	1.07E-01	2.64E-01	.00	2.36E-04
NP237	2 2	1.07E-02	2.45E-01	6.31E-02	.00	9.64E-06
NP237	2 3	1.08E-02	2.49E-01	3.98E-04	.00	5.83E-08
NP237	2 4	1.08E-02	2.47E-01	2.51E-06	.00	3.71E-10
NP237	2 5	1.07E-02	2.45E-01	1.49E-08	.00	.00

Appendix B - Inhalation Dose Rate Factors - FILE23

NP237	2 6	1.07E-02	2.44E-01	.00	.00	.00
NP237	2 7	1.06E-02	2.42E-01	.00	.00	.00
NP237	2 8	1.05E-02	2.41E-01	.00	.00	.00
NP237	2 9	1.04E-02	2.39E-01	.00	.00	.00
NP237	210	1.03E-02	2.37E-01	.00	.00	.00
NP237	211	1.03E-02	2.36E-01	.00	.00	.00
NP237	212	1.02E-02	2.33E-01	.00	.00	.00
NP237	213	1.02E-02	2.33E-01	.00	.00	.00
NP237	214	1.01E-02	2.30E-01	.00	.00	.00
NP237	215	1.00E-02	2.29E-01	.00	.00	.00
NP237	216	9.98E-03	2.28E-01	.00	.00	.00
NP237	217	9.89E-03	2.25E-01	.00	.00	.00
NP237	218	9.86E-03	2.25E-01	.00	.00	.00
NP237	219	9.76E-03	2.22E-01	.00	.00	.00
NP237	220	9.73E-03	2.21E-01	.00	.00	.00
NP237	221	9.67E-03	2.20E-01	.00	.00	.00
NP237	222	9.57E-03	2.18E-01	.00	.00	.00
NP237	223	9.54E-03	2.17E-01	.00	.00	.00
NP237	224	9.45E-03	2.15E-01	.00	.00	.00
NP237	225	9.42E-03	2.14E-01	.00	.00	.00
NP237	226	9.33E-03	2.12E-01	.00	.00	.00
NP237	227	9.30E-03	2.11E-01	.00	.00	.00
NP237	228	9.24E-03	2.10E-01	.00	.00	.00
NP237	229	9.15E-03	2.07E-01	.00	.00	.00
NP237	230	9.12E-03	2.07E-01	.00	.00	.00
NP237	231	9.03E-03	2.05E-01	.00	.00	.00
NP237	232	9.00E-03	2.04E-01	.00	.00	.00
NP237	233	8.97E-03	2.03E-01	.00	.00	.00
NP237	234	8.71E-03	1.97E-01	.00	.00	.00
NP237	235	8.94E-03	2.02E-01	.00	.00	.00
NP237	236	8.88E-03	2.01E-01	.00	.00	.00
NP237	237	8.55E-03	1.93E-01	.00	.00	.00
NP237	238	8.76E-03	1.98E-01	.00	.00	.00
NP237	239	8.44E-03	1.90E-01	.00	.00	.00
NP237	240	8.65E-03	1.95E-01	.00	.00	.00
NP237	241	8.33E-03	1.88E-01	.00	.00	.00
NP237	242	8.54E-03	1.93E-01	.00	.00	.00
NP237	243	8.22E-03	1.85E-01	.00	.00	.00
NP237	244	8.43E-03	1.90E-01	.00	.00	.00
NP237	245	8.38E-03	1.89E-01	.00	.00	.00
NP237	246	8.06E-03	1.81E-01	.00	.00	.00
NP237	247	8.27E-03	1.86E-01	.00	.00	.00
NP237	248	7.96E-03	1.79E-01	.00	.00	.00
NP237	249	8.16E-03	1.83E-01	.00	.00	.00
NP237	250	7.85E-03	1.76E-01	.00	.00	.00
PA233		0 0	3			
PA233	3 1	2.57E-07	1.48E-06	3.25E-04	.00	6.00E-05
PA233	3 2	3.65E-08	2.11E-07	3.62E-05	.00	1.78E-07
PA233	3 3	7.95E-12	4.58E-11	2.11E-09	.00	4.09E-12
U 233		0 0	50			

Appendix B - Inhalation Dose Rate Factors - FILE23

U 233	3 1	2.63E-04	2.17E-03	7.16E-01	0.00E+00	2.39E-04
U 233	3 2	3.25E-04	4.28E-03	1.03E+00	0.00E+00	1.51E-05
U 233	3 3	2.48E-04	4.13E-03	6.20E-01	0.00E+00	8.81E-06
U 233	3 4	2.18E-04	3.84E-03	3.74E-01	0.00E+00	5.31E-06
U 233	3 5	1.87E-04	3.41E-03	2.25E-01	0.00E+00	3.20E-06
U 233	3 6	1.56E-04	2.95E-03	1.36E-01	0.00E+00	1.93E-06
U 233	3 7	1.27E-04	2.47E-03	8.17E-02	0.00E+00	1.16E-06
U 233	3 8	1.03E-04	2.04E-03	4.94E-02	0.00E+00	7.01E-07
U 233	3 9	8.23E-05	1.65E-03	2.97E-02	0.00E+00	4.22E-07
U 233	310	6.51E-05	1.33E-03	1.79E-02	0.00E+00	2.54E-07
U 233	311	5.15E-05	1.06E-03	1.08E-02	0.00E+00	1.53E-07
U 233	312	4.04E-05	8.36E-04	6.49E-03	0.00E+00	9.21E-08
U 233	313	3.18E-05	6.62E-04	3.92E-03	0.00E+00	5.57E-08
U 233	314	2.48E-05	5.18E-04	2.36E-03	0.00E+00	3.35E-08
U 233	315	1.94E-05	4.07E-04	1.43E-03	0.00E+00	2.03E-08
U 233	316	1.51E-05	3.18E-04	8.58E-04	0.00E+00	1.22E-08
U 233	317	1.18E-05	2.48E-04	5.15E-04	0.00E+00	7.33E-09
U 233	318	9.18E-06	1.94E-04	3.12E-04	0.00E+00	4.42E-09
U 233	319	7.12E-06	1.50E-04	1.87E-04	0.00E+00	2.65E-09
U 233	320	5.55E-06	1.17E-04	1.13E-04	0.00E+00	1.63E-09
U 233	321	4.31E-06	9.13E-05	6.84E-05	0.00E+00	9.60E-10
U 233	322	3.34E-06	7.08E-05	4.08E-05	0.00E+00	5.82E-10
U 233	323	2.60E-06	5.52E-05	2.48E-05	0.00E+00	3.49E-10
U 233	324	2.02E-06	4.27E-05	1.48E-05	0.00E+00	2.04E-10
U 233	325	1.57E-06	3.33E-05	9.06E-06	0.00E+00	1.46E-10
U 233	326	1.22E-06	2.58E-05	5.48E-06	0.00E+00	5.82E-11
U 233	327	9.48E-07	2.01E-05	3.34E-06	0.00E+00	5.82E-11
U 233	328	7.36E-07	1.56E-05	1.67E-06	0.00E+00	2.91E-11
U 233	329	5.70E-07	1.21E-05	1.19E-06	0.00E+00	2.91E-11
U 233	330	4.44E-07	9.41E-06	7.15E-07	0.00E+00	0.00E+00
U 233	331	3.43E-07	7.28E-06	4.77E-07	0.00E+00	0.00E+00
U 233	332	2.68E-07	5.67E-06	2.38E-07	0.00E+00	0.00E+00
U 233	333	2.08E-07	4.41E-06	2.38E-07	0.00E+00	0.00E+00
U 233	334	1.59E-07	3.36E-06	0.00E+00	0.00E+00	0.00E+00
U 233	335	1.27E-07	2.69E-06	0.00E+00	0.00E+00	0.00E+00
U 233	336	9.85E-08	2.08E-06	2.38E-07	0.00E+00	2.91E-11
U 233	337	7.38E-08	1.56E-06	0.00E+00	0.00E+00	0.00E+00
U 233	338	5.91E-08	1.26E-06	0.00E+00	0.00E+00	0.00E+00
U 233	339	4.42E-08	9.42E-07	0.00E+00	0.00E+00	0.00E+00
U 233	340	3.61E-08	7.60E-07	0.00E+00	0.00E+00	0.00E+00
U 233	341	2.68E-08	5.70E-07	0.00E+00	0.00E+00	0.00E+00
U 233	342	2.14E-08	4.54E-07	0.00E+00	0.00E+00	0.00E+00
U 233	343	1.61E-08	3.46E-07	0.00E+00	0.00E+00	0.00E+00
U 233	344	1.30E-08	2.76E-07	0.00E+00	0.00E+00	0.00E+00
U 233	345	1.02E-08	2.16E-07	0.00E+00	0.00E+00	0.00E+00
U 233	346	7.45E-09	1.60E-07	0.00E+00	0.00E+00	0.00E+00
U 233	347	6.05E-09	1.30E-07	0.00E+00	0.00E+00	0.00E+00
U 233	348	4.66E-09	8.94E-08	0.00E+00	0.00E+00	0.00E+00
U 233	349	3.73E-09	8.20E-08	0.00E+00	0.00E+00	0.00E+00
U 233	350	2.79E-09	5.96E-08	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

TH229		0	0	50			
TH229	3 1	1.84E-03	3.67E-02	3.86E+00	0.00E+00	1.97E-03	
TH229	3 2	6.35E-03	1.27E-01	5.56E+00	0.00E+00	1.24E-04	
TH229	3 3	1.03E-02	2.05E-01	3.35E+00	0.00E+00	7.26E-05	
TH229	3 4	1.38E-02	2.76E-01	2.02E+00	0.00E+00	4.38E-05	
TH229	3 5	1.68E-02	3.37E-01	1.22E+00	0.00E+00	2.64E-05	
TH229	3 6	1.94E-02	3.89E-01	7.34E-01	0.00E+00	1.59E-05	
TH229	3 7	2.14E-02	4.29E-01	4.41E-01	0.00E+00	9.56E-06	
TH229	3 8	2.31E-02	4.63E-01	2.66E-01	0.00E+00	5.78E-06	
TH229	3 9	2.44E-02	4.89E-01	1.60E-01	0.00E+00	3.48E-06	
TH229	310	2.53E-02	5.08E-01	9.64E-02	0.00E+00	2.09E-06	
TH229	311	2.62E-02	5.25E-01	5.83E-02	0.00E+00	1.26E-06	
TH229	312	2.67E-02	5.36E-01	3.50E-02	0.00E+00	7.59E-07	
TH229	313	2.72E-02	5.46E-01	2.12E-02	0.00E+00	4.59E-07	
TH229	314	2.74E-02	5.51E-01	1.27E-02	0.00E+00	2.76E-07	
TH229	315	2.77E-02	5.57E-01	7.68E-03	0.00E+00	1.67E-07	
TH229	316	2.78E-02	5.61E-01	4.63E-03	0.00E+00	1.00E-07	
TH229	317	2.78E-02	5.61E-01	2.78E-03	0.00E+00	6.01E-08	
TH229	318	2.79E-02	5.64E-01	1.68E-03	0.00E+00	3.66E-08	
TH229	319	2.78E-02	5.62E-01	1.01E-03	0.00E+00	2.19E-08	
TH229	320	2.79E-02	5.64E-01	6.08E-04	0.00E+00	1.33E-08	
TH229	321	2.78E-02	5.63E-01	3.68E-04	0.00E+00	7.92E-09	
TH229	322	2.77E-02	5.61E-01	2.23E-04	0.00E+00	4.89E-09	
TH229	323	2.77E-02	5.61E-01	1.32E-04	0.00E+00	2.79E-09	
TH229	324	2.75E-02	5.58E-01	8.01E-05	0.00E+00	1.86E-09	
TH229	325	2.75E-02	5.59E-01	4.96E-05	0.00E+00	9.31E-10	
TH229	326	2.73E-02	5.55E-01	2.86E-05	0.00E+00	6.98E-10	
TH229	327	2.73E-02	5.55E-01	1.72E-05	0.00E+00	4.66E-10	
TH229	328	2.72E-02	5.54E-01	1.14E-05	0.00E+00	2.33E-10	
TH229	329	2.70E-02	5.50E-01	3.81E-06	0.00E+00	0.00E+00	
TH229	330	2.69E-02	5.50E-01	3.81E-06	0.00E+00	2.33E-10	
TH229	331	2.67E-02	5.47E-01	3.81E-06	0.00E+00	0.00E+00	
TH229	332	2.67E-02	5.46E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	333	2.67E-02	5.46E-01	1.91E-06	0.00E+00	0.00E+00	
TH229	334	2.60E-02	5.32E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	335	2.67E-02	5.48E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	336	2.66E-02	5.46E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	337	2.56E-02	5.27E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	338	2.63E-02	5.42E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	339	2.54E-02	5.23E-01	1.91E-06	0.00E+00	0.00E+00	
TH229	340	2.61E-02	5.38E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	341	2.52E-02	5.19E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	342	2.59E-02	5.34E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	343	2.49E-02	5.16E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	344	2.56E-02	5.30E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	345	2.55E-02	5.29E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	346	2.46E-02	5.10E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	347	2.53E-02	5.25E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	348	2.44E-02	5.07E-01	0.00E+00	0.00E+00	0.00E+00	
TH229	349	2.51E-02	5.21E-01	0.00E+00	0.00E+00	0.00E+00	

Appendix B - Inhalation Dose Rate Factors - FILE23

TH229	350	2.42E-02	5.03E-01	0.00E+00	0.00E+00	0.00E+00
RA225		0 3	0			
RA225	2 1	5.86E-03	2.93E-02	3.81E-01	0.00E+00	9.83E-04
RA225	2 2	3.95E-04	1.98E-03	1.71E-02	0.00E+00	4.21E-06
RA225	2 3	0.00E+00	3.73E-09	0.00E+00	0.00E+00	0.00E+00
AC225		0 0	2			
AC225	3 1	8.11E-05	1.21E-03	3.58E-01	0.00E+00	1.44E-03
AC225	3 2	3.55E-06	5.29E-05	1.36E-02	0.00E+00	2.80E-06
U 238		0 0	50			
U 238	3 1	2.26E-04	1.91E-03	6.15E-01	.00	2.10E-04
U 238	3 2	2.80E-04	3.76E-03	8.85E-01	.00	1.32E-05
U 238	3 3	2.13E-04	3.64E-03	5.34E-01	.00	7.73E-06
U 238	3 4	1.87E-04	3.38E-03	3.21E-01	.00	4.66E-06
U 238	3 5	1.61E-04	3.01E-03	1.94E-01	.00	2.81E-06
U 238	3 6	1.34E-04	2.59E-03	1.17E-01	.00	1.69E-06
U 238	3 7	1.09E-04	2.17E-03	7.02E-02	.00	1.02E-06
U 238	3 8	8.85E-05	1.79E-03	4.25E-02	.00	6.16E-07
U 238	3 9	7.07E-05	1.46E-03	2.56E-02	.00	3.71E-07
U 238	310	5.60E-05	1.17E-03	1.54E-02	.00	2.23E-07
U 238	311	4.43E-05	9.32E-04	9.29E-03	.00	1.35E-07
U 238	312	3.47E-05	7.36E-04	5.58E-03	.00	8.09E-08
U 238	313	2.73E-05	5.82E-04	3.37E-03	.00	4.89E-08
U 238	314	2.13E-05	4.56E-04	2.03E-03	.00	2.94E-08
U 238	315	1.67E-05	3.58E-04	1.23E-03	.00	1.78E-08
U 238	316	1.30E-05	2.80E-04	7.38E-04	.00	1.07E-08
U 238	317	1.01E-05	2.18E-04	4.43E-04	.00	6.42E-09
U 238	318	7.89E-06	1.70E-04	2.68E-04	.00	3.89E-09
U 238	319	6.12E-06	1.32E-04	1.61E-04	.00	2.33E-09
U 238	320	4.77E-06	1.03E-04	9.74E-05	.00	1.41E-09
U 238	321	3.71E-06	8.03E-05	5.87E-05	.00	8.49E-10
U 238	322	2.87E-06	6.23E-05	3.52E-05	.00	5.09E-10
U 238	323	2.24E-06	4.86E-05	2.13E-05	.00	3.09E-10
U 238	324	1.73E-06	3.76E-05	1.28E-05	.00	1.87E-10
U 238	325	1.35E-06	2.93E-05	7.72E-06	.00	1.11E-10
U 238	326	1.05E-06	2.27E-05	4.65E-06	.00	6.91E-11
U 238	327	8.15E-07	1.77E-05	2.83E-06	.00	3.82E-11
U 238	328	6.33E-07	1.37E-05	1.67E-06	.00	2.55E-11
U 238	329	4.90E-07	1.06E-05	1.04E-06	.00	1.46E-11
U 238	330	3.82E-07	8.28E-06	6.26E-07	.00	7.28E-12
U 238	331	2.95E-07	6.41E-06	3.58E-07	.00	7.28E-12
U 238	332	2.30E-07	4.99E-06	2.38E-07	.00	3.64E-12
U 238	333	1.79E-07	3.89E-06	1.19E-07	.00	.00
U 238	334	1.36E-07	2.95E-06	5.96E-08	.00	.00
U 238	335	1.09E-07	2.37E-06	5.96E-08	.00	.00
U 238	336	8.44E-08	1.83E-06	2.98E-08	.00	.00
U 238	337	6.35E-08	1.38E-06	2.98E-08	.00	.00
U 238	338	5.09E-08	1.11E-06	.00	.00	.00
U 238	339	3.83E-08	8.31E-07	.00	.00	.00
U 238	340	3.07E-08	6.68E-07	.00	.00	.00
U 238	341	2.31E-08	5.02E-07	.00	.00	.00

Appendix B - Inhalation Dose Rate Factors - FILE23

U 238	342	1.85E-08	4.03E-07	.00	.00	.00
U 238	343	1.40E-08	3.03E-07	.00	.00	.00
U 238	344	1.12E-08	2.43E-07	.00	.00	.00
U 238	345	8.66E-09	1.88E-07	.00	.00	.00
U 238	346	6.50E-09	1.41E-07	.00	.00	.00
U 238	347	5.22E-09	1.14E-07	.00	.00	.00
U 238	348	3.91E-09	8.48E-08	.00	.00	.00
U 238	349	3.17E-09	6.82E-08	.00	.00	.00
U 238	350	2.37E-09	5.15E-08	.00	.00	.00
TH234		0 0	3			
TH234	3 1	6.43E-07	2.22E-05	1.46E-03	.00	4.13E-04
TH234	3 2	7.79E-08	2.69E-06	1.42E-04	.00	1.12E-06
TH234	3 3	4.87E-12	1.68E-10	2.34E-09	.00	7.28E-12
PA234M		0 0	2			
PA234M	3 1	4.32E-13	9.48E-12	2.52E-08	0.00E+00	0.00E+00
PA234M	3 2	2.68E-18	5.81E-17	8.17E-14	0.00E+00	0.00E+00
PA234		0 0	2			
PA234	3 1	1.04E-08	4.08E-08	2.12E-05	0.00E+00	2.13E-05
PA234	3 2	1.20E-11	4.71E-11	2.18E-08	0.00E+00	1.34E-08
AM242M		0 50	0			
AM*242	2 1	5.76E-03	1.28E-01	7.01E-02	.00	5.30E-06
AM*242	2 2	1.31E-02	2.92E-01	1.67E-02	.00	2.16E-07
AM*242	2 3	1.32E-02	2.96E-01	1.05E-04	.00	1.30E-09
AM*242	2 4	1.30E-02	2.93E-01	6.60E-07	.00	8.13E-12
AM*242	2 5	1.28E-02	2.89E-01	4.66E-09	.00	5.68E-14
AM*242	2 6	1.26E-02	2.86E-01	.00	.00	.00
AM*242	2 7	1.23E-02	2.82E-01	.00	.00	.00
AM*242	2 8	1.22E-02	2.80E-01	.00	.00	.00
AM*242	2 9	1.19E-02	2.77E-01	.00	.00	.00
AM*242	210	1.17E-02	2.73E-01	.00	.00	.00
AM*242	211	1.15E-02	2.70E-01	.00	.00	.00
AM*242	212	1.13E-02	2.66E-01	.00	.00	.00
AM*242	213	1.12E-02	2.64E-01	.00	.00	.00
AM*242	214	1.09E-02	2.60E-01	.00	.00	.00
AM*242	215	1.08E-02	2.58E-01	.00	.00	.00
AM*242	216	1.06E-02	2.55E-01	.00	.00	.00
AM*242	217	1.04E-02	2.52E-01	.00	.00	.00
AM*242	218	1.02E-02	2.50E-01	.00	.00	.00
AM*242	219	1.00E-02	2.46E-01	.00	.00	.00
AM*242	220	9.89E-03	2.44E-01	.00	.00	.00
AM*242	221	9.72E-03	2.41E-01	.00	.00	.00
AM*242	222	9.53E-03	2.38E-01	.00	.00	.00
AM*242	223	9.39E-03	2.36E-01	.00	.00	.00
AM*242	224	9.21E-03	2.32E-01	.00	.00	.00
AM*242	225	9.08E-03	2.30E-01	.00	.00	.00
AM*242	226	8.89E-03	2.27E-01	.00	.00	.00
AM*242	227	8.77E-03	2.25E-01	.00	.00	.00
AM*242	228	8.62E-03	2.23E-01	.00	.00	.00
AM*242	229	8.45E-03	2.19E-01	.00	.00	.00
AM*242	230	8.33E-03	2.18E-01	.00	.00	.00

Appendix B - Inhalation Dose Rate Factors - FILE23

AM*242	231	8.16E-03	2.14E-01	.00	.00	.00
AM*242	232	8.05E-03	2.13E-01	.00	.00	.00
AM*242	233	7.94E-03	2.11E-01	.00	.00	.00
AM*242	234	7.63E-03	2.04E-01	.00	.00	.00
AM*242	235	7.74E-03	2.08E-01	.00	.00	.00
AM*242	236	7.61E-03	2.06E-01	.00	.00	.00
AM*242	237	7.25E-03	1.97E-01	.00	.00	.00
AM*242	238	7.35E-03	2.01E-01	.00	.00	.00
AM*242	239	7.00E-03	1.92E-01	.00	.00	.00
AM*242	240	7.10E-03	1.96E-01	.00	.00	.00
AM*242	241	6.77E-03	1.88E-01	.00	.00	.00
AM*242	242	6.86E-03	1.92E-01	.00	.00	.00
AM*242	243	6.54E-03	1.84E-01	.00	.00	.00
AM*242	244	6.63E-03	1.88E-01	.00	.00	.00
AM*242	245	6.52E-03	1.85E-01	.00	.00	.00
AM*242	246	6.21E-03	1.78E-01	.00	.00	.00
AM*242	247	6.30E-03	1.81E-01	.00	.00	.00
AM*242	248	5.00E-03	1.74E-01	.00	.00	.00
AM*242	249	6.09E-03	1.77E-01	.00	.00	.00
AM*242	250	5.80E-03	1.70E-01	.00	.00	.00
AM242	0	2	0			
AM242	2 1	2.36E-05	5.40E-04	1.61E-03	.00	2.75E-05
AM242	2 2	6.47E-08	1.48E-06	3.76E-06	.00	2.89E-08
CM242	0	14	0			
CM242	2 1	4.59E-03	1.03E-01	2.76E-01	.00	2.83E-04
CM242	2 2	4.34E-03	9.80E-02	4.79E-02	.00	7.28E-06
CM242	2 3	9.52E-04	2.15E-02	6.37E-05	.00	9.01E-09
CM242	2 4	1.98E-04	4.51E-03	8.20E-08	.00	1.09E-11
CM242	2 5	4.13E-05	9.43E-04	.00	.00	.00
CM242	2 6	8.64E-06	1.98E-04	.00	.00	.00
CM242	2 7	1.79E-06	4.12E-05	.00	.00	.00
CM242	2 8	3.75E-07	8.65E-06	.00	.00	.00
CM242	2 9	7.80E-08	1.80E-06	.00	.00	.00
CM242	210	1.63E-08	3.76E-07	.00	.00	.00
CM242	211	3.38E-09	8.01E-08	.00	.00	.00
CM242	212	6.98E-10	1.49E-08	.00	.00	.00
CM242	213	1.16E-10	3.73E-09	.00	.00	.00
CM242	214	.00	1.86E-09	.00	.00	.00
PU242	0	0	50			
PU242	3 1	2.83E-04	6.24E-03	7.30E-01	0.00E+00	2.51E-04
PU242	3 2	9.78E-04	2.15E-02	1.05E+00	0.00E+00	1.58E-05
PU242	3 3	1.58E-03	3.48E-02	6.33E-01	0.00E+00	9.26E-06
PU242	3 4	2.13E-03	4.68E-02	3.81E-01	0.00E+00	5.58E-06
PU242	3 5	2.60E-03	5.70E-02	2.30E-01	0.00E+00	3.36E-06
PU242	3 6	3.01E-03	6.57E-02	1.39E-01	0.00E+00	2.03E-06
PU242	3 7	3.32E-03	7.23E-02	8.33E-02	0.00E+00	1.22E-06
PU242	3 8	3.58E-03	7.80E-02	5.04E-02	0.00E+00	7.37E-07
PU242	3 9	3.78E-03	8.22E-02	3.03E-02	0.00E+00	4.44E-07
PU242	310	3.93E-03	8.51E-02	1.82E-02	0.00E+00	2.67E-07
PU242	311	4.06E-03	8.78E-02	1.10E-02	0.00E+00	1.61E-07

Appendix B - Inhalation Dose Rate Factors - FILE23

PU242	312	4.14E-03	8.93E-02	6.62E-03	0.00E+00	9.69E-08
PU242	313	4.22E-03	9.08E-02	4.00E-03	0.00E+00	5.86E-08
PU242	314	4.26E-03	9.13E-02	2.40E-03	0.00E+00	3.52E-08
PU242	315	4.30E-03	9.21E-02	1.45E-03	0.00E+00	2.13E-08
PU242	316	4.33E-03	9.23E-02	8.75E-04	0.00E+00	1.28E-08
PU242	317	4.33E-03	9.21E-02	5.26E-04	0.00E+00	7.65E-09
PU242	318	4.35E-03	9.23E-02	3.18E-04	0.00E+00	4.66E-09
PU242	319	4.34E-03	9.18E-02	1.91E-04	0.00E+00	2.79E-09
PU242	320	4.35E-03	9.17E-02	1.16E-04	0.00E+00	1.72E-09
PU242	321	4.34E-03	9.13E-02	6.99E-05	0.00E+00	1.02E-09
PU242	322	4.32E-03	9.06E-02	4.17E-05	0.00E+00	6.11E-10
PU242	323	4.32E-03	9.04E-02	2.50E-05	0.00E+00	3.78E-10
PU242	324	4.30E-03	8.96E-02	1.53E-05	0.00E+00	2.33E-10
PU242	325	4.30E-03	8.94E-02	9.06E-06	0.00E+00	1.16E-10
PU242	326	4.27E-03	8.86E-02	5.48E-06	0.00E+00	5.82E-11
PU242	327	4.27E-03	8.83E-02	3.58E-06	0.00E+00	5.82E-11
PU242	328	4.26E-03	8.77E-02	1.67E-06	0.00E+00	2.91E-11
PU242	329	4.23E-03	8.69E-02	1.19E-06	0.00E+00	0.00E+00
PU242	330	4.23E-03	8.66E-02	7.15E-07	0.00E+00	2.91E-11
PU242	331	4.20E-03	8.57E-02	7.15E-07	0.00E+00	0.00E+00
PU242	332	4.20E-03	8.54E-02	2.38E-07	0.00E+00	0.00E+00
PU242	333	4.19E-03	8.51E-02	0.00E+00	0.00E+00	0.00E+00
PU242	334	4.09E-03	8.27E-02	0.00E+00	0.00E+00	0.00E+00
PU242	335	4.20E-03	8.47E-02	2.38E-07	0.00E+00	0.00E+00
PU242	336	4.18E-03	8.42E-02	0.00E+00	0.00E+00	0.00E+00
PU242	337	4.04E-03	8.10E-02	0.00E+00	0.00E+00	0.00E+00
PU242	338	4.15E-03	8.30E-02	0.00E+00	0.00E+00	0.00E+00
PU242	339	4.01E-03	7.99E-02	0.00E+00	0.00E+00	0.00E+00
PU242	340	4.12E-03	8.19E-02	0.00E+00	0.00E+00	0.00E+00
PU242	341	3.98E-03	7.88E-02	0.00E+00	0.00E+00	0.00E+00
PU242	342	4.09E-03	8.07E-02	0.00E+00	0.00E+00	0.00E+00
PU242	343	3.95E-03	7.77E-02	0.00E+00	0.00E+00	0.00E+00
PU242	344	4.06E-03	7.96E-02	0.00E+00	0.00E+00	0.00E+00
PU242	345	4.04E-03	7.91E-02	0.00E+00	0.00E+00	0.00E+00
PU242	346	3.90E-03	7.61E-02	0.00E+00	0.00E+00	0.00E+00
PU242	347	4.01E-03	7.80E-02	0.00E+00	0.00E+00	0.00E+00
PU242	348	3.87E-03	7.50E-02	0.00E+00	0.00E+00	0.00E+00
PU242	349	3.98E-03	7.69E-02	0.00E+00	0.00E+00	0.00E+00
PU242	350	3.84E-03	7.40E-02	0.00E+00	0.00E+00	0.00E+00
NP238		0	2	0		
NP238	2 1	5.31E-07	3.96E-06	5.24E-05	0.00E+00	0.00E+00
NP238	2 2	4.73E-09	3.53E-08	3.83E-07	0.00E+00	9.48E-08
PU238		0	0	50		
PU238	3 1	3.15E-04	6.96E-03	8.14E-01	0.00E+00	2.80E-04
PU238	3 2	1.08E-03	2.39E-02	1.17E+00	0.00E+00	1.76E-05
PU238	3 3	1.74E-03	3.83E-02	6.97E-01	0.00E+00	1.02E-05
PU238	3 4	2.33E-03	5.12E-02	4.16E-01	0.00E+00	6.10E-06
PU238	3 5	2.82E-03	6.19E-02	2.49E-01	0.00E+00	3.64E-06
PU238	3 6	3.23E-03	7.07E-02	1.49E-01	0.00E+00	2.18E-06
PU238	3 7	3.53E-03	7.73E-02	8.89E-02	0.00E+00	1.30E-06

Appendix B - Inhalation Dose Rate Factors - FILE23

PU238	3 8	3.79E-03	8.27E-02	5.33E-02	0.00E+00	7.80E-07
PU238	3 9	3.97E-03	8.64E-02	3.18E-02	0.00E+00	4.66E-07
PU238	310	4.09E-03	8.88E-02	1.90E-02	0.00E+00	2.78E-07
PU238	311	4.19E-03	9.09E-02	1.14E-02	0.00E+00	1.67E-07
PU238	312	4.24E-03	9.17E-02	6.79E-03	0.00E+00	9.94E-08
PU238	313	4.29E-03	9.25E-02	4.07E-03	0.00E+00	5.96E-08
PU238	314	4.29E-03	9.23E-02	2.43E-03	0.00E+00	3.55E-08
PU238	315	4.31E-03	9.24E-02	1.46E-03	0.00E+00	2.13E-08
PU238	316	4.30E-03	9.19E-02	8.70E-04	0.00E+00	1.27E-08
PU238	317	4.26E-03	9.09E-02	5.19E-04	0.00E+00	7.60E-09
PU238	318	4.25E-03	9.04E-02	3.11E-04	0.00E+00	4.54E-09
PU238	319	4.21E-03	8.92E-02	1.85E-04	0.00E+00	2.71E-09
PU238	320	4.18E-03	8.84E-02	1.11E-04	0.00E+00	1.63E-09
PU238	321	4.14E-03	8.74E-02	6.63E-05	0.00E+00	9.60E-10
PU238	322	4.09E-03	8.60E-02	3.96E-05	0.00E+00	5.82E-10
PU238	323	4.06E-03	8.52E-02	2.38E-05	0.00E+00	3.49E-10
PU238	324	4.01E-03	8.37E-02	1.41E-05	0.00E+00	2.04E-10
PU238	325	3.98E-03	8.29E-02	8.58E-06	0.00E+00	1.16E-10
PU238	326	3.92E-03	8.14E-02	5.01E-06	0.00E+00	8.73E-11
PU238	327	3.89E-03	8.06E-02	3.10E-06	0.00E+00	5.82E-11
PU238	328	3.85E-03	7.94E-02	1.91E-06	0.00E+00	0.00E+00
PU238	329	3.79E-03	7.80E-02	9.54E-07	0.00E+00	2.91E-11
PU238	330	3.76E-03	7.71E-02	4.77E-07	0.00E+00	0.00E+00
PU238	331	3.70E-03	7.58E-02	4.77E-07	0.00E+00	2.91E-11
PU238	332	3.67E-03	7.49E-02	2.38E-07	0.00E+00	0.00E+00
PU238	333	3.64E-03	7.41E-02	2.38E-07	0.00E+00	0.00E+00
PU238	334	3.52E-03	7.14E-02	0.00E+00	0.00E+00	0.00E+00
PU238	335	3.59E-03	7.26E-02	0.00E+00	0.00E+00	0.00E+00
PU238	336	3.55E-03	7.15E-02	0.00E+00	0.00E+00	0.00E+00
PU238	337	3.40E-03	6.83E-02	0.00E+00	0.00E+00	0.00E+00
PU238	338	3.47E-03	6.94E-02	0.00E+00	0.00E+00	0.00E+00
PU238	339	3.32E-03	6.63E-02	0.00E+00	0.00E+00	0.00E+00
PU238	340	3.39E-03	6.74E-02	0.00E+00	0.00E+00	0.00E+00
PU238	341	3.24E-03	6.44E-02	0.00E+00	0.00E+00	0.00E+00
PU238	342	3.31E-03	6.55E-02	0.00E+00	0.00E+00	0.00E+00
PU238	343	3.17E-03	6.25E-02	0.00E+00	0.00E+00	0.00E+00
PU238	344	3.23E-03	6.35E-02	0.00E+00	0.00E+00	0.00E+00
PU238	345	3.19E-03	6.26E-02	0.00E+00	0.00E+00	0.00E+00
PU238	346	3.06E-03	5.98E-02	0.00E+00	0.00E+00	0.00E+00
PU238	347	3.12E-03	6.08E-02	0.00E+00	0.00E+00	0.00E+00
PU238	348	2.99E-03	5.80E-02	0.00E+00	0.00E+00	0.00E+00
PU238	349	3.05E-03	5.90E-02	0.00E+00	0.00E+00	0.00E+00
PU238	350	2.92E-03	5.63E-02	0.00E+00	0.00E+00	0.00E+00
CM244	0 50	0	0			
CM244	2 1	5.60E-03	1.89E-01	3.22E-01	.00	2.79E-04
CM244	2 2	1.25E-02	4.24E-01	7.62E-02	.00	1.13E-05
CM244	2 3	1.22E-02	4.15E-01	4.63E-04	.00	6.55E-08
CM244	2 4	1.16E-02	3.97E-01	2.81E-06	.00	3.97E-10
CM244	2 5	1.11E-02	3.80E-01	1.86E-08	.00	.00
CM244	2 6	1.06E-02	3.64E-01	.00	.00	.00

Appendix B - Inhalation Dose Rate Factors - FILE23

CM244	2 7	1.01E-02	3.47E-01	.00	.00	.00
CM244	2 8	9.61E-03	3.33E-01	.00	.00	.00
CM244	2 9	9.16E-03	3.18E-01	.00	.00	.00
CM244	210	8.70E-03	3.03E-01	.00	.00	.00
CM244	211	8.32E-03	2.91E-01	.00	.00	.00
CM244	212	7.90E-03	2.77E-01	.00	.00	.00
CM244	213	7.55E-03	2.66E-01	.00	.00	.00
CM244	214	7.17E-03	2.54E-01	.00	.00	.00
CM244	215	6.85E-03	2.43E-01	.00	.00	.00
CM244	216	6.53E-03	2.33E-01	.00	.00	.00
CM244	217	6.20E-03	2.22E-01	.00	.00	.00
CM244	218	5.93E-03	2.13E-01	.00	.00	.00
CM244	219	5.63E-03	2.03E-01	.00	.00	.00
CM244	220	5.38E-03	1.94E-01	.00	.00	.00
CM244	221	5.13E-03	1.86E-01	.00	.00	.00
CM244	222	4.87E-03	1.77E-01	.00	.00	.00
CM244	223	4.66E-03	1.70E-01	.00	.00	.00
CM244	224	4.42E-03	1.62E-01	.00	.00	.00
CM244	225	4.23E-03	1.56E-01	.00	.00	.00
CM244	226	4.01E-03	1.48E-01	.00	.00	.00
CM244	227	3.84E-03	1.42E-01	.00	.00	.00
CM244	228	3.66E-03	1.36E-01	.00	.00	.00
CM244	229	3.47E-03	1.30E-01	.00	.00	.00
CM244	230	3.32E-03	1.24E-01	.00	.00	.00
CM244	231	3.15E-03	1.19E-01	.00	.00	.00
CM244	232	3.01E-03	1.14E-01	.00	.00	.00
CM244	233	2.88E-03	1.09E-01	.00	.00	.00
CM244	234	2.68E-03	1.02E-01	.00	.00	.00
CM244	235	2.64E-03	1.01E-01	.00	.00	.00
CM244	236	2.51E-03	9.63E-02	.00	.00	.00
CM244	237	2.32E-03	8.92E-02	.00	.00	.00
CM244	238	2.28E-03	8.80E-02	.00	.00	.00
CM244	239	2.11E-03	8.16E-02	.00	.00	.00
CM244	240	2.07E-03	8.05E-02	.00	.00	.00
CM244	241	1.91E-03	7.46E-02	.00	.00	.00
CM244	242	1.88E-03	7.36E-02	.00	.00	.00
CM244	243	1.74E-03	6.82E-02	.00	.00	.00
CM244	244	1.71E-03	6.73E-02	.00	.00	.00
CM244	245	1.63E-03	6.44E-02	.00	.00	.00
CM244	246	1.50E-03	5.96E-02	.00	.00	.00
CM244	247	1.48E-03	5.89E-02	.00	.00	.00
CM244	248	1.36E-03	5.45E-02	.00	.00	.00
CM244	249	1.34E-03	5.38E-02	.00	.00	.00
CM244	250	1.24E-03	4.99E-02	.00	.00	.00
PU244	0 0	50				
PU244	3 1	3.24E-04	7.28E-03	8.36E-01	0.00E+00	3.74E-04
PU244	3 2	1.12E-03	2.52E-02	1.20E+00	0.00E+00	2.36E-05
PU244	3 3	1.81E-03	4.06E-02	7.25E-01	0.00E+00	1.38E-05
PU244	3 4	2.44E-03	5.47E-02	4.37E-01	0.00E+00	8.32E-06
PU244	3 5	2.98E-03	6.66E-02	2.63E-01	0.00E+00	5.01E-06

Appendix B - Inhalation Dose Rate Factors - FILE23

PU244	3 6	3.44E-03	7.67E-02	1.59E-01	0.00E+00	3.03E-06
PU244	3 7	3.80E-03	8.45E-02	9.54E-02	0.00E+00	1.82E-06
PU244	3 8	4.10E-03	9.11E-02	5.77E-02	0.00E+00	1.10E-06
PU244	3 9	4.33E-03	9.60E-02	3.47E-02	0.00E+00	6.62E-07
PU244	310	4.50E-03	9.95E-02	2.09E-02	0.00E+00	3.98E-07
PU244	311	4.65E-03	1.03E-01	1.26E-02	0.00E+00	2.40E-07
PU244	312	4.74E-03	1.04E-01	7.58E-03	0.00E+00	1.44E-07
PU244	313	4.83E-03	1.06E-01	4.58E-03	0.00E+00	8.73E-08
PU244	314	4.87E-03	1.07E-01	2.75E-03	0.00E+00	5.25E-08
PU244	315	4.93E-03	1.08E-01	1.66E-03	0.00E+00	3.17E-08
PU244	316	4.95E-03	1.08E-01	1.00E-03	0.00E+00	1.91E-08
PU244	317	4.96E-03	1.08E-01	6.02E-04	0.00E+00	1.15E-08
PU244	318	4.98E-03	1.08E-01	3.64E-04	0.00E+00	6.93E-09
PU244	319	4.97E-03	1.07E-01	2.19E-04	0.00E+00	4.16E-09
PU244	320	4.98E-03	1.07E-01	1.32E-04	0.00E+00	2.53E-09
PU244	321	4.97E-03	1.07E-01	7.96E-05	0.00E+00	1.48E-09
PU244	322	4.95E-03	1.06E-01	4.82E-05	0.00E+00	9.31E-10
PU244	323	4.95E-03	1.06E-01	2.86E-05	0.00E+00	5.53E-10
PU244	324	4.92E-03	1.05E-01	1.74E-05	0.00E+00	3.49E-10
PU244	325	4.92E-03	1.04E-01	1.07E-05	0.00E+00	1.75E-10
PU244	326	4.89E-03	1.03E-01	6.44E-06	0.00E+00	1.16E-10
PU244	327	4.89E-03	1.03E-01	3.58E-06	0.00E+00	5.82E-11
PU244	328	4.88E-03	1.02E-01	2.15E-06	0.00E+00	5.82E-11
PU244	329	4.84E-03	1.01E-01	1.67E-06	0.00E+00	2.91E-11
PU244	330	4.84E-03	1.01E-01	4.77E-07	0.00E+00	0.00E+00
PU244	331	4.81E-03	1.00E-01	7.15E-07	0.00E+00	2.91E-11
PU244	332	4.81E-03	9.98E-02	2.38E-07	0.00E+00	0.00E+00
PU244	333	4.80E-03	9.94E-02	0.00E+00	0.00E+00	0.00E+00
PU244	334	4.68E-03	9.65E-02	4.77E-07	0.00E+00	0.00E+00
PU244	335	4.81E-03	9.90E-02	0.00E+00	0.00E+00	0.00E+00
PU244	336	4.79E-03	9.83E-02	0.00E+00	0.00E+00	0.00E+00
PU244	337	4.62E-03	9.46E-02	0.00E+00	0.00E+00	0.00E+00
PU244	338	4.76E-03	9.70E-02	0.00E+00	0.00E+00	0.00E+00
PU244	339	4.59E-03	9.33E-02	0.00E+00	0.00E+00	0.00E+00
PU244	340	4.72E-03	9.56E-02	0.00E+00	0.00E+00	0.00E+00
PU244	341	4.55E-03	9.20E-02	0.00E+00	0.00E+00	0.00E+00
PU244	342	4.68E-03	9.43E-02	0.00E+00	0.00E+00	0.00E+00
PU244	343	4.52E-03	9.07E-02	0.00E+00	0.00E+00	0.00E+00
PU244	344	4.65E-03	9.30E-02	0.00E+00	0.00E+00	0.00E+00
PU244	345	4.63E-03	9.24E-02	0.00E+00	0.00E+00	0.00E+00
PU244	346	4.47E-03	8.89E-02	0.00E+00	0.00E+00	0.00E+00
PU244	347	4.59E-03	9.11E-02	0.00E+00	0.00E+00	0.00E+00
PU244	348	4.43E-03	8.76E-02	0.00E+00	0.00E+00	0.00E+00
PU244	349	4.56E-03	8.98E-02	0.00E+00	0.00E+00	0.00E+00
PU244	350	4.40E-03	8.64E-02	0.00E+00	0.00E+00	0.00E+00
U 240		0 0	2			
U 240	3 1	2.37E-09	1.23E-08	5.30E-06	0.00E+00	1.20E-05
U 240	3 2	6.48E-12	3.37E-11	1.10E-08	0.00E+00	1.11E-08
PU240		0 0	50			
PU240	3 1	2.94E-04	6.74E-03	7.59E-01	0.00E+00	2.61E-04

Appendix B - Inhalation Dose Rate Factors - FILE23

PU240	3 2	1.02E-03	2.33E-02	1.09E+00	0.00E+00	1.65E-05
PU240	3 3	1.65E-03	3.76E-02	6.57E-01	0.00E+00	9.63E-06
PU240	3 4	2.22E-03	5.05E-02	3.96E-01	0.00E+00	5.80E-06
PU240	3 5	2.71E-03	6.16E-02	2.39E-01	0.00E+00	3.49E-06
PU240	3 6	3.12E-03	7.09E-02	1.44E-01	0.00E+00	2.11E-06
PU240	3 7	3.44E-03	7.81E-02	8.65E-02	0.00E+00	1.27E-06
PU240	3 8	3.72E-03	8.42E-02	5.23E-02	0.00E+00	7.66E-07
PU240	3 9	3.93E-03	8.87E-02	3.15E-02	0.00E+00	4.61E-07
PU240	310	4.08E-03	9.19E-02	1.89E-02	0.00E+00	2.77E-07
PU240	311	4.22E-03	9.47E-02	1.14E-02	0.00E+00	1.67E-07
PU240	312	4.30E-03	9.63E-02	6.87E-03	0.00E+00	1.01E-07
PU240	313	4.38E-03	9.79E-02	4.15E-03	0.00E+00	6.08E-08
PU240	314	4.42E-03	9.85E-02	2.49E-03	0.00E+00	3.65E-08
PU240	315	4.47E-03	9.93E-02	1.51E-03	0.00E+00	2.21E-08
PU240	316	4.49E-03	9.96E-02	9.08E-04	0.00E+00	1.33E-08
PU240	317	4.49E-03	9.93E-02	5.46E-04	0.00E+00	8.00E-09
PU240	318	4.51E-03	9.95E-02	3.30E-04	0.00E+00	4.83E-09
PU240	319	4.50E-03	9.89E-02	1.98E-04	0.00E+00	2.88E-09
PU240	320	4.51E-03	9.89E-02	1.20E-04	0.00E+00	1.78E-09
PU240	321	4.50E-03	9.84E-02	7.18E-05	0.00E+00	1.05E-09
PU240	322	4.48E-03	9.77E-02	4.34E-05	0.00E+00	6.40E-10
PU240	323	4.48E-03	9.74E-02	2.62E-05	0.00E+00	3.78E-10
PU240	324	4.46E-03	9.66E-02	1.60E-05	0.00E+00	2.33E-10
PU240	325	4.46E-03	9.63E-02	9.30E-06	0.00E+00	1.46E-10
PU240	326	4.43E-03	9.54E-02	5.72E-06	0.00E+00	8.73E-11
PU240	327	4.43E-03	9.51E-02	3.34E-06	0.00E+00	5.82E-11
PU240	328	4.41E-03	9.45E-02	2.38E-06	0.00E+00	2.91E-11
PU240	329	4.38E-03	9.35E-02	9.54E-07	0.00E+00	0.00E+00
PU240	330	4.38E-03	9.32E-02	7.15E-07	0.00E+00	2.91E-11
PU240	331	4.35E-03	9.23E-02	4.77E-07	0.00E+00	0.00E+00
PU240	332	4.35E-03	9.19E-02	4.77E-07	0.00E+00	0.00E+00
PU240	333	4.34E-03	9.16E-02	0.00E+00	0.00E+00	0.00E+00
PU240	334	4.23E-03	8.90E-02	0.00E+00	0.00E+00	0.00E+00
PU240	335	4.35E-03	9.12E-02	2.38E-07	0.00E+00	0.00E+00
PU240	336	4.33E-03	9.06E-02	0.00E+00	0.00E+00	0.00E+00
PU240	337	4.18E-03	8.71E-02	0.00E+00	0.00E+00	0.00E+00
PU240	338	4.30E-03	8.93E-02	0.00E+00	0.00E+00	0.00E+00
PU240	339	4.15E-03	8.59E-02	0.00E+00	0.00E+00	0.00E+00
PU240	340	4.27E-03	8.81E-02	0.00E+00	0.00E+00	0.00E+00
PU240	341	4.12E-03	8.47E-02	0.00E+00	0.00E+00	0.00E+00
PU240	342	4.23E-03	8.68E-02	0.00E+00	0.00E+00	0.00E+00
PU240	343	4.08E-03	8.35E-02	0.00E+00	0.00E+00	0.00E+00
PU240	344	4.20E-03	8.56E-02	0.00E+00	0.00E+00	0.00E+00
PU240	345	4.18E-03	8.50E-02	0.00E+00	0.00E+00	0.00E+00
PU240	346	4.03E-03	8.18E-02	0.00E+00	0.00E+00	0.00E+00
PU240	347	4.15E-03	8.38E-02	0.00E+00	0.00E+00	0.00E+00
PU240	348	4.00E-03	8.06E-02	0.00E+00	0.00E+00	0.00E+00
PU240	349	4.11E-03	8.27E-02	0.00E+00	0.00E+00	0.00E+00
PU240	350	3.97E-03	7.95E-02	0.00E+00	0.00E+00	0.00E+00
CM243	0 50	0	0			

Appendix B - Inhalation Dose Rate Factors - FILE23

CM243	2 1	5.63E-03	8.42E-02	3.23E-01	0.00E+00	2.94E-04
CM243	2 2	1.27E-02	1.90E-01	7.65E-02	0.00E+00	1.19E-05
CM243	2 3	1.26E-02	1.89E-01	4.71E-04	0.00E+00	7.01E-08
CM243	2 4	1.21E-02	1.83E-01	2.86E-06	0.00E+00	4.37E-10
CM243	2 5	1.17E-02	1.77E-01	2.98E-08	0.00E+00	0.00E+00
CM243	2 6	1.13E-02	1.72E-01	0.00E+00	0.00E+00	0.00E+00
CM243	2 7	1.09E-02	1.66E-01	0.00E+00	0.00E+00	0.00E+00
CM243	2 8	1.06E-02	1.62E-01	0.00E+00	0.00E+00	0.00E+00
CM243	2 9	1.02E-02	1.57E-01	0.00E+00	0.00E+00	0.00E+00
CM243	210	9.82E-03	1.52E-01	0.00E+00	0.00E+00	0.00E+00
CM243	211	9.51E-03	1.47E-01	0.00E+00	0.00E+00	0.00E+00
CM243	212	9.16E-03	1.42E-01	0.00E+00	0.00E+00	0.00E+00
CM243	213	8.87E-03	1.38E-01	0.00E+00	0.00E+00	0.00E+00
CM243	214	8.54E-03	1.34E-01	0.00E+00	0.00E+00	0.00E+00
CM243	215	8.27E-03	1.30E-01	0.00E+00	0.00E+00	0.00E+00
CM243	216	7.99E-03	1.26E-01	0.00E+00	0.00E+00	0.00E+00
CM243	217	7.69E-03	1.22E-01	0.00E+00	0.00E+00	0.00E+00
CM243	218	7.45E-03	1.18E-01	0.00E+00	0.00E+00	0.00E+00
CM243	219	7.17E-03	1.14E-01	0.00E+00	0.00E+00	0.00E+00
CM243	220	6.95E-03	1.11E-01	0.00E+00	0.00E+00	0.00E+00
CM243	221	6.71E-03	1.08E-01	0.00E+00	0.00E+00	0.00E+00
CM243	222	6.46E-03	1.04E-01	0.00E+00	0.00E+00	0.00E+00
CM243	223	6.26E-03	1.01E-01	0.00E+00	0.00E+00	0.00E+00
CM243	224	6.02E-03	9.78E-02	0.00E+00	0.00E+00	0.00E+00
CM243	225	5.84E-03	9.51E-02	0.00E+00	0.00E+00	0.00E+00
CM243	226	5.62E-03	9.19E-02	0.00E+00	0.00E+00	0.00E+00
CM243	227	5.44E-03	8.93E-02	0.00E+00	0.00E+00	0.00E+00
CM243	228	5.26E-03	8.66E-02	0.00E+00	0.00E+00	0.00E+00
CM243	229	5.06E-03	8.37E-02	0.00E+00	0.00E+00	0.00E+00
CM243	230	4.90E-03	8.13E-02	0.00E+00	0.00E+00	0.00E+00
CM243	231	4.72E-03	7.86E-02	0.00E+00	0.00E+00	0.00E+00
CM243	232	4.57E-03	7.64E-02	0.00E+00	0.00E+00	0.00E+00
CM243	233	4.43E-03	7.43E-02	0.00E+00	0.00E+00	0.00E+00
CM243	234	4.18E-03	7.04E-02	0.00E+00	0.00E+00	0.00E+00
CM243	235	4.17E-03	7.05E-02	0.00E+00	0.00E+00	0.00E+00
CM243	236	4.02E-03	6.83E-02	0.00E+00	0.00E+00	0.00E+00
CM243	237	3.77E-03	6.41E-02	0.00E+00	0.00E+00	0.00E+00
CM243	238	3.75E-03	6.41E-02	0.00E+00	0.00E+00	0.00E+00
CM243	239	3.51E-03	6.02E-02	0.00E+00	0.00E+00	0.00E+00
CM243	240	3.50E-03	6.02E-02	0.00E+00	0.00E+00	0.00E+00
CM243	241	3.28E-03	5.66E-02	0.00E+00	0.00E+00	0.00E+00
CM243	242	3.27E-03	5.66E-02	0.00E+00	0.00E+00	0.00E+00
CM243	243	3.06E-03	5.31E-02	0.00E+00	0.00E+00	0.00E+00
CM243	244	3.05E-03	5.32E-02	0.00E+00	0.00E+00	0.00E+00
CM243	245	2.94E-03	5.15E-02	0.00E+00	0.00E+00	0.00E+00
CM243	246	2.75E-03	4.84E-02	0.00E+00	0.00E+00	0.00E+00
CM243	247	2.74E-03	4.84E-02	0.00E+00	0.00E+00	0.00E+00
CM243	248	2.57E-03	4.54E-02	0.00E+00	0.00E+00	0.00E+00
CM243	249	2.56E-03	4.55E-02	0.00E+00	0.00E+00	0.00E+00
CM243	250	2.39E-03	4.27E-02	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

PU243		0	0	2			
PU243	3 1	2.05E-09	4.98E-08	4.57E-06	0.00E+00	4.59E-06	
PU243	3 2	1.75E-12	4.25E-11	3.49E-09	0.00E+00	2.37E-09	
AM243		0	50	0			
AM243	2 1	5.10E-03	1.15E-01	2.91E-01	.00	2.60E-04	
AM243	2 2	1.17E-02	2.64E-01	6.95E-02	.00	1.06E-05	
AM243	2 3	1.18E-02	2.69E-01	4.39E-04	.00	6.42E-08	
AM243	2 4	1.17E-02	2.67E-01	2.77E-06	.00	4.07E-10	
AM243	2 5	1.15E-02	2.65E-01	1.49E-08	.00	3.64E-12	
AM243	2 6	1.14E-02	2.63E-01	.00	.00	.00	
AM243	2 7	1.12E-02	2.61E-01	.00	.00	.00	
AM243	2 8	1.11E-02	2.60E-01	.00	.00	.00	
AM243	2 9	1.10E-02	2.58E-01	.00	.00	.00	
AM243	210	1.08E-02	2.55E-01	.00	.00	.00	
AM243	211	1.07E-02	2.54E-01	.00	.00	.00	
AM243	212	1.05E-02	2.52E-01	.00	.00	.00	
AM243	213	1.04E-02	2.51E-01	.00	.00	.00	
AM243	214	1.03E-02	2.48E-01	.00	.00	.00	
AM243	215	1.02E-02	2.47E-01	.00	.00	.00	
AM243	216	1.00E-02	2.46E-01	.00	.00	.00	
AM243	217	9.87E-03	2.43E-01	.00	.00	.00	
AM243	218	9.77E-03	2.42E-01	.00	.00	.00	
AM243	219	9.62E-03	2.40E-01	.00	.00	.00	
AM243	220	9.53E-03	2.39E-01	.00	.00	.00	
AM243	221	9.41E-03	2.37E-01	.00	.00	.00	
AM243	222	9.26E-03	2.35E-01	.00	.00	.00	
AM243	223	9.17E-03	2.34E-01	.00	.00	.00	
AM243	224	9.02E-03	2.31E-01	.00	.00	.00	
AM243	225	8.94E-03	2.31E-01	.00	.00	.00	
AM243	226	8.80E-03	2.28E-01	.00	.00	.00	
AM243	227	8.71E-03	2.27E-01	.00	.00	.00	
AM243	228	8.60E-03	2.26E-01	.00	.00	.00	
AM243	229	8.47E-03	2.23E-01	.00	.00	.00	
AM243	230	8.39E-03	2.23E-01	.00	.00	.00	
AM243	231	8.25E-03	2.20E-01	.00	.00	.00	
AM243	232	8.17E-03	2.20E-01	.00	.00	.00	
AM243	233	8.10E-03	2.19E-01	.00	.00	.00	
AM243	234	7.82E-03	2.12E-01	.00	.00	.00	
AM243	235	7.97E-03	2.18E-01	.00	.00	.00	
AM243	236	7.87E-03	2.16E-01	.00	.00	.00	
AM243	237	7.52E-03	2.08E-01	.00	.00	.00	
AM243	238	7.67E-03	2.13E-01	.00	.00	.00	
AM243	239	7.33E-03	2.05E-01	.00	.00	.00	
AM243	240	7.48E-03	2.10E-01	.00	.00	.00	
AM243	241	7.15E-03	2.02E-01	.00	.00	.00	
AM243	242	7.29E-03	2.07E-01	.00	.00	.00	
AM243	243	6.97E-03	1.99E-01	.00	.00	.00	
AM243	244	7.10E-03	2.04E-01	.00	.00	.00	
AM243	245	7.01E-03	2.03E-01	.00	.00	.00	
AM243	246	6.71E-03	1.95E-01	.00	.00	.00	

Appendix B - Inhalation Dose Rate Factors - FILE23

AM243	247	6.84E-03	2.00E-01	.00	.00	.00
AM243	248	6.54E-03	1.92E-01	.00	.00	.00
AM243	249	6.67E-03	1.97E-01	.00	.00	.00
AM243	250	6.38E-03	1.90E-01	.00	.00	.00
NP239		0	2	0		
NP239	2 1	3.26E-07	6.04E-06	3.25E-05	0.00E+00	6.35E-05
NP239	2 2	3.15E-09	5.83E-08	2.57E-07	0.00E+00	1.06E-07
PU239		0	0	50		
PU239	3 1	2.94E-04	6.74E-03	7.59E-01	0.00E+00	2.56E-04
PU239	3 2	1.02E-03	2.33E-02	1.09E+00	0.00E+00	1.61E-05
PU239	3 3	1.65E-03	3.76E-02	6.58E-01	0.00E+00	9.45E-06
PU239	3 4	2.22E-03	5.05E-02	3.96E-01	0.00E+00	5.69E-06
PU239	3 5	2.71E-03	6.16E-02	2.39E-01	0.00E+00	3.43E-06
PU239	3 6	3.12E-03	7.09E-02	1.44E-01	0.00E+00	2.07E-06
PU239	3 7	3.45E-03	7.81E-02	8.66E-02	0.00E+00	1.24E-06
PU239	3 8	3.72E-03	8.42E-02	5.23E-02	0.00E+00	7.52E-07
PU239	3 9	3.93E-03	8.88E-02	3.15E-02	0.00E+00	4.53E-07
PU239	310	4.08E-03	9.19E-02	1.89E-02	0.00E+00	2.72E-07
PU239	311	4.22E-03	9.48E-02	1.14E-02	0.00E+00	1.64E-07
PU239	312	4.30E-03	9.64E-02	6.88E-03	0.00E+00	9.88E-08
PU239	313	4.38E-03	9.80E-02	4.16E-03	0.00E+00	5.97E-08
PU239	314	4.42E-03	9.86E-02	2.50E-03	0.00E+00	3.59E-08
PU239	315	4.47E-03	9.94E-02	1.51E-03	0.00E+00	2.17E-08
PU239	316	4.49E-03	9.97E-02	9.10E-04	0.00E+00	1.30E-08
PU239	317	4.49E-03	9.94E-02	5.46E-04	0.00E+00	7.86E-09
PU239	318	4.52E-03	9.96E-02	3.30E-04	0.00E+00	4.74E-09
PU239	319	4.50E-03	9.90E-02	1.98E-04	0.00E+00	2.85E-09
PU239	320	4.52E-03	9.90E-02	1.20E-04	0.00E+00	1.72E-09
PU239	321	4.51E-03	9.86E-02	7.20E-05	0.00E+00	1.05E-09
PU239	322	4.49E-03	9.78E-02	4.36E-05	0.00E+00	6.11E-10
PU239	323	4.49E-03	9.76E-02	2.62E-05	0.00E+00	3.78E-10
PU239	324	4.46E-03	9.67E-02	1.57E-05	0.00E+00	2.33E-10
PU239	325	4.47E-03	9.65E-02	9.54E-06	0.00E+00	1.16E-10
PU239	326	4.44E-03	9.56E-02	5.72E-06	0.00E+00	8.73E-11
PU239	327	4.44E-03	9.53E-02	3.58E-06	0.00E+00	5.82E-11
PU239	328	4.42E-03	9.47E-02	1.91E-06	0.00E+00	2.91E-11
PU239	329	4.39E-03	9.37E-02	1.19E-06	0.00E+00	2.91E-11
PU239	330	4.39E-03	9.34E-02	9.54E-07	0.00E+00	0.00E+00
PU239	331	4.36E-03	9.25E-02	4.77E-07	0.00E+00	0.00E+00
PU239	332	4.36E-03	9.22E-02	2.38E-07	0.00E+00	0.00E+00
PU239	333	4.35E-03	9.18E-02	2.38E-07	0.00E+00	0.00E+00
PU239	334	4.24E-03	8.92E-02	0.00E+00	0.00E+00	0.00E+00
PU239	335	4.36E-03	9.14E-02	0.00E+00	0.00E+00	2.91E-11
PU239	336	4.35E-03	9.08E-02	0.00E+00	0.00E+00	0.00E+00
PU239	337	4.19E-03	8.74E-02	0.00E+00	0.00E+00	0.00E+00
PU239	338	4.31E-03	8.96E-02	0.00E+00	0.00E+00	0.00E+00
PU239	339	4.16E-03	8.62E-02	0.00E+00	0.00E+00	0.00E+00
PU239	340	4.28E-03	8.83E-02	0.00E+00	0.00E+00	0.00E+00
PU239	341	4.13E-03	8.50E-02	0.00E+00	0.00E+00	0.00E+00
PU239	342	4.24E-03	8.71E-02	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

PU239	343	4.10E-03	8.38E-02	0.00E+00	0.00E+00	0.00E+00
PU239	344	4.21E-03	8.59E-02	0.00E+00	0.00E+00	0.00E+00
PU239	345	4.20E-03	8.53E-02	0.00E+00	0.00E+00	0.00E+00
PU239	346	4.05E-03	8.21E-02	0.00E+00	0.00E+00	0.00E+00
PU239	347	4.16E-03	8.41E-02	0.00E+00	0.00E+00	0.00E+00
PU239	348	4.02E-03	8.09E-02	0.00E+00	0.00E+00	0.00E+00
PU239	349	4.13E-03	8.30E-02	0.00E+00	0.00E+00	0.00E+00
PU239	350	3.99E-03	7.98E-02	0.00E+00	0.00E+00	0.00E+00
PU241		0	0	50		
PU241	3 1	1.23E-05	3.43E-04	1.45E-03	0.00E+00	5.41E-06
PU241	3 2	4.12E-05	1.14E-03	2.02E-03	0.00E+00	3.27E-07
PU241	3 3	6.36E-05	1.76E-03	1.16E-03	0.00E+00	1.82E-07
PU241	3 4	8.17E-05	2.26E-03	6.67E-04	0.00E+00	1.05E-07
PU241	3 5	9.52E-05	2.63E-03	3.83E-04	0.00E+00	6.01E-08
PU241	3 6	1.05E-04	2.89E-03	2.20E-04	0.00E+00	3.46E-08
PU241	3 7	1.10E-04	3.03E-03	1.26E-04	0.00E+00	1.98E-08
PU241	3 8	1.13E-04	3.12E-03	7.27E-05	0.00E+00	1.14E-08
PU241	3 9	1.14E-04	3.13E-03	4.17E-05	0.00E+00	6.54E-09
PU241	310	1.13E-04	3.09E-03	2.39E-05	0.00E+00	3.75E-09
PU241	311	1.11E-04	3.04E-03	1.38E-05	0.00E+00	2.16E-09
PU241	312	1.08E-04	2.94E-03	7.88E-06	0.00E+00	1.24E-09
PU241	313	1.05E-04	2.85E-03	4.54E-06	0.00E+00	7.12E-10
PU241	314	1.01E-04	2.74E-03	2.60E-06	0.00E+00	4.07E-10
PU241	315	9.73E-05	2.63E-03	1.50E-06	0.00E+00	2.35E-10
PU241	316	9.32E-05	2.51E-03	8.60E-07	0.00E+00	1.35E-10
PU241	317	8.89E-05	2.39E-03	4.92E-07	0.00E+00	7.69E-11
PU241	318	8.51E-05	2.28E-03	2.83E-07	0.00E+00	4.46E-11
PU241	319	8.09E-05	2.16E-03	1.63E-07	0.00E+00	2.55E-11
PU241	320	7.73E-05	2.06E-03	9.31E-08	0.00E+00	1.50E-11
PU241	321	7.36E-05	1.95E-03	5.40E-08	0.00E+00	8.19E-12
PU241	322	6.98E-05	1.85E-03	3.03E-08	0.00E+00	5.00E-12
PU241	323	6.65E-05	1.76E-03	1.82E-08	0.00E+00	2.73E-12
PU241	324	6.30E-05	1.66E-03	9.78E-09	0.00E+00	1.82E-12
PU241	325	6.01E-05	1.58E-03	6.05E-09	0.00E+00	4.55E-13
PU241	326	5.69E-05	1.49E-03	3.26E-09	0.00E+00	4.55E-13
PU241	327	5.42E-05	1.41E-03	1.86E-09	0.00E+00	4.55E-13
PU241	328	5.15E-05	1.34E-03	1.40E-09	0.00E+00	0.00E+00
PU241	329	4.88E-05	1.26E-03	4.66E-10	0.00E+00	0.00E+00
PU241	330	4.64E-05	1.20E-03	4.66E-10	0.00E+00	0.00E+00
PU241	331	4.40E-05	1.13E-03	0.00E+00	0.00E+00	4.55E-13
PU241	332	4.19E-05	1.08E-03	0.00E+00	0.00E+00	0.00E+00
PU241	333	3.99E-05	1.02E-03	0.00E+00	0.00E+00	0.00E+00
PU241	334	3.70E-05	9.46E-04	4.66E-10	0.00E+00	0.00E+00
PU241	335	3.63E-05	9.24E-04	0.00E+00	0.00E+00	0.00E+00
PU241	336	3.44E-05	8.74E-04	0.00E+00	0.00E+00	0.00E+00
PU241	337	3.17E-05	8.02E-04	0.00E+00	0.00E+00	0.00E+00
PU241	338	3.10E-05	7.83E-04	0.00E+00	0.00E+00	0.00E+00
PU241	339	2.85E-05	7.18E-04	0.00E+00	0.00E+00	0.00E+00
PU241	340	2.80E-05	7.02E-04	0.00E+00	0.00E+00	0.00E+00
PU241	341	2.57E-05	6.43E-04	0.00E+00	0.00E+00	0.00E+00

Appendix B - Inhalation Dose Rate Factors - FILE23

PU241	342	2.52E-05	6.29E-04	0.00E+00	0.00E+00	0.00E+00
PU241	343	2.32E-05	5.76E-04	0.00E+00	0.00E+00	0.00E+00
PU241	344	2.27E-05	5.63E-04	0.00E+00	0.00E+00	0.00E+00
PU241	345	2.16E-05	5.33E-04	0.00E+00	0.00E+00	0.00E+00
PU241	346	1.98E-05	4.88E-04	0.00E+00	0.00E+00	0.00E+00
PU241	347	1.94E-05	4.77E-04	0.00E+00	0.00E+00	0.00E+00
PU241	348	1.79E-05	4.38E-04	0.00E+00	0.00E+00	0.00E+00
PU241	349	1.75E-05	4.28E-04	0.00E+00	0.00E+00	0.00E+00
PU241	350	1.61E-05	3.92E-04	0.00E+00	0.00E+00	0.00E+00
AM241		0 50	0			
AM241	2 1	5.39E-03	1.19E-01	3.08E-01	.00	2.70E-04
AM241	2 2	1.23E-02	2.74E-01	7.34E-02	.00	1.10E-05
AM241	2 3	1.24E-02	2.78E-01	4.62E-04	.00	6.65E-08
AM241	2 4	1.23E-02	2.76E-01	2.92E-06	.00	4.18E-10
AM241	2 5	1.21E-02	2.73E-01	1.86E-08	.00	3.64E-12
AM241	2 6	1.19E-02	2.71E-01	.00	.00	.00
AM241	2 7	1.17E-02	2.68E-01	.00	.00	.00
AM241	2 8	1.16E-02	2.67E-01	.00	.00	.00
AM241	2 9	1.14E-02	2.65E-01	.00	.00	.00
AM241	210	1.12E-02	2.62E-01	.00	.00	.00
AM241	211	1.11E-02	2.60E-01	.00	.00	.00
AM241	212	1.09E-02	2.57E-01	.00	.00	.00
AM241	213	1.08E-02	2.56E-01	.00	.00	.00
AM241	214	1.06E-02	2.53E-01	.00	.00	.00
AM241	215	1.05E-02	2.52E-01	.00	.00	.00
AM241	216	1.04E-02	2.49E-01	.00	.00	.00
AM241	217	1.02E-02	2.47E-01	.00	.00	.00
AM241	218	1.01E-02	2.45E-01	.00	.00	.00
AM241	219	9.90E-03	2.42E-01	.00	.00	.00
AM241	220	9.79E-03	2.41E-01	.00	.00	.00
AM241	221	9.65E-03	2.39E-01	.00	.00	.00
AM241	222	9.49E-03	2.36E-01	.00	.00	.00
AM241	223	9.38E-03	2.35E-01	.00	.00	.00
AM241	224	9.22E-03	2.32E-01	.00	.00	.00
AM241	225	9.12E-03	2.31E-01	.00	.00	.00
AM241	226	8.97E-03	2.29E-01	.00	.00	.00
AM241	227	8.87E-03	2.27E-01	.00	.00	.00
AM241	228	8.74E-03	2.25E-01	.00	.00	.00
AM241	229	8.59E-03	2.23E-01	.00	.00	.00
AM241	230	8.50E-03	2.22E-01	.00	.00	.00
AM241	231	8.35E-03	2.19E-01	.00	.00	.00
AM241	232	8.26E-03	2.18E-01	.00	.00	.00
AM241	233	8.17E-03	2.17E-01	.00	.00	.00
AM241	234	7.88E-03	2.10E-01	.00	.00	.00
AM241	235	8.02E-03	2.15E-01	.00	.00	.00
AM241	236	7.91E-03	2.13E-01	.00	.00	.00
AM241	237	7.55E-03	2.05E-01	.00	.00	.00
AM241	238	7.69E-03	2.10E-01	.00	.00	.00
AM241	239	7.34E-03	2.02E-01	.00	.00	.00
AM241	240	7.47E-03	2.06E-01	.00	.00	.00

Appendix B - Inhalation Dose Rate Factors - FILE23

AM241	241	7.14E-03	1.98E-01	.00	.00	.00
AM241	242	7.26E-03	2.03E-01	.00	.00	.00
AM241	243	6.94E-03	1.95E-01	.00	.00	.00
AM241	244	7.06E-03	2.00E-01	.00	.00	.00
AM241	245	6.96E-03	1.98E-01	.00	.00	.00
AM241	246	6.65E-03	1.90E-01	.00	.00	.00
AM241	247	6.77E-03	1.95E-01	.00	.00	.00
AM241	248	6.46E-03	1.87E-01	.00	.00	.00
AM241	249	6.58E-03	1.91E-01	.00	.00	.00
AM241	250	6.28E-03	1.84E-01	.00	.00	.00

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

Committed Dose Equivalents (Sv/Bq) ICRP Publication 30 (11-Aug-86 RAP)

H 3	1				H-3 (WATER)
		9.9E+00			F1
16		1.7E-11	1.7E-11		SOFT TISSUE
BE 10	5				Be-10
		5.0E-03	5.0E-03	5.0E-03	F1
4		4.2E-08	7.8E-07		LUNGS
3		7.2E-10	1.8E-08		R MARROW
6			5.3E-08		BONE SURF
9		4.3E-09			ULI WALL
10		1.3E-08			LLI WALL
C 14	11				C-14 (C02)
		9.9E+00			F1
4		6.4E-12			LUNGS
1		6.4E-12			GONADS
2		6.4E-12			BREAST
3		6.4E-12			R MARROW
5		6.4E-12			THYROID
6		6.4E-12			BONE SURF
7		6.4E-12			ST WALL
8		6.4E-12			SI WALL
9		6.4E-12			ULI WALL
10		6.4E-12			LLI WALL
21		6.4E-12			REMAINDER
		0.06			Remainder weight
N 13	0				
F 18	5				F-18
		1.0E+00	1.0E+00	1.0E+00	F1
4		1.1E-10	1.3E-10	1.4E-10	LUNGS
3		5.9E-11	2.8E-11		R MARROW
6		6.0E-11			BONE SURF
7		2.9E-10	4.1E-11		ST WALL
21		2.9E-11			REMAINDER
		0.06			Remainder weight
NA 22	10				Na-22
		1.0E+00	1.0E+00		F1
4		2.5E-09	2.5E-09		LUNGS
1		2.8E-09	1.8E-09		GONADS
2		2.6E-09	1.6E-09		BREAST

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

3	4.3E-09	2.7E-09	R MARROW
6	5.5E-09	3.5E-09	BONE SURF
5	2.5E-09	1.6E-09	THYROID
7	2.9E-09		ST WALL
8	3.0E-09	1.9E-09	SI WALL
10	3.1E-09	1.9E-09	LLI WALL
21	4.0E-09	2.6E-09	REMAINDER
	0.12	0.18	Remainder weight

NA 24	8			Na-24
	1.0E+00	1.0E+00		F1
4	2.6E-10	1.2E-09		LUNGS
1	3.4E-10	1.8E-10		GONADS
2	2.7E-10	1.6E-10		BREAST
3	3.7E-10	2.1E-10		R MARROW
6	4.7E-10			BONE SURF
7	1.2E-09	3.1E-10		ST WALL
10	3.4E-10			LLI WALL
21	4.4E-10			REMAINDER
	0.18			Remainder weight

P 32	7			P-32
	8.0E-01	8.0E-01	8.0E-01	F1
4		2.5E-09	2.6E-08	LUNGS
1	6.5E-10	4.8E-10		GONADS
2	6.5E-10	4.8E-10		BREAST
3	8.1E-09	6.0E-09	4.2E-09	R MARROW
6	7.9E-09	5.8E-09		BONE SURF
9	3.0E-09			ULI WALL
10	7.2E-09	1.5E-09		LLI WALL

P 33	9			P-33
	8.0E-01	8.0E-01	8.0E-01	F1
4	9.4E-11	3.0E-10	4.2E-09	LUNGS
1	9.4E-11	7.0E-11		GONADS
2	9.4E-11	7.0E-11		BREAST
3	5.0E-10	3.7E-10		R MARROW
6	1.3E-09	9.8E-10		BONE SURF
7	1.8E-10	8.3E-11		ST WALL
8	1.4E-10	7.6E-11		SI WALL
9	3.5E-10	1.1E-10		ULI WALL
10	8.4E-10	1.9E-10		LLI WALL

S 35	9			S-35
	8.0E-01	1.0E-01	8.0E-01	F1
4	7.6E-11	2.0E-10	5.1E-09	LUNGS

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

1	7.6E-11		5.7E-11	GONADS
2	7.6E-11		5.7E-11	BREAST
3	7.6E-11		5.7E-11	R MARROW
7	1.3E-10		6.6E-11	ST WALL
8	1.0E-10		6.1E-11	SI WALL
9	2.4E-10	7.5E-10	8.2E-11	ULI WALL
10	5.7E-10	2.2E-09	1.3E-10	LLI WALL
21	7.6E-11		5.7E-11	REMAINDER
	0.06		0.06	Remainder weight

S	35	11		S-35 (GASES)
			9.9E+00	F1
4			9.5E-11	LUNGS
1			9.5E-11	GONADS
2			9.5E-11	BREAST
3			9.5E-11	R MARROW
5			9.5E-11	THYROID
6			9.5E-11	BONE SURF
7			9.5E-11	ST WALL
8			9.5E-11	SI WALL
9			9.5E-11	ULI WALL
10			9.5E-11	LLI WALL
21			9.5E-11	REMAINDER
			0.06	Remainder weight

CL	36	11		CL-36
	1.0E+00		1.0E+00	F1
4	8.0E-10		1.3E-09	LUNGS
1	8.0E-10		5.0E-10	GONADS
2	8.0E-10		5.0E-10	BREAST
3	8.0E-10		5.0E-10	R MARROW
6	8.0E-10			BONE SURF
5	8.0E-10			THYROID
7	1.1E-09		5.5E-10	ST WALL
8	8.0E-10		5.0E-10	SI WALL
9	8.0E-10		5.0E-10	ULI WALL
10	8.0E-10		5.0E-10	LLI WALL
21	8.0E-10		5.0E-10	REMAINDER
	0.06		0.06	Remainder weight

AR 39 0

AR 41 0

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

K	40	10				K-40
		1.0E+00	1.0E+00			F1
4		4.9E-09	4.7E-09			LUNGS
1		5.1E-09	3.2E-09			GONADS
2		4.9E-09	3.1E-09			BREAST
3		4.9E-09	3.1E-09			R MARROW
6		4.9E-09	3.1E-09			BONE SURF
5		4.9E-09	3.1E-09			THYROID
7		5.5E-09	3.2E-09			ST WALL
8		5.0E-09	3.2E-09			SI WALL
10		5.0E-09	3.2E-09			LLI WALL
21		5.4E-09	3.4E-09			REMAINDER
		0.12	0.12			Remainder weight

CA	41	3				Ca-41
		3.0E-01	3.0E-01			F1
4			4.5E-10			LUNGS
3		1.8E-09	1.6E-09			R MARROW
6		4.0E-09	3.6E-09			BONE SURF

CA	45	5				Ca-45
		3.0E-01	3.0E-01			F1
4			9.7E-09			LUNGS
3		3.5E-09	2.9E-09			R MARROW
6		5.2E-09	4.4E-09			BONE SURF
9		9.9E-10				ULI WALL
10		2.8E-09				LLI WALL

SC	46	5				Sc-46
		1.0E-04		1.0E-04		F1
4				4.6E-08		LUNGS
1		2.0E-09				GONADS
8		2.3E-09				SI WALL
9		4.6E-09				ULI WALL
10		1.0E-08				LLI WALL

CR	51	9				Cr-51
		1.0E-01	1.0E-02	1.0E-01	1.0E-01	F1
4				3.8E-11	3.8E-10	LUNGS
1		4.0E-11	4.0E-11	2.7E-11	2.2E-11	GONADS
2				1.9E-11		BREAST
3		1.2E-11		2.7E-11		R MARROW
6				2.7E-11		BONE SURF
8		4.7E-11	4.7E-11	3.0E-11		SI WALL
9		1.1E-10	1.1E-10	3.8E-11		ULI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

10	2.5E-10	2.7E-10	5.9E-11	1.1E-10	1.2E-10	LLI WALL
21			2.5E-11			REMAINDER
			0.12			Remainder weight

MN 54	10					Mn-54
	1.0E-01		1.0E-01	1.0E-01		F1
4	2.3E-10		1.2E-09	6.7E-09		LUNGS
1	9.5E-10		8.9E-10	7.1E-10		GONADS
2	2.8E-10		9.1E-10	8.6E-10		BREAST
3	4.9E-10		1.7E-09	1.1E-09		R MARROW
6			2.6E-09			BONE SURF
12	1.0E-09		4.6E-09	2.5E-09		LIVER
8	9.8E-10					SI WALL
9	1.4E-09		1.3E-09			ULI WALL
10	2.2E-09					LLI WALL
21	5.0E-10		1.8E-09	1.8E-09		REMAINDER
	0.06		0.18	0.18		Remainder weight

MN 56	6					Mn-56
	1.0E-01		1.0E-01	1.0E-01		F1
4			4.4E-10	5.4E-10		LUNGS
1	8.5E-11		2.1E-11			GONADS
7	9.0E-10		1.4E-10			ST WALL
8	1.1E-09		1.6E-10			SI WALL
9	1.4E-09		2.0E-10			ULI WALL
10	5.4E-10					LLI WALL

FE 55	10					Fe-55
	1.0E-01		1.0E-01	1.0E-01		F1
4	1.0E-10		5.2E-10	1.1E-09		LUNGS
1	1.1E-10		5.2E-10	1.8E-10		GONADS
2	1.0E-10		5.1E-10	1.7E-10		BREAST
3	1.1E-10		5.2E-10	1.8E-10		R MARROW
12	3.4E-10		1.7E-09	5.8E-10		LIVER
13	5.6E-10		2.8E-09	9.5E-10		SPLEEN
8	1.2E-10					SI WALL
9	1.7E-10		5.2E-10			ULI WALL
10	3.0E-10		5.4E-10	2.8E-10		LLI WALL
21			5.2E-10			REMAINDER
			0.06			Remainder weight

FE 59	12					Fe-59
	1.0E-01		1.0E-01	1.0E-01		F1
4	6.4E-10		3.5E-09	1.4E-08		LUNGS
1	1.7E-09		3.3E-09	1.4E-09		GONADS
2	7.4E-10		3.0E-09	1.3E-09		BREAST

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

3	8.5E-10	3.2E-09			R MARROW
6		2.9E-09			BONE SURF
5		2.9E-09			THYROID
13	1.8E-09	8.3E-09	2.9E-09		SPLEEN
12	1.5E-09	7.1E-09			LIVER
8	2.1E-09				SI WALL
9	3.9E-09	4.1E-09			ULI WALL
10	8.4E-09	4.8E-09	4.5E-09		LLI WALL
21		4.7E-09			REMAINDER
		0.06			Remainder weight

CO 57	9				Co-57
	5.0E-02	3.0E-01	5.0E-02	5.0E-02	F1
4		1.6E-10	4.1E-09	1.7E-08	LUNGS
1	1.8E-10	2.9E-10			GONADS
2		1.6E-10			BREAST
3	8.8E-11	2.7E-10			R MARROW
12		4.6E-10			LIVER
8	2.3E-10	3.4E-10			SI WALL
9	5.3E-10	5.6E-10			ULI WALL
10	1.3E-09	1.1E-09			LLI WALL
21		2.5E-10			REMAINDER
		0.06			Remainder weight

CO 58	9				Co-58
	5.0E-02	3.0E-01	5.0E-02	5.0E-02	F1
4		4.1E-10	7.9E-09	1.6E-08	LUNGS
1	1.0E-09	1.1E-09	6.5E-10		GONADS
2	1.8E-10	4.5E-10			BREAST
3	2.6E-10	5.4E-10			R MARROW
12		1.0E-09			LIVER
8	1.1E-09	1.3E-09			SI WALL
9	1.9E-09	1.9E-09			ULI WALL
10	4.0E-09	3.3E-09	2.0E-09		LLI WALL
21	4.8E-10	7.8E-10			REMAINDER
	0.06	0.06			Remainder weight

CO 60	9				Co-60
	5.0E-02	3.0E-01	5.0E-02	5.0E-02	F1
4	8.7E-10	5.0E-09	3.6E-08	3.4E-07	LUNGS
1	3.2E-09	7.2E-09	4.0E-09		GONADS
2	1.1E-09	5.1E-09	4.2E-09		BREAST
3	1.3E-09	5.5E-09	4.2E-09		R MARROW
12	2.3E-09	1.3E-08	9.2E-09		LIVER
8	3.6E-09	8.2E-09			SI WALL
9	5.7E-09	9.6E-09			ULI WALL
10	1.1E-08	1.4E-08	8.2E-09		LLI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

21	2.1E-09	8.7E-09	8.0E-09	REMAINDER
	0.06	0.06	0.06	Remainder weight

NI 59	11			Ni-59 (INORGANIC)
	5.0E-02	5.0E-02	5.0E-02	F1
4	3.5E-11	3.6E-10	1.2E-09	LUNGS
1	3.8E-11	3.6E-10	1.1E-10	GONADS
2	3.6E-11	3.5E-10	1.1E-10	BREAST
3	3.7E-11	3.5E-10		R MARROW
6		3.5E-10		BONE SURF
5		3.8E-10		THYROID
7	4.1E-11			ST WALL
8	4.1E-11			SI WALL
9	1.2E-10	3.6E-10		ULI WALL
10	2.7E-10	3.8E-10		LLI WALL
21	3.7E-11	3.6E-10		REMAINDER
	0.06	0.18		Remainder weight

NI 63	11			Ni-63 (INORGANIC)
	5.0E-02	5.0E-02	5.0E-02	F1
4	8.5E-11	8.7E-10	3.1E-09	LUNGS
1	8.5E-11	8.2E-10	2.5E-10	GONADS
2	8.5E-11	8.2E-10	2.5E-10	BREAST
3	8.5E-11	8.2E-10		R MARROW
6		8.2E-10		BONE SURF
11		8.2E-10		KIDNEYS
5		8.2E-10		THYROID
7	1.0E-10	8.3E-10		ST WALL
8	1.3E-10	8.3E-10		SI WALL
9	3.6E-10	8.7E-10		ULI WALL
10	9.2E-10	9.5E-10	6.7E-10	LLI WALL

NI 65	6			Ni-65 (INORGANIC)
	5.0E-02	5.0E-02	5.0E-02	F1
4		3.1E-10	3.8E-10	LUNGS
1	2.4E-11			GONADS
7	6.2E-10	9.2E-11		ST WALL
8	7.3E-10	1.1E-10		SI WALL
9	9.3E-10	1.3E-10		ULI WALL
10	3.7E-10			LLI WALL

CU 64	6			Cu-64
	5.0E-01	5.0E-01	5.0E-01	F1
4		2.0E-10	3.4E-10	LUNGS
1	4.8E-11	1.6E-11	3.5E-10	GONADS
7	1.7E-10			ST WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

8	2.1E-10	4.2E-11			SI WALL
9	6.1E-10	1.0E-10	1.3E-10	1.5E-10	ULI WALL
10	7.5E-10	1.2E-10	1.6E-10	1.9E-10	LLI WALL

ZN 65	10				Zn-65
	5.0E-01			5.0E-01	F1
4	3.1E-09			2.1E-08	LUNGS
1	3.5E-09			2.0E-09	GONADS
2	3.3E-09			3.1E-09	BREAST
3	4.5E-09			3.6E-09	R MARROW
5	3.2E-09				THYROID
6	4.5E-09				BONE SURF
8	4.3E-09				SI WALL
9	4.2E-09				ULI WALL
10	5.0E-09				LLI WALL
21	4.8E-09			5.9E-09	REMAINDER
	0.12			0.18	Remainder weight

ZN 69M	6				Zn-69M
	5.0E-01			5.0E-01	F1
4				1.0E-09	LUNGS
1	1.2E-10				GONADS
7	2.7E-10				ST WALL
8	4.9E-10				SI WALL
9	1.8E-09			4.8E-10	ULI WALL
10	2.4E-09			6.3E-10	LLI WALL

ZN 69	4				Zn-69
	5.0E-01			5.0E-01	F1
4				8.0E-11	LUNGS
7	2.1E-10				ST WALL
8	1.1E-10				SI WALL
9	6.1E-11				ULI WALL

AS 76	5				As-76
	5.0E-01		5.0E-01		F1
4			5.0E-09		LUNGS
7	1.4E-09				ST WALL
8	1.7E-09				SI WALL
9	6.6E-09		1.8E-09		ULI WALL
10	1.2E-08		3.3E-09		LLI WALL

SE 75	13				Se-75
	8.0E-01	5.0E-02	8.0E-01	8.0E-01	F1
4			1.4E-09	5.4E-09	LUNGS

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

1	1.8E-09	5.9E-10	1.3E-09	1.1E-09	GONADS
2	1.5E-09	1.4E-10	1.1E-09	1.1E-09	BREAST
3	2.1E-09	2.4E-10	1.5E-09	1.5E-09	R MARROW
6	1.7E-09		1.3E-09		BONE SURF
11	7.2E-09	5.0E-10	5.4E-09	4.5E-09	KIDNEYS
12	5.7E-09	3.9E-10	4.3E-09	3.9E-09	LIVER
15	4.0E-09		3.0E-09	2.8E-09	PANCREAS
13	3.6E-09		2.7E-09	2.6E-09	SPLEEN
8		6.0E-10			SI WALL
9		9.4E-10			ULI WALL
10		1.8E-09			LLI WALL
21	2.8E-09		2.1E-09	2.1E-09	REMAINDER
	0.06		0.06	0.06	Remainder weight

SE 79	10				Se-79
	8.0E-01	5.0E-02	8.0E-01	8.0E-01	F1
4	9.1E-10		8.5E-10	9.8E-09	LUNGS
1	9.1E-10		6.8E-10	6.0E-10	GONADS
2	9.1E-10		6.8E-10		BREAST
3	9.1E-10		6.8E-10		R MARROW
11	1.3E-08	7.8E-10	9.4E-09	8.3E-09	KIDNEYS
12	6.5E-09	4.1E-10	4.9E-09	4.3E-09	LIVER
15	3.9E-09		2.9E-09	2.6E-09	PANCREAS
13	4.3E-09		3.2E-09	2.9E-09	SPLEEN
9		9.6E-10			ULI WALL
10		2.8E-09			LLI WALL

BR 82	8				Br-82
	1.0E+00		1.0E+00	1.0E+00	F1
4	3.8E-10		7.8E-10	1.7E-09	LUNGS
1	4.5E-10		2.5E-10	1.7E-10	GONADS
2	3.8E-10		2.4E-10	2.1E-10	BREAST
3	4.1E-10		2.5E-10	2.2E-10	R MARROW
6	3.8E-10				BONE SURF
7	8.3E-10		3.4E-10	3.8E-10	ST WALL
8	5.0E-10				SI WALL
21	5.6E-10		3.5E-10	3.5E-10	REMAINDER
	0.18		0.24	0.06	Remainder weight

BR 83	3				Br-83
	1.0E+00		1.0E+00	1.0E+00	F1
4			1.5E-10	1.8E-10	LUNGS
1	7.3E-12				GONADS
7	3.0E-10		4.3E-11		ST WALL

BR 84	2				Br-84
-------	---	--	--	--	-------

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

	1.0E+00	1.0E+00	1.0E+00	F1
4		1.6E-10	1.7E-10	LUNGS
7	6.8E-10	7.4E-11		ST WALL

BR 85 0

KR 83M 0

KR 85 0

KR 85M 0

KR 87 0

KR 88 0

KR 89 0

KR 90 0

KR 91 0

RB 86 9

	1.0E+00	1.0E+00
4	2.1E-09	3.3E-09
1	2.2E-09	1.3E-09
2	2.1E-09	1.3E-09
3	3.7E-09	2.3E-09
6	6.9E-09	4.3E-09
5	2.1E-09	1.3E-09
7	2.9E-09	1.5E-09

Rb-86
F1
LUNGS
GONADS
BREAST
R MARROW
BONE SURF
THYROID
ST WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

10	2.2E-09	1.4E-09	LLI WALL
21	2.2E-09	1.4E-09	REMAINDER
	0.18	0.18	Remainder weight

RB 87	11			Rb-87
	1.0E+00	1.0E+00		F1
4	1.1E-09	1.1E-09		LUNGS
1	1.1E-09	7.2E-10		GONADS
2	1.1E-09	7.2E-10		BREAST
3	2.0E-09	1.3E-09		R MARROW
6	3.8E-09	2.4E-09		BONE SURF
5	1.1E-09	7.2E-10		THYROID
7	1.3E-09	7.4E-10		ST WALL
8	1.1E-09	7.2E-10		SI WALL
9	1.1E-09	7.2E-10		ULI WALL
10	1.1E-09	7.2E-10		LLI WALL
21	1.1E-09	7.2E-10		REMAINDER
	0.06	0.06		Remainder weight

RB 88	2			Rb-88
	1.0E+00	1.0E+00		F1
4		1.5E-10		LUNGS
7	7.3E-10	6.2E-11		ST WALL

RB 89	2			Rb-89
	1.0E+00	1.0E+00		F1
4		6.8E-11		LUNGS
7	3.6E-10	3.0E-11		ST WALL

SR 85	9				Sr-85
	3.0E-01	1.0E-02	3.0E-01	1.0E-02	F1
4	2.0E-10		4.7E-10	7.2E-09	LUNGS
1	6.2E-10	5.8E-10	4.4E-10		GONADS
2	2.5E-10		3.7E-10		BREAST
3	6.0E-10	1.3E-10	9.2E-10		R MARROW
6	6.1E-10		1.0E-09		BONE SURF
8	6.2E-10	5.9E-10	4.2E-10		SI WALL
9	8.7E-10	9.6E-10	4.4E-10		ULI WALL
10	1.5E-09	1.8E-09	5.8E-10		LLI WALL
21	3.4E-10		5.7E-10		REMAINDER
	0.12		0.12		Remainder weight

SR 89	6				Sr-89
	3.0E-01	1.0E-02	3.0E-01	1.0E-02	F1
4			2.2E-09	8.4E-08	LUNGS

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

1			4.2E-10		GONADS
3	3.2E-09		5.6E-09		R MARROW
6	4.8E-09		8.4E-09		BONE SURF
9	7.3E-09	1.0E-08	1.5E-09		ULI WALL
10	2.1E-08	2.9E-08	3.6E-09		LLI WALL

SR 90	5				Sr-90
	3.0E-01	1.0E-02	3.0E-01	1.0E-02	F1
4				2.9E-06	LUNGS
3	1.9E-07	6.4E-09	3.3E-07		R MARROW
6	4.2E-07	1.4E-08	7.3E-07		BONE SURF
9		6.1E-09			ULI WALL
10		2.6E-08			LLI WALL

SR 91	7				Sr-91
	3.0E-01	1.0E-02	3.0E-01	1.0E-02	F1
4			9.2E-10	2.1E-09	LUNGS
1	2.1E-10	2.5E-10	6.4E-11		GONADS
3			1.2E-10		R MARROW
7	8.6E-10	8.5E-10			ST WALL
8	1.4E-09	1.8E-09	2.4E-10		SI WALL
9	3.7E-09	4.9E-09	5.9E-10	1.1E-09	ULI WALL
10	3.9E-09	5.1E-09	6.1E-10	1.2E-09	LLI WALL

SR 92	6				Sr-92
	3.0E-01	1.0E-02	3.0E-01	1.0E-02	F1
4			7.1E-10	1.1E-09	LUNGS
1	8.0E-11				GONADS
7	5.3E-10	5.2E-10			ST WALL
8	1.1E-09	1.4E-09	1.9E-10	2.8E-10	SI WALL
9	3.0E-09	3.9E-09	4.7E-10	6.1E-10	ULI WALL
10	2.1E-09	2.7E-09	3.3E-10	3.8E-10	LLI WALL

Y 89M 0

Y 90	3				Y-90
	1.0E-04		1.0E-04	1.0E-04	F1
4			8.9E-09	9.3E-09	LUNGS
9	1.3E-08		4.6E-09	5.3E-09	ULI WALL
10	3.2E-08		1.1E-08	1.3E-08	LLI WALL

Y 91M	7				Y-91M
	1.0E-04		1.0E-04	1.0E-04	F1

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

4		4.2E-11	7.0E-11	LUNGS
1	6.9E-12			GONADS
7	4.9E-11			ST WALL
8	3.1E-11			SI WALL
9	3.1E-11			ULI WALL
10	2.4E-11	8.6E-12		LLI WALL
21	1.1E-11			REMAINDER
	0.06			Remainder weight

Y	91	4			Y-91
	1.0E-04		1.0E-04	1.0E-04	F1
4			5.3E-08	9.9E-08	LUNGS
3			5.6E-09		R MARROW
9	1.0E-08				ULI WALL
10	3.0E-08		1.4E-08		LLI WALL

Y	92	5			Y-92
	1.0E-04		1.0E-04	1.0E-04	F1
4			1.2E-09	1.2E-09	LUNGS
7	1.4E-09				ST WALL
8	2.0E-09				SI WALL
9	3.3E-09		3.2E-10	3.9E-10	ULI WALL
10	1.7E-09				LLI WALL

Y	93	5			Y-93
	1.0E-04		1.0E-04	1.0E-04	F1
4			2.4E-09	2.5E-09	LUNGS
7	1.3E-09				ST WALL
8	2.5E-09			5.7E-10	SI WALL
9	7.8E-09		1.5E-09	1.8E-09	ULI WALL
10	8.8E-09		1.6E-09	2.0E-09	LLI WALL

ZR	93	4			Zr-93
	2.0E-03		2.0E-03	2.0E-03	F1
4				8.7E-08	LUNGS
3	7.4E-10	1.8E-07	4.5E-08	1.9E-08	R MARROW
6	9.1E-09	2.2E-06	5.5E-07	2.4E-07	BONE SURF
10	1.0E-09				LLI WALL

ZR	95	7			Zr-95
	2.0E-03		2.0E-03	2.0E-03	F1
4			1.9E-08	4.1E-08	LUNGS
1	8.1E-10	1.9E-09			GONADS
3		1.3E-08	3.2E-09		R MARROW
6		1.0E-07	2.2E-08		BONE SURF

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

8	1.1E-09			SI WALL
9	3.0E-09			ULI WALL
10	7.8E-09	4.2E-09		LLI WALL

ZR 97	6				Zr-97
	2.0E-03	2.0E-03	2.0E-03	2.0E-03	F1
4		2.1E-09	4.0E-09	4.1E-09	LUNGS
1	6.2E-10	1.8E-10			GONADS
3		5.0E-10			R MARROW
8	3.4E-09	6.1E-10	8.9E-10	1.0E-09	SI WALL
9	1.2E-08	1.9E-09	2.9E-09	3.5E-09	ULI WALL
10	1.8E-08	2.8E-09	4.3E-09	5.1E-09	LLI WALL

NB 93M	6				Nb-93M
	1.0E-02	1.0E-02	1.0E-02		F1
4		4.9E-09	6.4E-08		LUNGS
1		4.2E-10			GONADS
3		8.8E-10			R MARROW
6	8.1E-10	1.0E-08			BONE SURF
9	4.9E-10				ULI WALL
10	1.5E-09				LLI WALL

NB 94	6				Nb-94
	1.0E-02	1.0E-02	1.0E-02		F1
4		4.2E-08	7.5E-07		LUNGS
1	5.2E-10	4.8E-09			GONADS
3	7.3E-10	6.3E-09			R MARROW
8	2.2E-09				SI WALL
9	5.2E-09				ULI WALL
10	1.2E-08				LLI WALL

NB 95M	3				Nb-95M
	1.0E-02	1.0E-02	1.0E-02		F1
4		2.6E-09	3.1E-09		LUNGS
9	2.6E-09	9.5E-10	1.1E-09		ULI WALL
10	6.5E-09	2.4E-09	2.7E-09		LLI WALL

NB 95	7				Nb-95
	1.0E-02	1.0E-02	1.0E-02		F1
4		5.5E-09	8.3E-09		LUNGS
1	8.0E-10	4.8E-10	4.3E-10		GONADS
3		6.7E-10			R MARROW
6		2.4E-09			BONE SURF
8	9.1E-10				SI WALL
9	1.8E-09				ULI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

10 4.0E-09 1.9E-09 1.9E-09 LLI WALL

NB 97M 0

NB 97	6				Nb-97
1.0E-02		1.0E-02	1.0E-02		F1
4		1.4E-10	1.6E-10		LUNGS
1	1.5E-11				GONADS
7	3.9E-10				ST WALL
8	3.0E-10				SI WALL
9	2.2E-10				ULI WALL
10	4.7E-11				LLI WALL

MO 93	10				Mo-93
8.0E-01	5.0E-02	8.0E-01		5.0E-02	F1
4	1.1E-10	1.2E-10		6.3E-08	LUNGS
1	1.3E-10	2.5E-11	9.3E-11		GONADS
2	1.0E-10		7.5E-11		BREAST
3	2.8E-10		2.1E-10		R MARROW
6	1.1E-09		8.6E-10		BONE SURF
12	1.8E-09	1.1E-10	1.3E-09		LIVER
11	1.6E-09	1.0E-10	1.2E-09		KIDNEYS
8		4.7E-11			SI WALL
9		1.7E-10			ULI WALL
10	1.8E-10	4.4E-10			LLI WALL

MO 99	10				Mo-99
8.0E-01	5.0E-02	8.0E-01		5.0E-02	F1
4		1.2E-09		4.3E-09	LUNGS
1	2.2E-10		1.3E-10		GONADS
2	1.8E-10		1.3E-10		BREAST
3	5.3E-10		3.7E-10		R MARROW
6	7.7E-10		5.4E-10		BONE SURF
12	2.7E-09		1.9E-09		LIVER
11	2.5E-09		1.7E-09		KIDNEYS
7	6.7E-10				ST WALL
9	1.4E-09	5.7E-09	3.3E-10	2.3E-09	ULI WALL
10	3.1E-09	1.4E-08	5.8E-10	5.5E-09	LLI WALL

TC 99M	10				Tc-99M
8.0E-01		8.0E-01	8.0E-01		F1
4		2.3E-11	3.1E-11		LUNGS
1	9.7E-12	2.8E-12	1.7E-12		GONADS
2	3.6E-12	2.1E-12			BREAST

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

3	6.3E-12	3.4E-12			R MARROW
5	8.5E-11	5.0E-11	2.1E-11		THYROID
7	7.2E-11	2.9E-11	1.5E-11		ST WALL
8	2.2E-11	4.8E-12			SI WALL
9	3.7E-11	7.0E-12			ULI WALL
10	2.5E-11	5.0E-12			LLI WALL
21	1.1E-11	5.0E-12			REMAINDER
	0.06	0.06			Remainder weight

TC 99	5				Tc-99
	8.0E-01	8.0E-01	8.0E-01		F1
4		3.5E-10	1.7E-08		LUNGS
5	1.6E-09	1.2E-09			THYROID
7	3.4E-09	2.5E-09			ST WALL
9	4.1E-10				ULI WALL
10	1.1E-09				LLI WALL

TC 101	3				Tc-101
	8.0E-01	8.0E-01	8.0E-01		F1
4		2.8E-11	3.0E-11		LUNGS
7	1.5E-10	1.4E-11			ST WALL
8	2.3E-11				SI WALL

RU 103	10				Ru-103
	5.0E-02	5.0E-02	5.0E-02	5.0E-02	F1
4		1.0E-09	9.9E-09	1.6E-08	LUNGS
1	5.7E-10	7.3E-10			GONADS
2		6.1E-10			BREAST
3		6.7E-10			R MARROW
6		6.2E-10			BONE SURF
7		7.2E-10			ST WALL
8	8.5E-10	8.4E-10			SI WALL
9	2.5E-09	1.1E-09			ULI WALL
10	6.5E-09	1.7E-09	3.1E-09	3.1E-09	LLI WALL
21		8.1E-10			REMAINDER
		0.06			Remainder weight

RU 105	6				Ru-105
	5.0E-02	5.0E-02	5.0E-02	5.0E-02	F1
4		3.7E-10	5.4E-10	5.7E-10	LUNGS
1	9.7E-11	2.7E-11			GONADS
7	5.0E-10	8.9E-11			ST WALL
8	7.9E-10	1.3E-10		1.2E-10	SI WALL
9	1.6E-09	2.5E-10	2.3E-10	2.8E-10	ULI WALL
10	1.3E-09	2.1E-10	2.6E-10	3.1E-10	LLI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

RU 106 11					Ru-106
	5.0E-02	5.0E-02	5.0E-02	5.0E-02	F1
4		1.8E-08	2.1E-07	1.0E-06	LUNGS
1		1.4E-08			GONADS
2		1.4E-08			BREAST
3		1.4E-08			R MARROW
6		1.4E-08			BONE SURF
5		1.4E-08			THYROID
7		1.4E-08			ST WALL
8		1.5E-08			SI WALL
9	2.5E-08	1.7E-08			ULI WALL
10	7.1E-08	2.5E-08			LLI WALL
21		1.4E-08			REMAINDER
		0.06			Remainder weight
RH 103M 4					Rh-103M
	5.0E-02	5.0E-02	5.0E-02	5.0E-02	F1
4		7.8E-12	8.8E-12	9.5E-12	LUNGS
7	2.6E-11	3.2E-12			ST WALL
8	1.6E-11	2.0E-12			SI WALL
9	9.1E-12				ULI WALL
RH 105 5					Rh-105
	5.0E-02	5.0E-02	5.0E-02	5.0E-02	F1
4		3.7E-10	9.3E-10	9.6E-10	LUNGS
1		3.5E-11			GONADS
8	4.4E-10	9.4E-11			SI WALL
9	1.9E-09	3.1E-10	5.8E-10	6.7E-10	ULI WALL
10	3.8E-09	6.0E-10	1.2E-09	1.4E-09	LLI WALL
RH 105M 0					
RH 106 0					
PD 103 5					Pd-103
	5.0E-03	5.0E-03	5.0E-03	5.0E-03	F1
4		1.5E-10	2.1E-09	2.7E-09	LUNGS
11		1.9E-09			KIDNEYS
12		1.0E-09			LIVER
9	8.3E-10				ULI WALL
10	2.3E-09	3.6E-10	9.8E-10	1.1E-09	LLI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

PD 107	5					Pd-107
		5.0E-03	5.0E-03	5.0E-03	5.0E-03	F1
4				1.5E-09	2.9E-08	LUNGS
11		6.4E-10				KIDNEYS
12		3.3E-10				LIVER
9	1.6E-10					ULI WALL
10	4.7E-10	7.4E-11				LLI WALL

PD 109	7					Pd-109
		5.0E-03	5.0E-03	5.0E-03	5.0E-03	F1
4		6.6E-10	1.2E-09	1.2E-09		LUNGS
11		5.5E-10				KIDNEYS
12		2.9E-10				LIVER
7	4.8E-10					ST WALL
8	1.0E-09	1.6E-10		2.6E-10		SI WALL
9	3.5E-09	5.4E-10	7.6E-10	9.1E-10		ULI WALL
10	4.7E-09	7.2E-10	1.0E-09	1.2E-09		LLI WALL

PD 109M 0

AG 109M 0

AG 110 0

AG 110M	9					Ag-110M
		5.0E-02	5.0E-02	5.0E-02		F1
4	8.3E-10	8.1E-09	3.2E-08	1.2E-07		LUNGS
1	3.0E-09	3.3E-09	2.3E-09			GONADS
2	7.5E-10	4.1E-09	2.9E-09			BREAST
3	9.4E-10					R MARROW
12	8.6E-09	8.1E-08	2.6E-08			LIVER
8	3.5E-09					SI WALL
9	5.9E-09	8.4E-09				ULI WALL
10	1.1E-08					LLI WALL
21	1.6E-09	1.4E-08	6.9E-09			REMAINDER
	0.06	0.18	0.12			Remainder weight

AG 111	4					Ag-111
		5.0E-02	5.0E-02	5.0E-02		F1
4		1.1E-09	7.8E-09	8.7E-09		LUNGS

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

12		8.7E-09	1.8E-09		LIVER
9	5.4E-09	9.1E-10	2.1E-09	2.4E-09	ULI WALL
10	1.5E-08	2.3E-09	5.8E-09	6.6E-09	LLI WALL
CD 109	4				Cd-109
	5.0E-02	5.0E-02	5.0E-02	5.0E-02	F1
4			1.5E-08	7.8E-08	LUNGS
11	4.1E-08	3.9E-07	1.1E-07	3.4E-08	KIDNEYS
12	7.4E-09	7.1E-08	2.1E-08		LIVER
10	4.6E-09				LLI WALL
CD 113M	3				Cd-113M
	5.0E-02	5.0E-02	5.0E-02	5.0E-02	F1
4				4.1E-07	LUNGS
11	5.6E-07	5.5E-06	1.6E-06	7.8E-07	KIDNEYS
12	9.7E-08	9.4E-07	2.8E-07	1.3E-07	LIVER
CD 115M	5				Cd-115M
	5.0E-02	5.0E-02	5.0E-02	5.0E-02	F1
4			4.7E-08	7.8E-08	LUNGS
11	2.6E-08	2.5E-07	5.9E-08		KIDNEYS
12	4.5E-09	4.3E-08	1.0E-08		LIVER
9	9.9E-09				ULI WALL
10	2.9E-08		1.3E-08		LLI WALL
CD 115	5				Cd-115
	5.0E-02	5.0E-02	5.0E-02	5.0E-02	F1
4		1.2E-09	4.1E-09	4.2E-09	LUNGS
11		8.7E-09	1.8E-09		KIDNEYS
12		1.7E-09			LIVER
9	6.2E-09	1.1E-09	2.2E-09	2.6E-09	ULI WALL
10	1.5E-08	2.4E-09	5.1E-09	5.9E-09	LLI WALL
IN 111	11				In-111
	2.0E-02	2.0E-02	2.0E-02		F1
4		2.2E-10	6.2E-10		LUNGS
1	4.2E-10	1.3E-10	1.6E-10		GONADS
2		6.4E-11			BREAST
3	1.1E-10	3.3E-10	1.1E-10		R MARROW
6		1.7E-10			BONE SURF
11		4.6E-10			KIDNEYS
12		3.3E-10			LIVER
13		1.7E-10			SPLEEN
8	4.9E-10		1.9E-10		SI WALL
9	1.1E-09	2.4E-10	3.9E-10		ULI WALL
10	2.0E-09	3.8E-10	7.1E-10		LLI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

IN 114 0

IN 114M	8			In-114M
	2.0E-02	2.0E-02	2.0E-02	F1
4			7.2E-08	LUNGS
3	3.5E-09	8.3E-08	1.8E-08	R MARROW
6		4.3E-08		BONE SURF
11		9.5E-08	2.0E-08	KIDNEYS
12		4.7E-08		LIVER
13		2.3E-08		SPLEEN
9	1.5E-08			ULI WALL
10	4.4E-08		2.0E-08	LLI WALL

IN 115M	7			In-115M
	2.0E-02	2.0E-02	2.0E-02	F1
4		1.4E-10	1.8E-10	LUNGS
1	2.2E-11			GONADS
3		1.9E-11		R MARROW
7	1.9E-10	3.2E-11		ST WALL
8	3.0E-10	4.7E-11		SI WALL
9	5.7E-10	8.6E-11	6.6E-11	ULI WALL
10	3.6E-10	5.4E-11	4.1E-11	LLI WALL

IN 115	5			In-115
	2.0E-02	2.0E-02	2.0E-02	F1
3	1.5E-07	3.7E-06	1.0E-06	R MARROW
6	7.9E-08	1.9E-06	5.1E-07	BONE SURF
11	1.7E-07	4.1E-06	1.1E-06	KIDNEYS
12	8.5E-08	2.0E-06	5.5E-07	LIVER
13	4.3E-08	1.0E-06	2.8E-07	SPLEEN

SN 117M	6			Sn-117M
	2.0E-02	2.0E-02	2.0E-02	F1
4		5.8E-10	6.1E-09	LUNGS
1	2.2E-10			GONADS
3		1.1E-09		R MARROW
6		1.1E-08		BONE SURF
9	2.9E-09			ULI WALL
10	7.9E-09	1.3E-09	3.3E-09	LLI WALL

SN 119M	7			Sn-119M
	2.0E-02	2.0E-02	2.0E-02	F1
4		4.7E-10	1.2E-08	LUNGS
1		2.2E-10		GONADS

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

2		2.2E-10		BREAST
3		1.8E-09		R MARROW
6		4.3E-09		BONE SURF
9	1.4E-09	4.2E-10		ULI WALL
10	4.0E-09	8.4E-10		LLI WALL

SN 121M	7			Sn-121M
	2.0E-02	2.0E-02	2.0E-02	F1
4		9.0E-10	2.0E-08	LUNGS
3	2.3E-10	5.5E-09		R MARROW
1		7.0E-10		GONADS
2		6.9E-10		BREAST
6		1.5E-08		BONE SURF
9	1.1E-09			ULI WALL
10	4.5E-09	1.4E-09		LLI WALL

SN 123	7			Sn-123
	2.0E-02	2.0E-02	2.0E-02	F1
4		2.3E-09	6.1E-08	LUNGS
1		7.5E-10		GONADS
2		7.5E-10		BREAST
3		5.7E-09		R MARROW
6		1.6E-08		BONE SURF
9	8.7E-09	2.1E-09		ULI WALL
10	2.6E-08	4.7E-09	1.3E-08	LLI WALL

SN 125	6			Sn-125
	2.0E-02	2.0E-02	2.0E-02	F1
4		2.6E-09	2.2E-08	LUNGS
1		2.6E-10		GONADS
3		3.6E-09		R MARROW
6		5.2E-09		BONE SURF
9	1.3E-08	2.2E-09	5.4E-09	ULI WALL
10	3.7E-08	5.9E-09	1.5E-08	LLI WALL

SN 126	9			Sn-126
	2.0E-02	2.0E-02	2.0E-02	F1
4		1.6E-08	1.5E-07	LUNGS
1	2.4E-09	1.4E-08		GONADS
3	2.7E-09	5.6E-08	1.7E-08	R MARROW
2		1.4E-08		BREAST
6		1.2E-07		BONE SURF
8	4.4E-09	1.4E-08		SI WALL
9	1.6E-08	1.6E-08		ULI WALL
10	4.3E-08	2.1E-08		LLI WALL
21		1.9E-08		REMAINDER

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

0.12					Remainder weight
SB 124	10				Sb-124
	1.0E-01	1.0E-02	1.0E-01	1.0E-02	F1
4			2.0E-09	4.1E-08	LUNGS
1	1.7E-09	1.8E-09	9.1E-10		GONADS
2			6.5E-10		BREAST
3			1.5E-09		R MARROW
6			3.4E-09		BONE SURF
12			2.5E-09		LIVER
8	2.7E-09	2.8E-09	1.1E-09		SI WALL
9	8.2E-09	8.8E-09	1.9E-09		ULI WALL
10	2.1E-08	2.3E-08	4.0E-09	1.1E-08	LLI WALL
21			9.9E-10		REMAINDER
			0.06		Remainder weight
SB 125	10				Sb-125
	1.0E-01	1.0E-02	1.0E-01	1.0E-02	F1
4			6.4E-10	2.2E-08	LUNGS
1	5.2E-10	5.3E-10	3.2E-10		GONADS
2			2.5E-10		BREAST
3			6.5E-10		R MARROW
6			2.7E-09		BONE SURF
12			1.1E-09		LIVER
8	7.6E-10	7.8E-10	3.9E-10		SI WALL
9	2.2E-09	2.4E-09	6.2E-10		ULI WALL
10	5.8E-09	6.3E-09	1.1E-09		LLI WALL
21			3.6E-10		REMAINDER
			0.06		Remainder weight
SB 126M	3				Sb-126M
	1.0E-01	1.0E-02	1.0E-01	1.0E-02	F1
4			5.0E-11	5.6E-11	LUNGS
7	2.6E-10	2.6E-10	2.4E-11		ST WALL
8	6.9E-11	7.0E-11			SI WALL
SB 126	10				Sb-126
	1.0E-01	1.0E-02	1.0E-01	1.0E-02	F1
4			1.8E-09	1.4E-08	LUNGS
1	2.7E-09	2.9E-09	9.1E-10	1.3E-09	GONADS
2			5.9E-10		BREAST
3			1.1E-09		R MARROW
6			1.7E-09		BONE SURF
12			1.9E-09		LIVER
8	3.4E-09	3.6E-09	1.1E-09		SI WALL
9	7.8E-09	8.5E-09	1.8E-09	3.7E-09	ULI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

10	1.8E-08	1.9E-08	3.3E-09	8.1E-09	LLI WALL
21			8.9E-10		REMAINDER
			0.06		Remainder weight

SB 127	8				Sb-127
	1.0E-01	1.0E-02	1.0E-01	1.0E-02	F1
4			1.4E-09	6.9E-09	LUNGS
1	5.9E-10	6.1E-10	2.3E-10		GONADS
2			1.6E-10		BREAST
3			4.9E-10		R MARROW
12			7.4E-10		LIVER
8			3.9E-10		SI WALL
9	6.7E-09	7.3E-09	1.2E-09	2.9E-09	ULI WALL
10	1.8E-08	2.0E-08	2.9E-09	7.4E-09	LLI WALL

TE 123M	5				Te-123M
	2.0E-01		2.0E-01	2.0E-01	F1
4				1.3E-08	LUNGS
3	2.3E-09		5.8E-09	2.4E-09	R MARROW
6	2.4E-08		6.1E-08	2.4E-08	BONE SURF
9	1.7E-09				ULI WALL
10	4.5E-09				LLI WALL

TE 125M	5				Te-125M
	2.0E-01		2.0E-01	2.0E-01	F1
4				1.0E-08	LUNGS
3	1.2E-09		3.0E-09	1.1E-09	R MARROW
6	1.3E-08		3.2E-08	1.2E-08	BONE SURF
9	1.7E-09				ULI WALL
10	4.7E-09			2.2E-09	LLI WALL

TE 127M	5				Te-127M
	2.0E-01		2.0E-01	2.0E-01	F1
4				3.3E-08	LUNGS
3	5.4E-09		1.4E-08	5.4E-09	R MARROW
6	2.1E-08		5.2E-08	2.0E-08	BONE SURF
9	3.1E-09				ULI WALL
10	1.1E-08				LLI WALL

TE 127	5				Te-127
	2.0E-01		2.0E-01	2.0E-01	F1
4			2.8E-10	4.3E-10	LUNGS
7	2.4E-10				ST WALL
8	3.9E-10		6.4E-11		SI WALL
9	1.2E-09		1.8E-10	2.1E-10	ULI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

10	1.3E-09	1.9E-10	2.3E-10	LLI WALL
TE 129M	5			Te-129M
	2.0E-01	2.0E-01	2.0E-01	F1
4		2.2E-09	4.0E-08	LUNGS
3	3.5E-09	8.8E-09		R MARROW
6	8.0E-09	2.0E-08		BONE SURF
9	8.4E-09			ULI WALL
10	2.5E-08	4.2E-09	1.1E-08	LLI WALL
TE 129	4			Te-129
	2.0E-01	2.0E-01	2.0E-01	F1
4		1.3E-10	1.5E-10	LUNGS
7	4.0E-10	5.1E-11		ST WALL
8	2.7E-10	3.6E-11		SI WALL
9	1.9E-10			ULI WALL
TE 131M	5			Te-131M
	2.0E-01	2.0E-01	2.0E-01	F1
4		9.3E-10	2.2E-09	LUNGS
1	7.3E-10			GONADS
5	4.3E-08	3.3E-08	3.6E-08	THYROID
9	4.6E-09			ULI WALL
10	8.2E-09		2.4E-09	LLI WALL
TE 131	5			Te-131
	2.0E-01	2.0E-01	2.0E-01	F1
4		2.5E-10	3.0E-10	LUNGS
5	4.2E-09	2.6E-09	2.7E-09	THYROID
7	6.3E-10			ST WALL
8	5.5E-10			SI WALL
9	5.3E-10			ULI WALL
TE 132	3			Te-132
	2.0E-01	2.0E-01	2.0E-01	F1
4			1.7E-09	LUNGS
5	5.9E-08	5.9E-08	6.3E-08	THYROID
10	3.8E-09			LLI WALL
TE 133M	5			Te-133M
	2.0E-01	2.0E-01	2.0E-01	F1
4		1.8E-10	2.1E-10	LUNGS
5	4.2E-09	2.6E-09	2.6E-09	THYROID
7	6.5E-10			ST WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

8	4.1E-10			SI WALL
9	2.7E-10			ULI WALL
TE 133	3			Te-133
	2.0E-01	2.0E-01	2.0E-01	F1
4		4.4E-11	4.6E-11	LUNGS
5	9.4E-10	5.9E-10	5.9E-10	THYROID
7	2.4E-10			ST WALL
TE 134	6			Te-134
	2.0E-01	2.0E-01	2.0E-01	F1
4		6.0E-11	6.6E-11	LUNGS
1	2.0E-11	8.9E-12	7.5E-12	GONADS
5	8.8E-10	5.5E-10	5.6E-10	THYROID
7	2.3E-10	3.4E-11		ST WALL
8	1.2E-10			SI WALL
9	7.3E-11			ULI WALL
I 125	1			I-125
	1.0E+00	1.0E+00		F1
5	3.4E-07	2.2E-07		THYROID
I 129	1			I-129
	1.0E+00	1.0E+00		F1
5	2.5E-06	1.6E-06		THYROID
I 130	2			I-130
	1.0E+00	1.0E+00		F1
4		6.0E-10		LUNGS
5	3.9E-08	2.0E-08		THYROID
I 131	1			I-131
	1.0E+00	1.0E+00		F1
5	4.8E-07	2.9E-07		THYROID
I 132	3			I-132
	1.0E+00	1.0E+00		F1
4		2.7E-10		LUNGS
5	3.9E-09	1.7E-09		THYROID
7	6.3E-10	9.9E-11		ST WALL
I 133	1			I-133

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

	1.0E+00	1.0E+00	F1
5	9.1E-08	4.9E-08	THYROID
I 134	3		I-134
	1.0E+00	1.0E+00	F1
4		1.4E-10	LUNGS
5	6.2E-10	2.9E-10	THYROID
7	5.5E-10	7.1E-11	ST WALL
I 135	2		I-135
	1.0E+00	1.0E+00	F1
4		4.4E-10	LUNGS
5	1.8E-08	8.5E-09	THYROID
XE 131M	0		
XE 133	0		
XE 133M	0		
XE 135	0		
XE 135M	0		
XE 137	0		
XE 138	0		
XE 139	0		
XE 140	0		

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

CS 134M	5		Cs-134M
	1.0E+00	1.0E+00	F1
4	6.4E-12	6.4E-11	LUNGS
1	6.7E-12	3.6E-12	GONADS
2	6.3E-12		BREAST
3	6.9E-12		R MARROW
7	1.2E-10	1.9E-11	ST WALL
CS 134	9		CS-134
	1.0E+00	1.0E+00	F1
4	1.8E-08	1.2E-08	LUNGS
1	2.1E-08	1.3E-08	GONADS
2	1.7E-08	1.1E-08	BREAST
3	1.9E-08	1.2E-08	R MARROW
5	1.8E-08	1.1E-08	THYROID
6	1.7E-08	1.1E-08	BONE SURF
8	2.2E-08	1.4E-08	SI WALL
10	2.2E-08	1.4E-08	LLI WALL
21	2.3E-08	1.5E-08	REMAINDER
	0.18	0.18	Remainder weight
CS 135	11		Cs-135
	1.0E+00	1.0E+00	F1
4	1.9E-09	1.4E-09	LUNGS
1	1.9E-09	1.2E-09	GONADS
2	1.9E-09	1.2E-09	BREAST
3	1.9E-09	1.2E-09	R MARROW
5	1.9E-09	1.2E-09	THYROID
6	1.9E-09	1.2E-09	BONE SURF
7	2.0E-09	1.2E-09	ST WALL
8	1.9E-09	1.2E-09	SI WALL
9	1.9E-09	1.2E-09	ULI WALL
10	1.9E-09	1.2E-09	LLI WALL
21	1.9E-09	1.2E-09	REMAINDER
	0.06	0.06	Remainder weight
CS 136	9		Cs-136
	1.0E+00	1.0E+00	F1
4	2.6E-09	2.3E-09	LUNGS
1	3.0E-09	1.9E-09	GONADS
2	2.6E-09	1.7E-09	BREAST
3	3.0E-09	1.9E-09	R MARROW
5	2.7E-09	1.7E-09	THYROID
6	2.7E-09	1.7E-09	BONE SURF
8	3.4E-09	2.1E-09	SI WALL
10	3.4E-09	2.1E-09	LLI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

21	3.8E-09 0.18	2.4E-09 0.18	REMAINDER Remainder weight
CS 137	10		Cs-137
	1.0E+00	1.0E+00	F1
4	1.3E-08	8.8E-09	LUNGS
1	1.4E-08	8.8E-09	GONADS
2	1.2E-08	7.8E-09	BREAST
3	1.3E-08	8.3E-09	R MARROW
5	1.3E-08	7.9E-09	THYROID
6	1.3E-08	7.9E-09	BONE SURF
8	1.4E-08	9.1E-09	SI WALL
9	1.4E-08	9.0E-09	ULI WALL
10	1.4E-08	9.1E-09	LLI WALL
21	1.5E-08 0.12	9.5E-09 0.12	REMAINDER Remainder weight
CS 138	2		Cs-138
	1.0E+00	1.0E+00	F1
4		1.6E-10	LUNGS
7	7.0E-10	7.7E-11	ST WALL
CS 139	0		
CS 140	0		
BA 137M	0		
BA 139	5		Ba-139
	1.0E-01	1.0E-01	F1
4		2.5E-10	LUNGS
7	6.9E-10	9.1E-11	ST WALL
8	5.5E-10	7.4E-11	SI WALL
9	4.4E-10	5.8E-11	ULI WALL
10	9.9E-11		LLI WALL
BA 140	8		Ba-140
	1.0E-01	1.0E-01	F1
4		1.7E-09	LUNGS
1	1.0E-09	4.3E-10	GONADS

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

2		2.9E-10		BREAST
3		1.3E-09		R MARROW
6		2.4E-09		BONE SURF
8		5.3E-10		SI WALL
9	7.7E-09	1.5E-09		ULI WALL
10	2.6E-08	4.4E-09		LLI WALL
BA 141	5			Ba-141
		1.0E-01		F1
4		1.2E-10		LUNGS
7	3.9E-10	3.9E-11		ST WALL
8	1.9E-10	2.3E-11		SI WALL
9	2.2E-10	3.1E-11		ULI WALL
10	1.2E-10			LLI WALL
BA 142	6			Ba-142
		1.0E-01		F1
4		5.5E-11		LUNGS
1	9.9E-12			GONADS
7	2.0E-10	2.2E-11		ST WALL
8	1.1E-10	1.5E-11		SI WALL
9	9.4E-11	1.3E-11		ULI WALL
10	2.4E-11			LLI WALL
LA 140	9			La-140
		1.0E-03	1.0E-03	F1
4		1.7E-09	4.2E-09	LUNGS
1	1.3E-09	3.6E-10	4.5E-10	GONADS
2		2.0E-10		BREAST
3		4.6E-10		R MARROW
12		3.5E-09		LIVER
8	3.0E-09	6.5E-10	9.7E-10	SI WALL
9	9.1E-09	1.6E-09	2.9E-09	ULI WALL
10	1.7E-08	2.8E-09	5.5E-09	LLI WALL
21		4.4E-10		REMAINDER
		0.06		Remainder weight
LA 141	6			La-141
		1.0E-03	1.0E-03	F1
4		6.5E-10	8.9E-10	LUNGS
12		2.1E-10		LIVER
7	9.3E-10	1.4E-10		ST WALL
8	1.4E-09	2.1E-10		SI WALL
9	2.5E-09	3.6E-10	2.6E-10	ULI WALL
10	1.4E-09	2.2E-10		LLI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

LA 142	6				La-142
1.0E-03		1.0E-03	1.0E-03		F1
4		3.0E-10	3.5E-10		LUNGS
1	7.0E-11	1.6E-11			GONADS
7	8.5E-10	1.2E-10			ST WALL
8	7.8E-10	1.1E-10			SI WALL
9	7.2E-10	1.0E-10			ULI WALL
10	1.9E-10				LLI WALL

CE 141	5				Ce-141
3.0E-04			3.0E-04	3.0E-04	F1
4			1.1E-08	1.7E-08	LUNGS
12			3.5E-09		LIVER
13			2.8E-09		SPLEEN
9	3.0E-09				ULI WALL
10	8.6E-09		3.8E-09	4.1E-09	LLI WALL

CE 143	4				Ce-143
3.0E-04			3.0E-04	3.0E-04	F1
4			3.5E-09	3.9E-09	LUNGS
8	1.4E-09				SI WALL
9	5.7E-09		1.8E-09	2.1E-09	ULI WALL
10	1.2E-08		3.7E-09	4.3E-09	LLI WALL

CE 144	6				Ce-144
3.0E-04			3.0E-04	3.0E-04	F1
4			1.8E-07	7.9E-07	LUNGS
3			2.7E-08		R MARROW
12			2.5E-07		LIVER
13			2.1E-07		SPLEEN
9	2.2E-08				ULI WALL
10	6.6E-08				LLI WALL

PR 143	3				Pr-143
3.0E-04			3.0E-04	3.0E-04	F1
4			1.1E-08	1.3E-08	LUNGS
9	5.1E-09				ULI WALL
10	1.5E-08		6.1E-09	6.8E-09	LLI WALL

PR 144	3				Pr-144
3.0E-04			3.0E-04	3.0E-04	F1
4			8.8E-11	9.4E-11	LUNGS

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

7	4.1E-10				ST WALL
8	9.6E-11				SI WALL
ND 144	0				
ND 147	3				Nd-147
	3.0E-04	3.0E-04	3.0E-04		F1
4		8.4E-09	1.1E-08		LUNGS
9	4.6E-09	1.9E-09			ULI WALL
10	1.3E-08	5.2E-09	5.9E-09		LLI WALL
PM 147	6				Pm-147
	3.0E-04	3.0E-04	3.0E-04		F1
4		9.7E-09	7.7E-08		LUNGS
3		8.2E-09			R MARROW
6		1.0E-07			BONE SURF
12		2.7E-08			LIVER
9	1.1E-09				ULI WALL
10	3.2E-09				LLI WALL
PM 148M	8				Pm-148M
	3.0E-04	3.0E-04	3.0E-04		F1
4		2.2E-08	3.6E-08		LUNGS
1	2.2E-09	1.4E-09			GONADS
3		2.9E-09			R MARROW
6		9.0E-09			BONE SURF
12		1.1E-08			LIVER
8	2.6E-09				SI WALL
9	5.8E-09				ULI WALL
10	1.4E-08	6.6E-09			LLI WALL
PM 148	3				Pm-148
	3.0E-04	3.0E-04	3.0E-04		F1
4		1.3E-08	1.4E-08		LUNGS
9	1.2E-08	4.5E-09	5.2E-09		ULI WALL
10	3.1E-08	1.2E-08	1.3E-08		LLI WALL
PM 149	3				Pm-149
	3.0E-04	3.0E-04	3.0E-04		F1
4		3.0E-09	3.1E-09		LUNGS
9	5.0E-09	1.7E-09	1.9E-09		ULI WALL
10	1.1E-08	3.8E-09	4.4E-09		LLI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

PM 151	5			Pm-151
	3.0E-04	3.0E-04	3.0E-04	F1
4		1.6E-09	1.6E-09	LUNGS
1	2.1E-10			GONADS
8	1.0E-09		3.4E-10	SI WALL
9	3.8E-09	1.1E-09	1.3E-09	ULI WALL
10	7.1E-09	2.0E-09	2.4E-09	LLI WALL
SM 147	3			Sm-147
	3.0E-04	3.0E-04		F1
3	6.9E-08	2.8E-05		R MARROW
6	8.6E-07	3.4E-04		BONE SURF
12	2.4E-07	9.4E-05		LIVER
SM 151	5			Sm-151
	3.0E-04	3.0E-04		F1
6	3.5E-10	1.4E-07		BONE SURF
3		1.1E-08		R MARROW
12		3.7E-08		LIVER
9	3.4E-10			ULI WALL
10	1.0E-09			LLI WALL
SM 153	3			Sm-153
	3.0E-04	3.0E-04		F1
4		2.0E-09		LUNGS
9	3.7E-09	1.2E-09		ULI WALL
10	8.2E-09	2.6E-09		LLI WALL
EU 152	11			Eu-152
	1.0E-03	1.0E-03		F1
4		5.8E-08		LUNGS
1	1.3E-09	1.3E-08		GONADS
2		1.7E-08		BREAST
3	9.2E-10	7.9E-08		R MARROW
6	2.1E-09	2.4E-07		BONE SURF
11		3.7E-08		KIDNEYS
12	3.0E-09	3.5E-07		LIVER
8	1.7E-09			SI WALL
9	4.2E-09			ULI WALL
10	1.0E-08			LLI WALL
21		5.0E-08		REMAINDER
		0.12		Remainder weight
EU 153	0			

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

EU 154	9			Eu-154
1.0E-03		1.0E-03		F1
4		7.9E-08		LUNGS
1 1.4E-09		1.2E-08		GONADS
3 1.1E-09		1.1E-07		R MARROW
6 4.5E-09		5.2E-07		BONE SURF
12 3.7E-09		4.3E-07		LIVER
8 2.2E-09				SI WALL
9 6.9E-09				ULI WALL
10 1.8E-08				LLI WALL
21		4.4E-08		REMAINDER
		0.06		Remainder weight

EU 155	7			Eu-155
1.0E-03		1.0E-03		F1
4		1.2E-08		LUNGS
1 9.8E-11				GONADS
3		1.4E-08		R MARROW
6 1.3E-09		1.5E-07		BONE SURF
12 4.1E-10		4.8E-08		LIVER
9 1.2E-09				ULI WALL
10 3.4E-09				LLI WALL

EU 156	5			Eu-156
1.0E-03		1.0E-03		F1
4		1.8E-08		LUNGS
1 1.2E-09				GONADS
8 2.4E-09				SI WALL
9 8.6E-09		3.8E-09		ULI WALL
10 2.3E-08		9.5E-09		LLI WALL

GD 153	8			Gd-153
3.0E-04		3.0E-04		F1
4		7.8E-09		LUNGS
1 2.0E-10				GONADS
3		1.1E-08		R MARROW
6		9.2E-08		BONE SURF
12		2.6E-08		LIVER
8 3.2E-10				SI WALL
9 1.0E-09				ULI WALL
10 2.7E-09				LLI WALL

Tb 160	8			Tb-160
3.0E-04		3.0E-04		F1
4		3.0E-08		LUNGS

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

1	1.2E-09			GONADS
3		4.4E-09		R MARROW
6		2.5E-08		BONE SURF
12		9.1E-09		LIVER
8	1.9E-09			SI WALL
9	5.9E-09			ULI WALL
10	1.6E-08	7.6E-09		LLI WALL
HO 166M	11			Ho-166
	3.0E-04	3.0E-04		F1
4		1.1E-07		LUNGS
1	2.1E-09	3.0E-08		GONADS
2		4.8E-08		BREAST
3	8.1E-10	1.6E-07		R MARROW
6	2.3E-09	8.9E-07		BONE SURF
12	2.0E-09	7.5E-07		LIVER
15	3.1E-09	1.1E-06		PANCREAS
8	2.4E-09			SI WALL
9	5.0E-09			ULI WALL
10	1.1E-08			LLI WALL
21		1.5E-07		REMAINDER
		0.06		Remainder weight
W 181	11			W-181
	1.0E-02	3.0E-01	3.0E-01	F1
4			5.3E-11	LUNGS
1	7.3E-11	5.4E-11	1.1E-11	GONADS
2			5.9E-12	BREAST
3		4.9E-11	5.0E-11	R MARROW
6			7.1E-11	BONE SURF
11		7.4E-11	1.2E-10	KIDNEYS
12			3.2E-11	LIVER
13		6.5E-11	1.1E-10	SPLEEN
8	1.0E-10	7.6E-11		SI WALL
9	2.8E-10	2.0E-10	3.5E-11	ULI WALL
10	7.1E-10	5.0E-10	8.1E-11	LLI WALL
W 185	8			W-185
	1.0E-02	3.0E-01	3.0E-01	F1
4			3.8E-10	LUNGS
3			8.4E-11	R MARROW
6			2.5E-10	BONE SURF
11			6.9E-10	KIDNEYS
12			1.2E-10	LIVER
13			5.9E-10	SPLEEN
9	2.1E-09	1.5E-09	2.3E-10	ULI WALL
10	6.3E-09	4.5E-09	6.9E-10	LLI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

W 187	5				W-187
	1.0E-02	3.0E-01	3.0E-01		F1
4			6.0E-10		LUNGS
1	2.6E-10	1.9E-10	2.9E-11		GONADS
8	1.0E-09	7.5E-10			SI WALL
9	3.6E-09	2.6E-09	3.9E-10		ULI WALL
10	6.0E-09	4.4E-09	6.6E-10		LLI WALL

RE 187	5				Re-187
	8.0E-01		8.0E-01	8.0E-01	F1
4			2.3E-12	1.1E-10	LUNGS
5	1.1E-11		7.9E-12		THYROID
7	2.2E-11		1.6E-11		ST WALL
9	2.6E-12				ULI WALL
10	7.2E-12				LLI WALL

OS 185	11				Os-185
	1.0E-02	1.0E-02	1.0E-02	1.0E-02	F1
4		2.0E-09	6.5E-09	1.4E-08	LUNGS
1	8.3E-10	1.5E-09	7.2E-10		GONADS
2		1.5E-09	7.1E-10		BREAST
3	2.1E-10	1.8E-09	8.3E-10		R MARROW
11		7.0E-09	1.8E-09		KIDNEYS
12		8.5E-09	2.5E-09		LIVER
13		6.0E-09	1.9E-09		SPLEEN
8	8.7E-10				SI WALL
9	1.4E-09				ULI WALL
10	2.8E-09		1.7E-09		LLI WALL
21	3.6E-10	3.3E-09	1.4E-09		REMAINDER
	0.06	0.12	0.06		Remainder weight

OS 191	9				Os-191
	1.0E-02	1.0E-02	1.0E-02	1.0E-02	F1
4		6.0E-10	5.6E-09	6.8E-09	LUNGS
1		1.9E-10			GONADS
3		2.3E-10			R MARROW
2		1.7E-10			BREAST
11		2.2E-09			KIDNEYS
12		2.0E-09			LIVER
13		1.9E-09			SPLEEN
9	2.3E-09	5.5E-10			ULI WALL
10	6.6E-09	1.2E-09	2.8E-09	3.1E-09	LLI WALL

IR 192	11				Ir-192
	1.0E-02	1.0E-02	1.0E-02	1.0E-02	F1

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

4		3.2E-09	2.5E-08	5.2E-08	LUNGS
1	1.0E-09	2.2E-09			GONADS
2		2.1E-09			BREAST
3		2.4E-09			R MARROW
11		1.7E-08			KIDNEYS
12		1.7E-08			LIVER
13		1.5E-08			SPLEEN
8	1.6E-09				SI WALL
9	4.9E-09				ULI WALL
10	1.3E-08	4.1E-09	6.5E-09		LLI WALL
21		4.0E-09			REMAINDER
		0.06			Remainder weight

HG 203	9				Hg-203 (ORG)
	1.0E+00	4.0E-01	1.0E+00		F1
4	1.2E-09	4.9E-10	1.1E-09		LUNGS
1	1.4E-09	7.3E-10	8.6E-10		GONADS
2	1.2E-09	5.1E-10	7.8E-10		BREAST
3	1.7E-09	7.1E-10	1.1E-09		R MARROW
11	1.9E-08	7.5E-09	1.2E-08		KIDNEYS
17	1.2E-08	4.6E-09	7.3E-09		BRAIN
8		9.3E-10			SI WALL
9		1.8E-09			ULI WALL
10		3.9E-09			LLI WALL

PB 210	4				Pb-210
	2.0E-01	2.0E-01			F1
3	1.5E-06	3.7E-06			R MARROW
6	2.2E-05	5.5E-05			BONE SURF
11	2.8E-06	7.1E-06			KIDNEYS
12	6.1E-06	1.5E-05			LIVER

PB 212	7				Pb-212
	2.0E-01	2.0E-01			F1
4		2.0E-07			LUNGS
3	1.5E-08	3.3E-08			R MARROW
6	1.7E-07	3.7E-07			BONE SURF
12	2.2E-08	4.9E-08			LIVER
11	1.1E-08				KIDNEYS
9	1.7E-08				ULI WALL
10	2.0E-08				LLI WALL

BI 210	4				Bi-210
	5.0E-02	5.0E-02	5.0E-02		F1
4			4.3E-07		LUNGS
11	5.9E-09	5.8E-08			KIDNEYS

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

9	5.7E-09			ULI WALL
10	1.5E-08			LLI WALL
BI 212	5			Bi-212
	5.0E-02	5.0E-02	5.0E-02	F1
4		3.4E-08	3.9E-08	LUNGS
11	1.1E-09	2.7E-08		KIDNEYS
7	1.6E-09			ST WALL
8	1.1E-09			SI WALL
9	6.6E-10			ULI WALL
PO 210	4			Po-210
	1.0E-01	1.0E-01	1.0E-01	F1
4			1.3E-05	LUNGS
11	2.5E-06	1.2E-05	3.9E-06	KIDNEYS
12	4.4E-07	2.2E-06		LIVER
13	4.4E-06	2.2E-05	6.7E-06	SPLEEN
RN 222	0			
FR 223	10			Fr-223
	1.0E+00	1.0E+00		F1
4	2.3E-09	3.4E-09		LUNGS
1	2.3E-09	1.4E-09		GONADS
2	2.3E-09	1.4E-09		BREAST
3	2.3E-09	1.4E-09		R MARROW
5	2.3E-09	1.4E-09		THYROID
6	2.3E-09	1.4E-09		BONE SURF
7	2.5E-09	1.5E-09		ST WALL
8	2.3E-09			SI WALL
9	2.3E-09			ULI WALL
21	2.3E-09	1.4E-09		REMAINDER
	0.12	0.24		Remainder weight
RA 223	5			Ra-223
	2.0E-01		2.0E-01	F1
4			1.7E-05	LUNGS
1	4.2E-08			GONADS
3	2.8E-07			R MARROW
6	2.9E-06			BONE SURF
10	2.8E-07			LLI WALL
RA 224	6			Ra-224

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

4	2.0E-01	2.0E-01	F1
1	2.1E-08	6.6E-06	LUNGS
3	1.5E-07		GONADS
6	1.6E-06		R MARROW
9	8.3E-08		BONE SURF
10	2.0E-07		ULI WALL
			LLI WALL

RA 225	4				Ra-225
4	2.0E-01	2.0E-01			F1
1	3.4E-08	1.7E-05			LUNGS
3	1.7E-07				GONADS
6	1.8E-06				R MARROW
					BONE SURF

RA 226	4				Ra-226
4	2.0E-01	2.0E-01			F1
1	9.2E-08	1.6E-05			LUNGS
3	6.0E-07				GONADS
6	6.8E-06	7.6E-06			R MARROW
					BONE SURF

RA 228	5				Ra-228
4	2.0E-01	2.0E-01			F1
1	1.6E-07	7.2E-06			LUNGS
2	1.6E-07				GONADS
3	6.5E-07	7.4E-07			BREAST
6	5.8E-06	6.5E-06			R MARROW
					BONE SURF

AC 225	6				Ac-225
4	1.0E-03	1.0E-03	1.0E-03	1.0E-03	F1
3		1.6E-06	1.5E-05	1.8E-05	LUNGS
6	9.9E-08	3.7E-06			R MARROW
12		4.7E-05	7.8E-06		BONE SURF
9	9.8E-08	1.3E-05			LIVER
10	2.8E-07				ULI WALL
					LLI WALL

AC 227	5				Ac-227
4	1.0E-03	1.0E-03	1.0E-03	1.0E-03	F1
1	8.3E-07	4.0E-04	1.0E-04	1.5E-03	LUNGS
3	5.4E-06	2.6E-03	6.5E-04	2.3E-04	GONADS
6	6.7E-05	3.2E-02	8.1E-03	2.9E-03	R MARROW
					BONE SURF

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

12	1.5E-05	7.3E-03	1.9E-03	6.7E-04	LIVER
AC 228	9				Ac-228
	1.0E-03	1.0E-03	1.0E-03	1.0E-03	F1
4			3.5E-08	2.5E-07	LUNGS
1	1.8E-10				GONADS
3	2.7E-10	1.1E-07	2.8E-08		R MARROW
6	3.0E-09	1.4E-06	3.5E-07		BONE SURF
12	8.2E-10	3.8E-07	9.2E-08		LIVER
7	6.2E-10				ST WALL
8	1.1E-09				SI WALL
9	2.4E-09				ULI WALL
10	1.9E-09				LLI WALL
TH 227	5				Th-227
	2.0E-04		2.0E-04	2.0E-04	F1
4			2.4E-05	3.6E-05	LUNGS
3	5.7E-09		2.4E-06		R MARROW
6	6.8E-08		2.9E-05		BONE SURF
9	2.5E-08				ULI WALL
10	9.1E-08				LLI WALL
TH 228	4				Th-228
	2.0E-04		2.0E-04	2.0E-04	F1
4			9.5E-05	6.9E-04	LUNGS
3	1.9E-07		1.1E-04		R MARROW
6	2.4E-06		1.4E-03		BONE SURF
10	1.3E-07				LLI WALL
TH 229	3				Th-229
	2.0E-04		2.0E-04	2.0E-04	F1
4				2.0E-03	LUNGS
3	1.9E-06		1.1E-03	4.6E-04	R MARROW
6	2.4E-05		1.4E-02	5.7E-03	BONE SURF
TH 230	3				Th-230
	2.0E-04		2.0E-04	2.0E-04	F1
4				3.0E-04	LUNGS
3	2.9E-07		1.7E-04	7.0E-05	R MARROW
6	3.6E-06		2.2E-03	8.7E-04	BONE SURF
TH 231	6				Th-231
	2.0E-04		2.0E-04	2.0E-04	F1
4			7.8E-10	8.8E-10	LUNGS

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

3		7.9E-11		R MARROW
6		9.2E-10		BONE SURF
8	4.5E-10			SI WALL
9	1.9E-09	5.3E-10	6.2E-10	ULI WALL
10	3.4E-09	9.4E-10	1.1E-09	LLI WALL

TH 232	3			Th-232
	2.0E-04	2.0E-04	2.0E-04	F1
4			9.4E-04	LUNGS
3	1.5E-06	8.9E-04	4.0E-04	R MARROW
6	1.9E-05	1.1E-02	5.0E-03	BONE SURF

TH 234	3			Th-234
	2.0E-04	2.0E-04	2.0E-04	F1
4		4.6E-08	6.4E-08	LUNGS
9	1.5E-08			ULI WALL
10	4.3E-08	1.9E-08	2.0E-08	LLI WALL

PA 231	3			Pa-231
	1.0E-03	1.0E-03	1.0E-03	F1
4			7.5E-04	LUNGS
3	5.8E-06	7.0E-04	2.9E-04	R MARROW
6	7.2E-05	8.7E-03	3.6E-03	BONE SURF

PA 233	5			Pa-233
	1.0E-03	1.0E-03	1.0E-03	F1
4		1.2E-08	1.7E-08	LUNGS
1	2.6E-10			GONADS
6		7.4E-09		BONE SURF
9	3.6E-09			ULI WALL
10	1.0E-08	4.5E-09	4.8E-09	LLI WALL

PA 234	6			Pa-234
	1.0E-03	1.0E-03	1.0E-03	F1
4		8.4E-10	9.0E-10	LUNGS
1	3.3E-10	5.0E-11	6.1E-11	GONADS
7	7.8E-10			ST WALL
8	1.5E-09	2.2E-10	2.7E-10	SI WALL
9	3.1E-09	4.6E-10	5.7E-10	ULI WALL
10	2.5E-09	3.6E-10	4.5E-10	LLI WALL

PA 234M	0			
---------	---	--	--	--

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

U	232	6					U-232
	5.0E-02	2.0E-03	5.0E-02	5.0E-02	2.0E-03		F1
4				2.5E-05	1.5E-03		LUNGS
3	4.2E-07	1.7E-08	4.1E-06				R MARROW
6	6.6E-06	2.7E-07	6.4E-05	1.9E-05			BONE SURF
11	1.6E-06	6.3E-08	1.5E-05				KIDNEYS
9		1.8E-08					ULI WALL
10		5.6E-08					LLI WALL

U	233	6					U-233
	5.0E-02	2.0E-03	5.0E-02	5.0E-02	2.0E-03		F1
4			3.2E-07	1.6E-05	3.0E-04		LUNGS
3	7.4E-08	2.9E-09	7.1E-07				R MARROW
6	1.2E-06	4.6E-08	1.1E-05				BONE SURF
11	4.7E-07	1.9E-08	4.6E-06				KIDNEYS
9		1.6E-08					ULI WALL
10		5.0E-08					LLI WALL

U	234	6					U-234
	5.0E-02	2.0E-03	5.0E-02	5.0E-02	2.0E-03		F1
4			3.2E-07	1.6E-05	3.0E-04		LUNGS
3	7.2E-08	2.9E-09	7.0E-07				R MARROW
6	1.1E-06	4.5E-08	1.1E-05				BONE SURF
11	4.7E-07	1.9E-08	4.5E-06				KIDNEYS
9		1.6E-08					ULI WALL
10		4.9E-08					LLI WALL

U	235	6					U-235
	5.0E-02	2.0E-03	5.0E-02	5.0E-02	2.0E-03		F1
4			2.9E-07	1.5E-05	2.8E-04		LUNGS
3	6.8E-08	2.8E-09	6.6E-07				R MARROW
6	1.0E-06	4.2E-08	1.0E-05				BONE SURF
11	4.3E-07	1.7E-08	4.2E-06				KIDNEYS
10	5.3E-08	5.3E-08					LLI WALL
9		1.7E-08					ULI WALL

U	236	6					U-236
	5.0E-02	2.0E-03	5.0E-02	5.0E-02	2.0E-03		F1
4			3.0E-07	1.5E-05	2.8E-04		LUNGS
3	6.8E-08	2.7E-09	6.6E-07				R MARROW
6	1.1E-06	4.3E-08	1.0E-05				BONE SURF
11	4.4E-07	1.8E-08	4.3E-06				KIDNEYS
9		1.5E-08					ULI WALL
10		4.7E-08					LLI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

U 237	6					U-237
	5.0E-02	2.0E-03	5.0E-02	5.0E-02	2.0E-03	F1
4			6.1E-10	4.3E-09	4.7E-09	LUNGS
3			4.1E-10			R MARROW
6			4.0E-09			BONE SURF
11			2.4E-09			KIDNEYS
9	3.2E-09	3.4E-09	5.3E-10	1.3E-09	1.5E-09	ULI WALL
10	8.5E-09	8.9E-09	1.3E-09	3.3E-09	3.9E-09	LLI WALL

U 238	6					U-238
	5.0E-02	2.0E-03	5.0E-02	5.0E-02	2.0E-03	F1
4			2.8E-07	1.4E-05	2.7E-04	LUNGS
3	6.8E-08	2.7E-09	6.6E-07			R MARROW
6	1.0E-06	4.0E-08	9.8E-06			BONE SURF
11	4.1E-07	1.7E-08	4.0E-06			KIDNEYS
9		1.5E-08				ULI WALL
10		4.6E-08				LLI WALL

U 240	5					U-240
	5.0E-02	2.0E-03	5.0E-02	5.0E-02	2.0E-03	F1
4			1.3E-09	2.3E-09	2.4E-09	LUNGS
11			8.9E-10			KIDNEYS
8	1.9E-09	2.0E-09	3.2E-10		5.4E-10	SI WALL
9	6.7E-09	7.0E-09	1.0E-09	1.5E-09	1.8E-09	ULI WALL
10	9.1E-09	9.5E-09	1.4E-09	2.0E-09	2.5E-09	LLI WALL

NP 237	4					Np-237
	1.0E-02			1.0E-02		F1
1	2.5E-06			3.1E-05		GONADS
3	1.5E-05			1.9E-04		R MARROW
6	1.9E-04			2.4E-03		BONE SURF
12	4.1E-05			5.1E-04		LIVER

NP 238	7					Np-238
	1.0E-02			1.0E-02		F1
1	5.2E-10			2.1E-09		GONADS
3	1.1E-09			1.2E-08		R MARROW
6	1.2E-08			1.5E-07		BONE SURF
12	2.7E-09			3.3E-08		LIVER
8	1.1E-09					SI WALL
9	4.2E-09					ULI WALL
10	8.9E-09					LLI WALL

NP 239	5					Np-239
--------	---	--	--	--	--	--------

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

	1.0E-02		1.0E-02	F1
4			2.4E-09	LUNGS
6			1.4E-09	BONE SURF
8	8.7E-10			SI WALL
9	3.8E-09		1.3E-09	ULI WALL
10	8.6E-09		2.9E-09	LLI WALL

PU 236	7			Pu-236
	1.0E-04	1.0E-05	1.0E-04	1.0E-05
4				1.9E-04
1	7.8E-09		9.3E-06	LUNGS
3	5.1E-08	5.1E-09	6.0E-05	GONADS
6	6.3E-07	6.3E-08	2.0E-05	R MARROW
12	1.4E-07	1.4E-08	7.5E-04	BONE SURF
9		1.9E-08	1.7E-04	2.6E-04
10	6.0E-08	6.0E-08		5.8E-05
				LIVER
				ULI WALL
				LLI WALL

PU 237	8			Pu-237
	1.0E-04	1.0E-05	1.0E-04	1.0E-05
4				1.9E-04
1	7.2E-11	7.2E-11	2.2E-09	3.7E-09
3				
6			2.5E-10	LUNGS
12			1.8E-09	GONADS
8	1.2E-10	1.2E-10	8.0E-10	R MARROW
9	4.0E-10	4.0E-10		BONE SURF
10	1.0E-09	1.0E-09		LIVER
				SI WALL
				ULI WALL
			4.7E-10	LLI WALL

PU 238	7			Pu-238
	1.0E-04	1.0E-05	1.0E-04	1.0E-05
4				3.2E-04
1	2.3E-08	2.3E-09	2.8E-05	LUNGS
3	1.5E-07	1.5E-08	1.8E-04	GONADS
6	1.8E-06	1.8E-07	6.6E-05	R MARROW
12	4.0E-07	4.0E-08	2.2E-03	BONE SURF
9		1.8E-08	4.8E-04	8.3E-04
10		5.7E-08		1.8E-04
				LIVER
				ULI WALL
				LLI WALL

PU 239	7			Pu-239
	1.0E-04	1.0E-05	1.0E-04	1.0E-05
4				3.2E-04
1	2.6E-08	2.6E-09	3.2E-05	LUNGS
3	1.6E-07	1.6E-08	2.0E-04	GONADS
6	2.1E-06	2.1E-07	7.6E-05	R MARROW
12	4.4E-07	4.4E-08	2.5E-03	BONE SURF
9		1.7E-08	5.3E-04	9.5E-04
				2.1E-04
				LIVER
				ULI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

10	5.3E-08				LLI WALL
PU 240	7				Pu-240
	1.0E-04	1.0E-05	1.0E-04	1.0E-05	F1
4				3.2E-04	LUNGS
1	2.6E-08	2.6E-09	3.2E-05		GONADS
3	1.6E-07	1.6E-08	2.0E-04	7.6E-05	R MARROW
6	2.1E-06	2.1E-07	2.5E-03	9.5E-04	BONE SURF
12	4.4E-07	4.4E-08	5.3E-04	2.1E-04	LIVER
9		1.7E-08			ULI WALL
10		5.3E-08			LLI WALL
PU 241	6				Pu-241
	1.0E-04	1.0E-05	1.0E-04	1.0E-05	F1
4				3.2E-06	LUNGS
1	5.7E-10	5.7E-11	6.8E-07	2.8E-07	GONADS
3	3.4E-09	3.4E-10	4.1E-06	1.7E-06	R MARROW
6	4.2E-08	4.2E-09	5.1E-05	2.1E-05	BONE SURF
12	8.6E-09	8.6E-10	1.0E-05	4.4E-06	LIVER
10		2.7E-10			LLI WALL
PU 242	7				Pu-242
	1.0E-04	1.0E-05	1.0E-04	1.0E-05	F1
4				3.1E-04	LUNGS
1	2.5E-08	2.5E-09	3.0E-05		GONADS
3	1.6E-07	1.6E-08	1.9E-04	7.2E-05	R MARROW
6	2.0E-06	2.0E-07	2.3E-03	9.0E-04	BONE SURF
12	4.2E-07	4.2E-08	5.0E-04	2.0E-04	LIVER
9		1.6E-08			ULI WALL
10		5.1E-08			LLI WALL
PU 243	7				Pu-243
	1.0E-04	1.0E-05	1.0E-04	1.0E-05	F1
4			1.9E-10	2.3E-10	LUNGS
6			2.2E-10		BONE SURF
12			4.8E-11		LIVER
7	1.8E-10	1.8E-10			ST WALL
8	2.9E-10	2.9E-10			SI WALL
9	6.0E-10	6.0E-10	7.3E-11	9.0E-11	ULI WALL
10	4.1E-10	4.1E-10	5.0E-11	6.2E-11	LLI WALL
PU 244	7				Pu-244
	1.0E-04	1.0E-05	1.0E-04	1.0E-05	F1
4				3.0E-04	LUNGS
1	2.5E-08	2.9E-09	3.0E-05		GONADS

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

3	1.6E-07	1.6E-08	1.9E-04	7.2E-05	R MARROW
6	1.9E-06	1.9E-07	2.3E-03	8.9E-04	BONE SURF
12	4.2E-07	4.2E-08	5.0E-04	2.0E-04	LIVER
9		2.4E-08			ULI WALL
10		8.3E-08			LLI WALL

AM 241	4				Am-241
		5.0E-04	5.0E-04		F1
1		1.4E-07	3.2E-05		GONADS
3		8.4E-07	2.0E-04		R MARROW
6		1.1E-05	2.5E-03		BONE SURF
12		2.3E-06	5.5E-04		LIVER

AM 242M	4				Am-242M
		5.0E-04	5.0E-04		F1
1		1.3E-07	3.2E-05		GONADS
3		8.3E-07	2.0E-04		R MARROW
6		1.0E-05	2.5E-03		BONE SURF
12		2.2E-06	5.3E-04		LIVER

AM 242	7				Am-242
		5.0E-04	5.0E-04		F1
4			5.5E-08		LUNGS
6		8.3E-10	1.8E-07		BONE SURF
3			1.4E-08		R MARROW
12			4.6E-08		LIVER
8		4.4E-10			SI WALL
9		1.7E-09			ULI WALL
10		2.6E-09			LLI WALL

AM 243	4				Am-243
		5.0E-04	5.0E-04		F1
1		1.4E-07	3.2E-05		GONADS
3		8.4E-07	2.0E-04		R MARROW
6		1.1E-05	2.5E-03		BONE SURF
12		2.3E-06	5.4E-04		LIVER

CM 242	6				Cm-242
		5.0E-04	5.0E-04		F1
4			1.5E-05		LUNGS
3		1.8E-08	4.0E-06		R MARROW
6		2.3E-07	5.0E-05		BONE SURF
12		6.0E-08	1.3E-05		LIVER
9		2.0E-08			ULI WALL
10		6.3E-08			LLI WALL

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

CM 243	4			Cm-243
		5.0E-04		F1
1		8.6E-08	2.1E-05	GONADS
3		5.6E-07	1.3E-04	R MARROW
6		6.9E-06	1.7E-03	BONE SURF
12		1.6E-06	3.8E-04	LIVER

CM 244	4			Cm-244
		5.0E-04		F1
1		6.6E-08	1.6E-05	GONADS
3		4.4E-07	1.0E-04	R MARROW
6		5.4E-06	1.3E-03	BONE SURF
12		1.3E-06	3.0E-04	LIVER

CM 245	4			Cm-245
		5.0E-04		F1
1		1.4E-07	3.4E-05	GONADS
3		8.7E-07	2.1E-04	R MARROW
6		1.1E-05	2.6E-03	BONE SURF
12		2.3E-06	5.6E-04	LIVER

CM 246	4			Cm-246
		5.0E-04		F1
1		1.4E-07	3.3E-05	GONADS
3		8.6E-07	2.1E-04	R MARROW
6		1.1E-05	2.6E-03	BONE SURF
12		2.3E-06	5.6E-04	LIVER

CM 247	4			Cm-247
		5.0E-04		F1
1		1.3E-07	3.1E-05	GONADS
3		7.9E-07	1.9E-04	R MARROW
6		9.9E-06	2.4E-03	BONE SURF
12		2.1E-06	5.1E-04	LIVER

CM 248	4			Cm-248
		5.0E-04		F1
1		5.1E-07	1.2E-04	GONADS
3		3.2E-06	7.6E-04	R MARROW
6		3.9E-05	9.5E-03	BONE SURF
12		8.4E-06	2.0E-03	LIVER

Appendix B - ICRP Publication 30 Dose Rate Factors - LB30SVBQ

CF 252	6			Cf-252
	5.0E-04	5.0E-04	5.0E-04	F1
4		3.7E-05	3.0E-04	LUNGS
1	2.5E-08			GONADS
3	1.7E-07	3.9E-05		R MARROW
6	2.1E-06	4.9E-04		BONE SURF
12	5.4E-07	1.3E-04		LIVER
10	1.5E-07			LLI WALL

DISTRIBUTION

<u>No. of</u> <u>Copies</u>		<u>No. of</u> <u>Copies</u>	
	<u>OFFSITE</u>		<u>ONSITE</u>
	U.S. Nuclear Regulatory Commission Division of Technical Information and Document Control 7920 Norfolk Avenue Bethesda, MD 20014	50	<u>Pacific Northwest Laboratory</u> P. E. Bramson D. W. Dragnich W. T. Farris J. M. Hales D. G. Huizenga P. C. Hays G. R. Hoenes W. E. Kennedy, Jr. (10) B. A. Napier (10) T. L. Page R. A. Peloquin (10) R. G. Schreckhise J. K. Soldat J. A. Stottlemire E. C. Watson R. E. Wildung Publishing Coordination (2) Technical Information (5)
10	R. B. Neel U.S. Nuclear Regulatory Commission Mail Stop 623 SS Office of NMSS Washington, DC 20555		
10	S. M. Neuder U.S. Nuclear Regulatory Commission Division of Waste Management Office of NMSS Washington, DC 20555		
	Director, Office of NMSS U.S. Nuclear Regulatory Commission Washington, DC 20555		
	Director, Division of Waste Management U.S. Nuclear Regulatory Commission Washington, DC 20555		

NRC FORM 305 2-84 NRCM 1102 J201-1202 BIBLIOGRAPHIC DATA SHEET SEE INSTRUCTIONS ON THE REVERSE		U.S. NUCLEAR REGULATORY COMMISSION REPORT NUMBER (Assigned by NRC and Vol. No. in series) NUREG/CR-3620, Supp. No. 2 PNL-4054	
2. TITLE AND SUBTITLE Intruder Dose Pathway Analysis for the Onsite Disposal of Radioactive Wastes: The ONSITE/MAXII Computer Program		3. LEAVE BLANK	
5. AUTHOR(S) W. E. Kennedy, Jr., R. A. Peloquin, B. A. Napier/PNL S. M. Neuder/NRC		4. DATE REPORT COMPLETED MONTH: November YEAR: 1986 6. DATE REPORT ISSUED MONTH: February YEAR: 1987	
7. PERFORMING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code) Pacific Northwest Laboratory P.O. Box 999 Richland, WA 99352		8. PROJECT/TASK/WORK UNIT NUMBER 9. FIN OR GRANT NUMBER FIN B2476	
10. SPONSORING ORGANIZATION NAME AND MAILING ADDRESS (Include Zip Code) Division of Waste Management Office of Nuclear Material Safety and Safeguards U.S. Nuclear Regulatory Commission Washington, DC 20555		11. TYPE OF REPORT 12. PERIOD COVERED (Include dates)	
13. ABSTRACT (200 words or less) The document entitled <u>Intruder Dose Pathway Analysis of the Onsite Disposal of Radioactive Wastes: The ONSITE/MAXII Computer Program</u> (1984) by Napier et al. summarizes our initial efforts to develop human-intrusion scenarios and a modified version of the MAXII computer program for potential use by the NRC in reviewing applications for onsite radioactive waste disposal. Supplement 1 of NUREG/CR-3620 (1986) by Kennedy et al. summarized modifications and improvements to the ONSITE/MAXII software package. This document summarizes a modified version of the ONSITE/MAXII computer program. This modified version of the computer program operates on a personal computer and permits the user to optionally select radiation dose conversion factors published by the International Commission on Radiological Protection (ICRP) in their Publication No. 30 (ICRP 1979-1982) in place of those published by the ICRP in their Publication No. 2 (ICRP 1959) (as implemented in the previous versions of the ONSITE/MAXII computer program). The pathway-to-human models used in the computer program have not been changed from those described previously (Napier et al. 1984; Kennedy et al. 1986). Computer listings of the ONSITE/MAXII computer program and supporting data bases are included in the appendices of this document.			
14. DOCUMENT ANALYSIS - KEYWORDS/DESCRIPTORS ONSITE/MAXII computer program onsite radioactive waste disposal 15. IDENTIFIERS/OPEN ENDED TERMS		15. AVAILABILITY STATEMENT unlimited 16. SECURITY CLASSIFICATION (This page) unclassified (This report) unclassified 17. NUMBER OF PAGES 18. PRICE	